Faculty of Medicine

JSS ACADEMY OF HIGHER EDUCATION & RESEARCH
(DEEMED TO BE UNIVERSITY) MYSURU

JSS Academy of Higher Education & Research
Deemed to be University)
Re-Accredited "A+" Grade by NAAC
Sri Shivarathreeshwara Nagara, Mysuru - 570 015, Karnataka

Regulation & Syllabus

M.Sc. IN MEDICAL PHARMACOLOGY
2020

MSc

REGULATIONS AND SYLLABUS

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Postgraduate MSc in Medical Sciences

Programmes Offered:

1. MSc Medical Anatomy
2. MSc Medical Physiology
3. MSc Medical Biochemistry
4. MSc Medical Pharmacology
5. MSc Medical Microbiology

Goals:

The Goals of Postgraduate MSc in Medical Sciences is to produce

1. Competent medical and biomedical teachers with a sound knowledge in basic sciences.
2. Personnel with translational research knowledge
3. Skilled laboratory experts
4. Industry technical experts
5. Competent individuals with emotional intelligence

General Objectives

At the end of the postgraduate training in the discipline concerned the student should be able to:

1. Develop skills in using educational methods and techniques as applicable to the teaching of medical/biomedical/allied health workers.
2. Demonstrate competence in developing diagnostic and analytical tools
3. Demonstrate competence in basic concepts of research methodology and be able to critically analyse relevant published research literature

Components of the course curriculum:

The major components of the Postgraduate curriculum shall be:

- Theoretical knowledge
- Practical skills
- Diagnostic and analytical skills
- Project skills.
- Attitudes including communication skills.
- Training in research methodology.

Self- learning mode- Seminars, assignments, group discussions, journal club presentations, Problem solving exercises.

Regulations

1. Branch of the study

Post graduate degree Programme

2. Courses offered in M.Sc. Medical Sciences:

a. MSc in Anatomy
b. MSc in Physiology
c. MSc in Biochemistry
d. MSc in Pharmacology
e. MSc in Microbiology

3. Eligibility for Admission

A candidate seeking admission to MSc medical science course must have passed BSc with at least one subject of biological Sciences or BAMS or MBBS or BHMS or BPT or BPharm or any other Science/ professional graduates from a recognized University

4. Duration of the course

The duration of the course shall be a period of 3 years (6 semesters)

5. Medium of instructions

The medium of instruction and examination shall be in English

6. Method of Training

Training includes involvement in theory classes, practical skills, laboratory and experimental work, research studies, Self- learning mode - Seminars, assignments, group discussions, journal club presentations.

7. Attendance

Candidates should have attended at least 80% of the total number of classes conducted in each semester, from the date of commencement of the term to the last working day, as notified by the JSSAHER, in each of the subjects prescribed for that semester, separately in theory and practical, to be eligible to appear for the examinations.

8. Monitoring Progress of Studies:

A) Formative Assessment

Formative assessment will be done continually to assess medical knowledge, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system.

Two Internal Assessment tests will be conducted for both theory and practical in each semester covering all domains of learning and feedback will be provided for improvement of the student. Average of two internal assessments in theory and practical's separately will be considered for final internal assessment marks. A candidate should get minimum 50% IA marks separately in theory and practical to be eligible for final JSSAHER examinations.

The candidates who have failed in final examination shall be given an internal assessment improvement test and the best marks shall be submitted to JSSAHER

when called for.

B) Summative Assessment

The end semester examination for core papers both for theory and practical will be conducted by JSS AHER.

For allied papers, general electives and discipline specific electives examination will be conducted by respective colleges

C) Project Work

During study every candidate must perform a project on the selected topic under the guidance and supervision of a recognised postgraduate teacher. The project should be aimed to train a post graduate student in research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search, review of literature, getting acquainted with recent advances, designing a research study, collection of data, critical analysis, and comparison of results and drawing conclusions.

The suggested time schedule for project work is:

- Identification and selection of topic for project in third semester.
- Preparation of synopsis and submission of the synopsis for ethical clearance in third semester as per the dates notified by the ethical committee. Such synopsis will be reviewed, and the project topic will be registered by the JSS Academy of Higher Education and Research. No change in the **project** topic or guide shall be made without prior approval of the JSSAHER.
- Project work should start from third semester onwards.

Submission of Project Report

Four copies of the project report shall be submitted to the controller of examination of the JSSAHER two months before sixth semester examination or as per the dates notified by the JSSAHER.

The Project should be written under the following headings

i. Introduction
ii. Aims and objectives of study
iii. Review of Literature
iv. Material and Methods
v. Results
vi. Discussion
vii. Conclusion
viii. Summary
ix. References
x. Tables
xi. Annexure

The project shall be valued by examiners appointed by the JSS Academy of Higher Education and Research. Approval of project work is an essential precondition for a candidate to appear for the final examination.

A co-guide may be included provided the work requires substantial contribution from a sister department or from another medical institution recognized for teaching/training by JSS Academy of Higher Education and Research.

Project Evaluation: Every semester student shall present the progress of the project and monitored by the respective guide. Project work shall be presented during sixth semester examinations and carries 100 marks.

D) Maintenance of Logbook and Practical record

A diary showing each day's work must be maintained by the candidate, which shall be scrutinized by the Head of the department every month. A list of the seminars and journal reviews that have been attended and presented by the student has to be maintained which should be scrutinized by the Head of the Department.

Practical record must be maintained by every candidate and duly scrutinized and certified by the head of the department and to be submitted to the external examiner during the final examination.

E) **Seminars, Journal clubs and Teaching**:

Students are expected to actively participate in the departmental seminars and journal clubs. A record should be maintained for each student with the list of seminars and paper presented in journal club by each student.

Post graduate students should participate in undergraduate teaching, in theory, practical and tutorials.

9. Course of study

First and Second semester subjects are common to all medical MSc programmes. Students can choose one among the general electives and discipline specific electives mentioned in the respective semesters.

Course of study: Subjects and hours of teaching for theory, practical and clinical training

First Semester

Theory		**Hrs**	**Credits**
Core 1	Anatomy I**:** General anatomy, general histology, general embryology and thorax	40	4
Core 2	Physiology I	40	4
Core 3	General biochemistry	40	4
Practicals			
Module1	Anatomy I: General anatomy, general histology, general embryology and thorax	30	1
Module2	Physiology I	30	1

Module3	Basic biochemistry experiments Part I	30	1
Non- Core Subjects			
General Electives	Yoga/Music	30	2
Total		**250**	**17**

Second semester

Theory		**Hrs**	**Credits**
Core 4	Anatomy II: Abdomen, Pelvis, Head & Neck and Systemic histology	40	4
Core 5	Physiology II	40	4
Core 6	Energy metabolism and metabolism of biomolecules	40	4
Practicals			
Module1	Anatomy II**:** Abdomen, Pelvis, Head & Neck and Systemic histology	30	1
Module2	Physiology II	30	1
Module3	Basic Biochemistry Experiments: Part -II	30	1
Non-Core			
General Electives	Humanities/ Health economics	30	2
Total		**250**	**17**

MSc Medical Pharmacology

Third semester

Subjects and hours of teaching for theory, practicals & Clinical training

Third semester

Theory		Hrs	Credits
Core PH1	General Pharmacology	40	4
Core PH2	Clinical Pharmacology	40	4
Core PH3	Animal House Postings	40	4
Practicals			
Module PH1	Pharmacokinetic Problems &Pharmaco-Economic Problems	30	1

Module PH2	Animal Experiments a) Demonstration of instruments b) Short technique demonstration in animals c) Screening methods in animals Culture techniques, Staining	30	1
Non-Core			
Allied 3	Environmental science & Health	30	2
General Electives	Soft skills / Teaching & Learning methodology	30	2
Total		**240**	**18**

Fourth semester

Theory		**Hrs**	**Credits**
Core PH 4	Drugs Acting on Autonomic Nervous System, Respiratory System, Renal System, Cardiovascular System	40	4
Core PH 5	Autacoids, Haematinics & Drugs Acting On Gastro Intestinal System	40	4
Core PH 6	Geriatric postings	40	4
Practicals			
Module PH 3	ANIMAL SIMULATION EXPERIMENTS a) Bioassay b) Interpretation of graphs using animal simulation and charts	30	1
Module PH 4	Quantitative & Qualitative Analysis of Drugs a) Chemical tests- alkaloids, glycosides, steroids, acids. b) Total phenol content and protein estimation c) Antioxidant activity- FRAP, DPPH, TBARS methods	30	1
Non-Core			
Allied 4	Biostatistics	30	2
DSE	Pharmacoeconomics / Pharmacovigilance	30	2
Total		**240**	**18**

Fifth semester

Theory		**Hrs**	**Credits**
Core PH 7	Drugs Related To Endocrine System.	40	4
Core PH 8	General Chemotherapy& Systemic Chemotherapy.	40	4
Core PH 9	Molecular Biology and Research lab postings	40	4
Practicals			
Module PH 5	Molecular Techniques For Drug Identification & Estimation a) Electrophoretic separation of proteins and DNA b) DNA fragmentation assay c) HPLC, column chromatography, UV-visible spectrophotometry	30	1
Module PH 6	**Drugs Stations For Various Diseases** Hypertension, Angina and MI, NSAIDs, Bronchial asthma, peptic ulcer, epilepsy, antiplatelet and anticoagulant drugs, Diabetes mellitus, corticosteroids, haematinics, Tuberculosis, Leprosy, antiviral drugs, antifungal drugs, migraine, sedatives and hypnotics.	30	1
Non – Core			
Allied 5	Bioinformatics	30	2
DSE	Dermatology postings /Pulmonology postings	30	2
Total		**240**	**18**

Sixth Semester

Project work	20 credits
Value added programme: Workshops on career-life balance, CV-writing, and interviewing	10 credits
Total	**30 credits**

10. Conduct of Examination

The end semester examination for core papers will be held at the end of each semester for both Theory and Practical separately, conducted by JSS AHER. Examinations for non- core subjects will be conducted by respective Colleges. Division of marks for non - core paper will vary according to the subjects.

Theory Examination: – 3 hours paper, 100 marks for each core paper.

Pattern of theory question paper

Theory			
Type of Questions	**Number of Questions**	**Marks for each question**	**Total**
Long Essay	2	10	20
Short Essay	10	5	50
Short Answer	10	3	30
Total Marks			**100**

Examination Pattern:

First Semester- JSSAHER Examination				
Theory Examination				
Category	**Subjects**	**IA**	**Final Exam**	**Total**
Core 1	Anatomy I**:** General anatomy, general histology, general embryology and thorax	100	100	200
Core 2	Physiology I	100	100	200
Core 3	General biochemistry	100	100	200
Practicals				
Module1	Anatomy I**:** General anatomy, general histology, general embryology and thorax	100	100	200
Module2	Physiology I	100	100	200
Module3	General biochemistry	100	100	200
Non -Core subjects				
		Theory	**Practical**	**Total**
General Electives	Yoga/Music	25	25	50

Second Semester- JSSAHER Examination				
Theory Examination				
Category	**Subjects**	**IA**	**Final Exam**	**Total**
Core 4	Anatomy II: Abdomen, Pelvis, Head & Neck and Systemic histology	100	100	200
Core 5	Physiology II	100	100	200

Core 6	Energy metabolism and metabolism of biomolecules	100	100	200
Practicals				
Module1	Anatomy II**:** Abdomen, Pelvis, Head & Neck and Systemic histology	100	100	200
Module2	Physiology II	100	100	200
Module3	Basic Biochemistry Experiments: Part -II	100	100	200
Non - Core subjects				
		Theory	**Practical**	**Total**
Gen Electives	Humanities/ Health economics	50	--	50

MSc Medical Pharmacology

Category	**Subjects**	**Theory Marks distribution**			
		IA	**JSSAHER Exam**	**Non JSSAHER Exam**	**Total**
Core PH1	General Pharmacology	100	100	---	200
Core PH 2	Clinical Pharmacology	100	100	---	200
Core PH 3	Animal House postings	-----	------	---	---
Allied 3	Environmental science	-----	-----	50	50
Practical Marks distribution					
Module PH1	P.K, P.E, Problems & Dosage forms	100	100	---	200
PH2	Instruments ,Technique demo & Screening methods				
General Electives	Soft skills/ Teaching methodology	----	---	50	50

- There will be no separate examination for Core PH3 - Animal House postings.
- 10-15% of questions in theory paper shall be from Animal House training material.

Medical Pharmacology: Fourth semester

Category	Subjects	Theory Marks distribution			
		IA	JSSAHER Exam	Non JSSAHER Exam	Total
Core PH 4	ANS, RS, Renal, CVS, Autacoids & Blood	100	100	---	200
Core PH 5	PNS, CNS, & GIT.	100	100	---	200
Core PH 6	Molecular biology and Research lab postings	---	---	---	---
Allied 4	Biostatistics	----	---	50	50
DSE	Pharmacovigilance **/** Pharmacoeconomics	----	---	50	50
Practical's Marks distribution					
Module PH3	Bioassay & interpretation of Graphs & Charts	100	100	---	200
PH4	Chemical tests Phenolic estimation, Antioxidant assay				

- There will be no separate examination for Core PH6 - Clinical Laboratory postings.
- 10-15% of questions in theory papers shall be from clinical laboratory training material.

Medical Pharmacology: Fifth semester

Category	subjects	Theory Marks distribution			
		IA	JSSAHER Exam	Non JSSAHER Exam	Total
Core PH 7	Endocrines & Miscellaneous	100	100	---	200
Core PH 8	General & Systemic Chemotherapy, Cancer chemotherapy & immunotherapy	100	100	---	200
Core PH 9	Geriatric Clinic Postings	---	---	---	---
Allied 5	Computer skills & Bioinformatics	----	---	50	50

DSE	Dermatology postings / Clinical trial study .	----	---	50	50
Practicals Marks distribution					
Module PH 5	Molecular techniques for drug identification	100	100	---	200
PH 6	Drug & Disease stations				

- **There will be no separate examination for Core PH9 -** Geriatric Clinic Postings**.**
- **10-15% of questions in theory papers shall be from** Geriatric Clinic Postings**.**

Medical Pharmacology: Sixth semester

Category	**Marks**
Project work	100
Subject Viva Voce	70
Pedagogy	30

11. Appointment of examiners:

There shall be at least two examiners in theory and practical examination. Any staff with MD or MSc, PhD degree with 3 years of teaching experience is eligible to become examiners.

12. Criteria for declaring as pass in JSSAHER examination

Candidate should secure minimum 50% marks in each subject Theory including IA marks and Practicals including IA Marks separately to declare pass both in core and non – core papers.

Theory and Practical shall be considered as separate course. If a candidate passes in practical examination but fails in theory paper, such candidate is exempted from reappearing for practical but shall have to appear for theory paper in which subject paper candidate in has failed the subsequent examinations or vice versa.

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

A candidate securing less than 50% of marks as described above shall be declared to have failed in the examination. Failed candidate may appear in subsequent examination upon payment of examination fee to the JSSAHER.

13. Grading of performances

Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course.

Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any subject(s) in the end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the same in due course.

The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). s. It is the ratio of total credit points secured by a student in various courses in a semester and the total course credits of that semester. It shall be expressed up to two decimal places. The credit point (CP) of a course is equal to Credits (C) x Grade Point (G). Total Credit Point of a semester is sum of credit points (CP) of all courses of that semester.

Thus the SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses in a semester and the sum of the number of credits of all the courses in that semester, i.e

$SGPA = \Sigma(C_i \times G_i) / \Sigma C_i$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

For example, if a student takes five courses (Theory/Practical) in a semester with credits C_1, C_2, C_3, C_4 and C_5 and the student's grade points in these courses are G_1, G_2, G_3, G_4 and G_5, respectively, and then students' SGPA is equal to:

$$\textbf{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The SGPA shall be expressed up to two decimal places. The SGPA for each semester shall be calculated and awarded only for those students who have passed all the courses of that semester.

Cumulative Grade Point Average (CGPA)

It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places. CGPA shall be awarded only on successful completion of the programme (all eight semesters) and it is given in final semester grade report card/final transcript.

CGPA shall be calculated as follows:

$$\text{CGPA} = \frac{CP_1 + CP_2 + CP_3 + CP_4 + CP_5 + CP_6}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6}$$

Where CP_1, CP_2, CP_3,.... is the total credit points for semester I,II,III,.... and C_1, C_2, C_3,.... is the total number of credits for semester I,II,III,....

14. Declaration of class

Class shall be awarded only on successful completion of the programme (all eight semesters) and it is given in final semester grade report card/final transcript. The class shall be awarded on the basis of CGPA as follows:

First Class with Distinction = CGPA of. 8.00 and above
First Class = CGPA of 7.00 to 7.99
Second Class = CGPA of 6.00 to 6.99

The candidates who secure a CGPA of 8.00 or above and have passed in all the subjects in all the semesters in first attempt shall be declared to have obtained First Class with Distinction.

15. Carry over system:

A candidate who has failed in one or more subject in the First semester JSSAHER examinations can be permitted to enter II semester and so on. However, candidate should have passed JSSAHER examinations of all core and non- core papers from first to fifth semester to appear for Sixth semester examinations.

16. Award of Degree: A candidate who has passed all the subjects of I semester to VI Semester shall be eligible for award of Degree

17. Award of Ranks/Medals: Ranks and medals shall be awarded on the basis of final CGPA. However candidates who fail in one or more courses during the programme shall not be eligible for the award of ranks.

18. Duration for completion of the course of study

The duration for the completion of the course shall be fixed as double the actual

duration of the course and the students have to pass within the said period, otherwise they have to get fresh Registration.

19. Revaluation *I* Retotalling of answer papers

There is no provision for revaluation of the answer papers of failed candidates in any examination. However, the failed candidates can apply for retotalling.

20. **Re-admission after break of study**

Candidate who seeks re-admission to the course after break of study has to get the approval from the JSSAHER by paying a condonation fee.

No condonation is allowed for the candidate who has more than 2 years of break up period and he/she have to rejoin the course by paying the required fees.

MSc Medical Pharmacology

Goal:

The goal of postgraduate training in Pharmacology is to produce a competent MSc Pharmacologist equipped with required skills for teaching and applied research. The guidelines will help the post graduate students to achieve the same.

Objectives:

At the end of the MSc course in Pharmacology, the student should be able to:

- Recognize the importance of Pharmacology as a key branch in health sciences.
- Demonstrate sound knowledge of general pharmacological principles, systemic pharmacology and clinical pharmacology.
- Plan and conduct lecture, demonstration, practical and tutorial classes for students of medical and allied disciplines.
- Carry out screening of drugs for pharmacological and toxicological profile.
- Carry out drug related literature search, formulate a research project and undertake the same. Apply appropriate statistical methods for summarizing and analysing data.
- Present research findings in conferences (oral / poster sessions), communicate research / educational papers in peer reviewed journals, critically review and comment on research papers.
- Use computer and IT tools for teaching, research and presentation / publication of data.
- Monitor adverse drug reactions and perform a number of service activities e.g. therapeutic drug monitoring, pharmacovigilance, Pharmacoeconomics and pharmacoepidemiology
- Understand the principles of essential drug concept and rational use of drugs including rational pharmacotherapy.
- Provide drug information service to doctors / public
- Demonstrate knowledge of drug rules and regulations existing in the country.
- Be aware of the legal and ethical issues involved in drug development and research.
- Be able to constitute and conduct the proceedings of various committees e.g. IAEC, IEC, etc.
- They should also become a lifetime learner so as to be regularly updated about the advances in the field of Pharmacology.

Course outcome

After completing the course, the postgraduate should:

- To gain opportunity as a Researcher involved in drug discovery and pre-clinical screening.
- Possible outcome of research work - publications, thesis or dissertation.
- Provide a platform for their placement at Pharmaceutical Industry in R & D dept. and also in Drug marketing.
- Teaching for Medical and allied health disciplines.

Methods of training:

- Group discussions, Seminars, Symposia, Journal Clubs and case discussions.
- Lectures, demonstrations may be arranged for selected topics in pharmacology as well as in allied disciplines.
- Every candidate during his postgraduate studies, shall actively and regularly participate in undergraduate training programme.
- Web based guest lectures.
- Animal simulation experiments.
- Training in pharmacological approach to geriatric care.

Semester I

Core 1: Anatomy I- General anatomy, general histology, general embryology, and thorax

Specific Learning Objectives: During the course of the study students should be able to

1. Describe & demonstrate normal anatomical position, various planes, relation,
2. comparison, laterality & movement in our body
3. Describe the parts, blood and nerve supply of a long bone
4. Describe various joints with subtypes and examples
5. Describe superficial fascia & deep fascia along with fat distribution in body
6. Describe & differentiate between blood vascular and lymphatic system
7. Describe & demonstrate the microscopic structure of epithelial tissue, skin, blood vessels, connective tissue, cartilages, bones, nervous tissue, muscular tissue, salivary glands & lymphatic tissue
8. Describe & demonstrate the first 8 weeks of development of embryo with its anomalies
9. Describe & demonstrate the structures of thorax

THEORY **40 hrs**

I. General anatomy **(10 hrs)**

a. Introduction: Anatomical terms & terminology/body regions.
b. Connective tissue
c. Bones.
d. Muscles.
e. Joints.
f. Blood vessels & Lymphatic system.
g. Nervous system.
h. Blood vessels and nerves of upper limb
i. Blood vessels and nerves of lower limb.
j. Musculoskeletal system: Names of muscles & bones of upper & lower limb

II. General histology **(10 hrs)**

a. Histology of Epithelium.
b. Histology of Connective tissue & Cartilages.
c. Histology of Muscles.
d. Histology of bones.
e. Histology of blood vessels.
f. Histology of lymph node & spleen.
g. Histology of Tonsil & thymus.
h. Histology of nervous tissue & Ganglia
i. Histology of skin.
j. Histology of salivary glands.

III. General Embryology (10 hrs)

a. Gametogenesis.
b. Fertilization, cleavage &Implantation.
c. Second week of development.
d. Third week of development (Gastrulation, notochord, allantois)
e. Fourth week of development
f. Fetal membranes
g. Development of Placenta
h. Teratogens & Developmental anomalies
i. Genetics: Introduction, Chromosomes, Inheritance, Karyotyping & Chromosomal abnormalities. (2Hrs)

IV. Thorax (10 hrs)

a. Thoracic wall & intercostal spaces & muscles (01 hr)
b. Mediastinum (01hrs)
c. Lungs, trachea & Pleura. (02hrs)
d. Heart & pericardium (02hrs)
e. Diaphragm (01hr)
f. Histology of trachea & lungs (01 hr)
g. Histology of GIT, Liver, gall bladder, pancreas (02hrs)

Module I: Anatomy (Practicals) 30 hrs

a. Demonstration of bones of limbs (02 hrs)
b. Demonstration of slides of general Histology and slides of trachea & lung, GIT, Liver & gall bladder (10 hrs)
c. Embryology models (02 hrs)
d. Demonstration of bones of Thorax (2 hrs)
e. Demonstration of thoracic wall & mediastinum (02 hrs)
f. Demonstration of pleura, lung & trachea (06 hrs)
g. Demonstration of pericardium & heart (06 hrs)

1. Practical Evaluation: 100 marks

Description	Marks
Spotters: 20*2mark	40
Gross specimen discussion: 2*20 marks	40
Histology Slide discussion: 1*20marks	20
Total	**100**

A. RECOMMENDED TEXT BOOKS

Gross Anatomy:

1. Dutta A.K. Human Anatomy vol. I-III, Current publisher.
2. Dutta A.K. Principle of General Anatomy. Current Publisher.
3. Keith and Moore Clinical Oriented Anatomy. Lippincot Williams and Willkins.
4. Vishram Singh. Textbook of general anatomy. Elsevier.
5. Frank H. Netter. Atlas of Human Anatomy. Saunders Elsevier.

Histology:

1. Difiore's. Atlas of histology with functional co-relation.
2. Text book of histology Inderbir Singh

Genetics:

1. Medical genetics by SD GANGANE

Embryology:

1. Human Embryology by INDERBIR SINGH
2. Vishram singh Textbook of clinical Embryology

Core 2- Physiology I

Specific Learning Objectives: During the course of the study students should be able to

1. Describe the structure and functions of cell, cell membrane & cell organelles, Transport across cell membrane and membrane potentials.
2. Describe the composition, formation and functions of different blood components
3. Describe the structure & properties of nerve and different types of muscle. Describe the mechanism of muscle contraction
4. Describe the composition, functions and regulation of secretions of GIT and describe the movements of GIT.
5. Describe the mechanism of formation of urine and micturition process
6. Describe the electrical events, mechanical events and haemodynamics of cardiovascular system

Theory **40 hrs**

I. GENERAL PHYSIOLOGY **04 Hours**

1. Organization of the cell, Cell membrane & its function, cell organelles
2. Intercellular communications
3. Transport across cell membrane
4. Membrane potentials – RMP & Action potential
5. Body fluid compartments
6. Homeostasis, concepts of physiological norms, range and variations.

II. BLOOD **08 Hours**

1. Composition and functions of blood, Plasma Proteins
2. Red Blood cells – Erythropoiesis, Morphology of RBC, Functions, Normal values, Variations, PCV and ESR
3. Haemoglobin - Structure, Functions, Types, Derivatives.
4. Life span and destruction of RBC & Haemoglobin, Jaundice
5. Leucocytes – Leucopoiesis, Morphology of different types of leucocytes, functions, Variations, Humoral & Cell mediated Immunity
6. Platelets – thrombopoiesis, morphology, functions, normal values & Variation.
7. Hemostasis and blood coagulation – definition, clotting factors.
8. Mechanism of clotting, Bleeding disorders, anticoagulants
9. Blood groups –ABO system and Rh factor. Blood transfusion

III. NERVE AND MUSCLE PHYSIOLOGY **05 Hours**

1. Structure of a neuron and classification of nerve fibers, Properties, Degeneration and regeneration of nerve fibers, Neuroglia.
2. Muscle: Types, Structure of skeletal muscle.
3. Neuromuscular junction and transmission across it
4. Mechanism of muscle contraction and its molecular basis. Types of

contraction- isotonic and isometric contractions.

5. Types of skeletal muscle fibres
6. Energetics of muscle contraction– Rigor mortis.
7. Smooth muscle – Structure & Mechanism of contraction

IV. GASTROINTESTINAL SYSTEM 06 Hours

1. Introduction – Anatomy of G.I. tract, composition, functions of saliva
2. Mastication & Deglutition
3. Stomach – Compositions, functions of gastric juice, Mechanism of secretion of HCl, Gastric Motility
4. Exocrine pancreas – Compositions, functions of Pancreatic juice.
5. Liver and gall bladder – Function of liver, Composition and functions of bile. Function of gall bladder,
6. Small intestine – Composition and functions of succus entericus , Small intestine movements.
7. Large intestine – Functions and motility

V RENAL SYSTEM , SKIN AND TEMPERATURE REGUALTION 07 Hours

1. Functional anatomy of kidney, Types of nephrons, JG Apparatus and Renal blood flow , Non excretory functions of kidney.
2. G.F.R- Definition, Mechanism of filtration and its regulation.
3. Tubular function– Glucose, Water, Sodium and Chloride Reabsorption, concentration mechanism of urine, acidification of urine
4. Micturition and Cystometrogram, Renal function tests.
5. Skin & its functions and temperature.

VI CARDIO VASCULAR SYSTEM 10 Hours

1. Functional anatomy of heart, Properties of cardiac muscle, Innervation of the heart
2. Conducting system of Heart, Origin & Spread of cardiac impulse, ECG
3. Cardiac cycle.
4. Heart rate and regulation of heart rate.
5. Cardiac output definitions, variations, Regulation .
6. Blood flow & factors affecting it.
7. Blood pressure – Normal values, measurement, factors affecting and regulation
8. Regional circulation – coronary
9. Shock, Cardiopulmonary resuscitation
10. Cardio vascular changes during muscular exercises.

Practicals: 30 hrs 01 credit

Module 2: Physiology I

1. Study of the microscope & Effect of different concentrations of Saline on RBC 04 hrs
2. Haemoglobin estimation 06 hrs

3. Study of Hemocytometer 02 hrs
4. Enumeration of Red Cell Count 08 hrs
5. Demonstration of Packed cell volume and ESR 02 hrs
6. Determination of Bleeding time and clotting time 06 hrs
7. Demonstration of ECG 02hrs

Practicals Evaluation: 100 Marks

Haematology

- Major - 50 marks
- Minor - 30 marks
- Spotters - 20 marks

VII. RECOMMENDED TEXT AND REFERENCE BOOKS

TEXT BOOKS

- A K JAIN - **Complete Medical Physiology**Avichal Publishers Delhi
- INDU KHURANA - **Textbook of Physiology for Undergraduates**, Elsevier, 2nd edition
- D.Venktesh &H HSudhakar – Text book of medical physiology, Wolter kluver, 2nd edition

REFERENCE BOOKS

- GUYTON & HALL - Text of Physiology, Elsevier, 13th Edition
- GANONG's **Review of Medical Physiology**, Lange Publications, 27th edition

PRACTICAL MANUALS

- G.K.PAL – **Textbook of Practical Physiology** – University Press, 4th edition
- A.K.JAIN - **Manual of Practical Physiology**, Arya` Publishers Delhi, 5th edition

CORE 3: GENERAL BIOCHEMISTRY

Specific Learning objectives:

During the study students shall be able toUnderstand the principles and structure, functional and interaction of biomolecules.

Understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, glycoproteins and glycolipids and their importance in biological systems

Understand the basic concepts of enzymes, vitamins, and minerals along with their role in metabolizing biomolecules.

Theory **40 hrs**

UNIT – I: INTRODUCTION TO MEDICAL BIOCHEMISTRY (2 hrs)

Importance and scope of medical biochemistry in prevention, diagnosis, and therapeutics of diseases.

UNIT-II Cell Biology and Cell membrane (4 hrs)

structure and composition. Functions of cellular structures. Transport across the cell membrane i. Facilitated diffusion ii. Passive transport iii. Active transport iv. Receptor mediation v. Endocytosis and exocytosis

Membrane transport: Simple diffusion, Facilitated diffusion, Active transport (primary and secondary), Passive transport, Symport, Uniport and Antiport. Exocytosis, Endocytosis, Pinocytosis and Receptor mediation transport.

UNIT – III: CARBOHYDRATES CHEMISTRY (4 hrs)

Carbohydrates: Definition, Biological importance of Carbohydrates. Optical and Stereoisomerism of sugars.Mutarotation, Cyclicstructure, Epimers and Anomers. Monosaccharides -Classification, Structure and Biological importance of Trioses, Tetroses, Pentoses and Hexose sugars; Reactions of sugars. Disaccharides - Structure and Biological importance of Sucrose, Lactose and Maltose. Polysaccharides: Homopolysaccharides; Structure, Biological functions of Starch, Glycogen, Cellulose.Chitin, Dextrin, and Inulin.Heteropolysaccharides; Structure, Biological functions of Hyaluronic acid, Chondroitin sulphate and Heparin.

UNIT – IV: LIPIDS CHEMISTRY (4hrs)

Definition, Classification and Biological importance of lipids. Simple lipids, Properties and Characterization of fats – Hydrolysis, Saponification, Rancidity. Compound lipids - Structure and function of phospholipids -Lecithin, Sphingomyelin, Cephalin, Phosphatidyl Inositol and Phosphatidylserine. Glycolipids (Gangliosides and Cerebrosides). Derived lipids - Classification, structure, and properties of saturated and unsaturated fatty acids; Essential and Non-essential fatty acids. Sterols – Structure, Function and Properties of Cholesterol, Bile acids and lipoproteins biological importance and significance. Eicosanoids, Prostaglandins, Leukotrienes and Thromboxanes

UNIT – V: AMINOACIDS AND PROTEINS (4 hrs)

Amino acids: Definition, Amino acids. Structure and classification of amino acids, Chemical reaction of amino acids. Essential and Non-essential amino acids. Naturally occurring peptides-Glutathione, bradykinin. Peptide bond: Structure and significance of peptide bond, amino acid sequencing (Sanger's and Edman methods). Protein structure: Levels of structure in Protein Architecture, Primary structure of proteins (Eg.Insulin), Secondary structure of proteins – helix and β- pleated sheet, fibrous proteins; α-keratins,collagen.Tertiary structure of proteins (Eg. Myoglobin), Protein folding. Quaternary structure of proteins (Eg. Haemoglobin), globular proteins. Bonds stabilizing the Protein structure. Plasma proteins and its biological importance

UNIT – VI: NUCLEIC ACIDS CHEMISTRY (4 hrs)

Properties of purines, pyrimidines. Nucleosides, nucleotides. Functions of nucleotides. DNA: base composition, primary and secondary structure. Double helical structure (B, A and Z forms); stabilizing forces secondary structure. Tertiary structure of DNA. Physicochemical properties of nucleic acid: denaturation. Chemical and enzymatic hydrolysis of nucleic acids. Hybridization and its significance. Isolation of nucleic acids. RNA and its types: Structure, types mRNA, tRNA and rRNA. Primary, secondary, and tertiary structure of tRNA. Functions of RNAs.

UNIT – VII: ENZYMES (6 hrs)

Enzyme definition and classification, nomenclature, Properties, specificity, cofactors and coenzymes, Km value, factors influencing velocity of enzyme action, inhibition of Enzyme catalysed reactions, Mechanism of enzyme action, enzyme kinetics, regulation of enzyme action, isoenzymes, clinical enzymology. Immobilized enzymes- applications, Diagnostics, Therapeutics, and analytical use of Enzymes

UNIT – VIII: VITAMINS AND MINERALS (6hrs)

Classification of Vitamins - Fat soluble and water soluble. Dietary source, structures, RDA, functions, and deficiency states. Macro and micro elements – Dietary source, structures, RDA, functions and deficiency of Iron, calcium, phosphorus, magnesium, iodine, Zinc, and copper.

UNIT – IX: NUTRITION (4hrs)

Nutrients, Calorific value of food, BMR, SDA, respiratory quotient, and its applications. Balanced diet based on age, sex and activity, biological value of proteins, nitrogen balance. Dietary fibres, and its biological importance. Protein energy malnutrition – kwashiorkor and marasmus. Biochemistry of obesity. Dietetics, Total parenteral nutrition, Nutritional disorders.

UNIT –X FREE RADICALS AND ANTIOXIDENTS (2 hrs)

Formation of reactive oxygen species, Exogenous causes of formation of Free Radicals, Antioxidants

SEMESTER I – PRACTICALS **(30 Hrs)**

MODULE-3A- Basic biochemistry experiments **PART-I**

QUALITATIVE ANALYSIS OF SUBSTANCE OF PHYSIOLOGICAL IMPORTANCE 15 Hrs

1. Introduction to Biochemistry Practical's.
2. Qualitative analysis of carbohydrates-
3. Qualitative analysis of amino acids
4. Qualitative analysis of lipids
5. Reactions of NPN substances
6. Identification of substance of physiological importance

MODULE-3A-PART-II

QUANTITATIVE ESTIMATIONS 15 Hrs

1. Estimation of serum total protein
2. Principles of colorimetry& spectrophotometry
3. Estimation of glucose by GOD-POD method.
4. Estimation of blood urea by DAM method
5. Estimation of urine creatinine.

Practical Evaluation B1 & B2-100 marks

1. Spotters-Reagents, Tests, Glassware's., Instruments, equipments- 20 marks
2. Qualitative analysis of substance of physiological importance & interpretation- 40 marks
3. Quantitative estimation & interpretation- 40 marks

Recommended books

1. DL Nelson and MM Cox (2013) Lehninger, Principles of Biochemistry, WH Freeman Publication, 6th Edition
2. D Voet and JG Voet (2010) Biochemistry, John Willey & Sons Publication, 4th Edition
3. T. Palmer (2004) Enzymes: Biochemistry, biotechnology, clinical chemistry; Affiliated East West Press Private Limited.
4. L. Stryer (2002) Biochemistry; W H Freeman & Co., 5th edition.
5. Robert A. Weinberg, The Biology of Cancer, Garland Science; 2nd edition, 2013

Non- Core Subjects

General Electives-Yoga/Music

Yoga

INTRODUCTION

Yoga has gained acceptance and popularity across the Globe. It offers solace for the restless mind and a traditional and time-tested way of keeping the mind and body fit. Some use it for developing memory, intelligence and creativity. With its multi fold advantages it is becoming a part of education as a mandate or elective course. Specialists use it to unfold deeper layers of consciousness in their move towards perfection.

OBJECTIVES

In this unit you will be learning the benefits of yoga at the muscular level, breathing level, mental level, intellectual level, emotional level and the manifestations of divinity in all walks of life and the yoga way of life taking man from animal level to perfection. The application of yoga in health, in warding off executive tensions also mentioned along with work for practitioner of yoga.

BENEFITS AS MENTIONED IN YOGASUTRAS, HATHA YOGA ETC.

Yoga is a process of all-round personality development by

1. Deep relaxation at muscular level.
2. Slowing down of breath and maintaining balance at Pranic Level,
3. Increasing the intellect and calming down the mind at intellectual level,
4. Sharpening the intellect and calming down the mind at intellectual level,
5. Enhancing the happiness in life and equipoise at emotional level, and
6. Manifesting the innate divinity in man in all aspects of life.

Loosening Exercises

Stage I: **Slow Jogging**
Stage II: **Backward Jogging**
Stage III: **Forward Jogging**
Stage IV: **Side Jogging**
Stage V: **Mukha Dhauti to relax**
Forward and Backward Bending
Side Bending
Twisting
Suryanamaskara

Asanas in Standing Postures

Tadasana
Vrukshasana
Ardhakati Chakrasana
Ardha Chakrasana
Pada Hastasana

Asanas in Sitting Postures

Vajrasana
Ustrasana
Pascimottanasana

Asanas in Prone Postures

Bhujangasana
Salabhasana

Asanas in Supine Postures

Sarvangasana
Halasana
Shavasana (Quick Relaxation Technique)

Assessment plan
Theory: 25 marks
Short essay- 3 questions x 5 marks = 15 marks
Short answers- 5 questions x 2 marks= 10 marks

Practicals- 25 marks
Performing any two Asanas- 25 marks

Music

Syllabus and teaching plan

Unit 1	Brief introduction to Indian Music Knowledge of technical terms; Naada, Shruthi, Swara
Unit 2	Knowledge of Laya,Taala, sulaadisapthataala Classification of musical instruments
Unit 3	Music as medicine
Unit 4	Basic lesson 1SaraleVarase - 4, JantiVarase - 1
Unit 5	Basic lesson 2 PillariGeethe - 1, SanchariGeethe -1
Unit 6	Patriotic song, Bhajan
Unit 7	Devaranaama, Bhaavageethe
Unit 8	Vachana

Gen Elective - Music	Hours Per week	Theory Evaluation	Practical evaluation	Total Marks
	2	25	25	50

Semester II

Core 4: Anatomy II- Abdomen, Pelvis, Head & Neck and Systemic histology
Specific learning Objectives: At end of the semester students should be able to

1. Describe & demonstrate the structures of abdominal organs
2. Describe & demonstrate the anterior and posterior abdominal wall
3. Describe & demonstrate the structures of pelvis & perineum
4. Describe & demonstrate the structures of head & neck
5. Describe the parts of brain and spinal cord, Blood supply of brain & spinal cord and Cranial nerves
6. Describe & demonstrate the microscopic structure of abdominal organs, pelvic organs & head & neck organs

(Theory) **40 hours**

I. Abdomen & pelvis **(20 hrs)**

a. Anterior abdominal wall & Inguinal Region (01 hr)
b. Posterior abdominal wall (01 hr)
c. Peritoneal cavity and Peritoneum (01 hr)
d. GIT: Stomach, Duodenum, Jejunum and Ilium, Cecum and Appendix, & spleen (04 hrs)
e. Pancreas, Liver, Extra hepatic biliary apparatus, Portal venous system (02 hrs)
f. Urinary system: Kidney, Urinary bladder, Urethra (02 hrs)
g. Supra renal gland (01 hr)
h. Male genital system (02 hrs)
i. Female genital system (02hrs)
j. Anal canal & rectum (01 hr)
k. Perineal pouches (01hr)
l. Ischiorectal fossa (01hr)
m. Internal & external iliac arteries (01hr)

II. Head & neck **(16 hrs)**

a. Scalp (01hr)
b. Face: Muscles of Facial expression, facial artery, Parotid region with parotid gland (01hr)
c. Neck: Anterior Triangle of the Neck, Posterior Triangle of the Neck, Thyroid and parathyroid gland, Sub-occipital region (03hrs)
d. Temporal & infra-temporal regions & TM Joint (02hrs)
e. Submandibular region (01hr)
f. Interior of skull: Dural venous sinuses and Pituitary gland, Orbit and extra ocular muscles (02hrs)
g. Cut section of Neck: Oral Cavity and Tongue, Nose and nasal cavity, Paranasal air sinuses, Pharynx, Larynx, Auditory tube & palatine tonsil (04hrs)
h. Central nervous system: Parts of brain and spinal cord, Blood supply of brain

& spinal cord, Cranial nerves (02hr)

III. Systemic histology (04 hrs)

a. Histology of Kidney, ureter, urinary bladder
b. Histology of male & female genital system: uterus, uterine tube, ovary, testis, prostate, epididymis
c. Histology of tongue, retina & cornea.
d. Histology of Endocrine glands: Thyroid, suprarenal, pituitary

Practical 30hrs.

a. Demonstration of lumbar vertebrae, bony pelvis (02 hrs)
b. Demonstration of slides of Histology and slides of Kidney, ureter, urinary bladder, Male & female genital system, Tongue, Retina & cornea, Thyroid , suprarenal & pituitary gland (06 hrs)
c. Demonstration of organs of abdomen & pelvis (20 hrs)
d. Demonstration of anterior & posterior abdominal wall (02hrs)

Practical Evaluation: 100 marks

Description	Marks
Spotters: 20*2mark	40
Gross specimen discussion: 2*20 marks	40
Histology Slide discussion: 1*20marks	20
Total	**100**

RECOMMENDED TEXT BOOKS

Gross Anatomy:

- Dutta A.K. Human Anatomy vol. I-III, Current publisher.
- Dutta A.K. Principle of General Anatomy. Current Publisher.
- Keith and Moore Clinical Oriented Anatomy. Lippincot Williams and Willkins.
- Vishram Singh. Textbook of general anatomy. Elsevier.
- Frank H. Netter. Atlas of Human Anatomy. Saunders Elsevier.

Histology:

1. Difiore's. Atlas of histology with functional co-relation.
2. Text book of histology Inderbir Singh

Genetics:

1. Medical genetics by SD GANGANE

Embryology:

1. Human Embryology by INDERBIR SINGH
2. Vishram singh Textbook of clinical Embryology

Core 5- Physiology II

Specific learning Objectives: During the course of the study students should be able to

1. Describe the mechanics of breathing, diffusion & transport of gases, regulation of respiration and applied aspects.
2. Describe the synthesis, actions and regulation of secretion of various endocrine hormones
3. Describe the structure and function of male & female reproductive system
4. Describe the mechanism of perception of sensations and motor control
5. Describe the structure and mechanism of special sensations.

Theory: 40 hrs

I. RESPIRATORY SYSTEM **08 Hours**

1. Introduction – Functional anatomy of respiratory system
2. Pulmonary Ventilation – Mechanism of ventilation, Muscles, pressure changes, Lung volume & capacities Surfactant , compliance, Airway resistance.
3. Alveolar ventilation, dead space ventilation, Ventilation Perfusion ratio
4. Respiratory membrane, partial pressure of gases. Diffusion of gases and factors affecting it.
5. Oxygen transport – O_2 –Hb dissociation curve and CO_2 transport
6. Regulation of respiration – Neural & Chemical
7. Hypoxia - types, Periodic breathing.
8. Decompression sickness
9. Respiratory adjustments during muscular exercise.

II. ENDOCRINES **08 Hours**

1. Introduction to endocrinology, classification and mechanism of action of hormones.
2. Pituitary gland:
   - Anterior pituitary hormones, their actions, Regulation of secretion and disorders,
   - Posterior pituitary hormones - Actions, Control and disorders
3. Thyroid hormones - Synthesis, actions, Regulation of secretion and disorders
4. Parathyroid hormones - Actions, Regulation of secretion and disorders
5. Calcium homeostasis
6. Endocrine pancreas – Insulin & Glucagon.
   - a) Source b) Actions c) regulation d) Clinical disorders
7. Adrenal gland:
   - a) Adrenal cortical hormones – Actions, Regulation and Disorders.
   - b)Adrenal medullary hormones – actions

IX REPRODUCTIVE SYTEM **06 Hours**

1. Introduction.
2. Male reproductive system
   - Physiological anatomy, spermatogenesis and its regulation
   - Testosterone, compositon of semen.
3. Female reproductive system
   - Oogenesis, Oestrogen & Progesterone
   - Menstrual cycle
   - Physiology of Pregnancy
   - Contraceptive measures

X CENTRAL NERVOUS SYSTEM **12 Hours**

1. Organization of central nervous system
2. Synapse : Transmission and properties, excitatory and inhibitory neurotransmitters
3. Receptors and properties
4. Sensory system: Primary sensations : ascending tracts and sensory cortex
5. Pain sensation and thalamus
6. Spinal cord: Reflexes.
7. Pyramidal and extra pyramidal tracts
8. Functions of Basal ganglia, Cerebellum and Vestibular apparatus.
9. Functions of hypothalamus, ANS, Limbic system
10. Sleep and EEG
11. CSF and blood brain barrier (BBB)

XI SPECIAL SENSES

Vision:

1. Functional anatomy, Aqueous humor & IOP
2. Image forming mechanism, Errors of refractions
3. Retina – structure and Photochemistry of vision
4. Visual activity, Visual pathway and its lesion, visual cortex
5. Accommodation, Dark adaptation, Pupillary reflexes,
6. Color vision

Hearing :

1. Functional anatomy of Ear
2. Role of tympanic membrane, middle ear and cochlea in hearing.
3. Auditory pathway and auditory cortex.
4. Tests for hearing and deafness.

Taste and smell:

Modalities, receptors, pathways

P**ractical: 30 hrs**

Module 4: Physiology

1.Total Leucocyte count	06 hrs
2.Differential leucocyte count	12 hrs
3.Absolute Eosinophil count	06 hrs
4. Blood grouping	04 hrs
5.Demonstration of Spirometry	02 hrs

Practicals evaluation: 100 Marks

Haematology

- Major - 50 marks
- Minor - 30 marks
- Spotters - 20 marks

VII. RECOMMENDED TEXT AND REFERENCE BOOKS

TEXT BOOKS

- A K JAIN - **Complete Medical Physiology** Avichal Publishers Delhi
- INDU KHURANA - **Textbook of Physiology for Undergraduates**, Elsevier, 2nd edition
- D.Venktesh &H HSudhakar – Text book of medical physiology, Wolter kluver, 2nd edition

REFERENCE BOOKS

- GUYTON & HALL - Text of Physiology, Elsevier, 13th Edition
- GANONG's **Review of Medical Physiology**, Lange Publications, 27th edition

PRACTICAL MANUALS

- G.K.PAL – **Textbook of Practical Physiology** – University Press, 4th edition
- A.K.JAIN - **Manual of Practical Physiology**, Arya` Publishers Delhi, 5th edition

CORE 6: ENERGY METABOLISM AND METABOLISM OF BIOMOLECULES

Specific Learning objectives:

1. Students will understand the role of High energy compounds, Importance of reducing equivalents Electron transport chain and Oxidative Phosphorylation.
2. Students will understand the process of Digestion and absorption of Carbohydrates, Lipids and Proteins with associated disorders.
3. Students will understand the synthesis and utilisation of Carbohydrates, Specialised pathways, Glucose tolerance and transport, Regulation of Blood Glucose and Diabetes Mellitus.
4. Students will understand the synthesis and utilisation of lipids including lipoprotein metabolism, regulation and associated Disorders
5. Students will learn about basic of molecular biology and immunology

Theory: 40 hrs

UNIT – I: BIOENERGETICS AND BIOLOGICAL OXIDATION (2 hrs)

Redox potential, concept of bioenergetics in relation to thermodynamics. High energy compounds. Enzymes involved with special reference to oxygenases. Shuttle mechanisms. Components and organization of respiratory chain in mitochondria. Oxidative phosphorylation. Formation of ATP and its regulation. Inhibitors and uncouplers (Brown adipose tissue and thermogenesis)

UNIT – II: DIGESTION AND ABSORPTION (3 hrs)

- Carbohydrate
- Lipids
- Proteins
- Malabsorption syndromes and other related disorders
- Digestion: Digestion and absorption of Carbohydrates, proteins and fats. Role of gastro intestinal hormones in digestion.

UNIT – III: METABOLISM OF CARBOHYDRATES (6 hrs)

Glucose transporters. Glycolysis. Oxidation of pyruvate. TCA cyclee. Gluconeogenesis, Cori's cycle, Metabolism of glycogen (glycogenesis, glycogenolysis, storage disorders). HMP shunt pathway. Metabolism of fructose, galactose, uronic acid pathway, inborn errors associated with them. Blood glucose regulation. Diabetes Mellitus-Etiology, metabolism in Diabetes Mellitus, biochemical basis of acute and chronic complications, laboratory diagnosis and monitoring (Glycated Hb,). Glucose tolerance test

UNIT – IV: METABOLISM OF AMINO ACIDS AND PROTEINS (6 hrs)

Dynamic state of body proteins, protein turnover, nitrogen balance. Cellular reactions of amino acids. Formation, transport and disposal of ammonia (urea cycle). Metabolism of amino acids – glycine, serine, aromatic amino acids, sulphur containing amino acids, histidine, arginine, glutamic acid, branched chain amino acids and metabolic disorders associated with them along with laboratory diagnosis. Specialized products obtained from amino acid metabolism and their importance (Polyamines, creatine, nitric oxide), one carbon metabolism

UNIT – V: METABOLISM OF LIPIDS (6 hrs)

Oxidation of fatty acids – alpha, beta, omega – beta oxidation of odd chain and even chain fatty acids along with disorders. Formation and utilization of ketone bodies and ketosis. De novo synthesis of fatty acids, elongation and desaturation. Phospholipids (lecithin and cephalin only) and triglycerides – formation and breakdown. Lipid storage disorders. Synthesis of cholesterol, Fate of cholesterol and compounds derived from cholesterol. Lipoproteins – classification, metabolism, functions and disorders Atherosclerosis and role of PUFA in preventing atherosclerosis. Eicosanoids. Metabolism in adipose tissue, fatty liver and lipoatrophic factors

UNIT – VI: METABOLISM OF NUCLEIC ACIDS (2 hrs)

Biosynthesis and catabolism of purine and pyrimidine nucleotides. Salvage pathways and disorders

UNIT – VII: INTERMEDIARY METABOLISM (2 hrs)

Integration of carbohydrate, protein and lipid metabolism. Regulation by hormones in starvation, well fed state and diabetes mellitus. Methods of study of intermediary metabolism

UNIT – VIII: HEMOGLOBIN METABOLISM (6hrs)

Biosynthesis of heme, regulation and porphyrins. Breakdown of haemoglobin. Biochemical basis of jaundice and distinguishing features of different types of jaundice. Haemoglobin variants and Hb derivatives. Abnormal haemoglobins, hemoglobinopathies and thalassemia

UNIT – IX: GENETICS AND MOLECULAR BIOLOGY (4 hrs)

DNA replication. Transcription post transcriptional modifications, reverse transcriptase. Genetic code, translation, post translational modifications. Regulation of gene expression, mutation, Polymerase Chain Reaction, recombinant DNA technology, gene therapy, blotting techniques, Restriction Fragment Length Polymorphism, DNA fingerprinting

UNIT – X: IMMUNOLOGY (3 hrs)

Immune system, T & B lymphocytes, antigen presenting cells, humoral and cell mediated immunity, lymphokines, immune regulation, monoclonal antibodies, applications of immunological techniques, immunological disorders

SEMESTER II- PRACTICALS

Basic Biochemistry Experiments: Part -II

1. Qualitative analysis of urine and blood
    - Analysis of normal urine
    - Analysis of abnormal urine
    - Spectroscopic examination of Blood
2. Demonstration experiments
    - Chromatography
    - Electrophoresis
    - ELISA
3. Quantitative Experiments
    - Identification of unknown sample
    - Oral Glucose tolerance test
    - Determination of molar extinction coefficient of aromatic amino acids
    - Screening test for amino acids.
    - Estimation of serum creatinine by Jaffe's method & calculation of creatinine

clearance.

- Estimation of total cholesterol and HDL cholesterol CHOD-POD method
- Estimation of serum AST & ALT by Reitman &Fankel method
- Estimation of serum total & direct bilirubin
- Estimation of Uric acid in serum

Practical assessment plan- 100 marks

1. Spotters-Reagents,Tests,Glassware's.,Instruments,equipments,demonstration experiments- 20 marks
2. Qualitative analysis of urine, blood & interpretation- 40 marks
3. Quantitative estimation & interpretation- 40 marks

Recommended books

1. Lehninger's Principles of Biochemistry, Nelson, David l. and Cox, 2000 M.M. Macmillan/ worth,.NY
2. Fundamentals Of Biochemistry, Donald Voet, Judith G.Voet and Charlotte W Pratt, 1999, John Wiley & Sons, NY
3. Outlines of Biochemistry, Eric E.Conn, P.K. Stumpf, G.Brueins and Ray H.Doi, 1987. John Wiley & Sons, NY
4. Biochemistry, Lubert stryer, 1994. 3rd Edn., W H freeman and co, Sanfrancisco.
5. Text book of biochemistry,Thomas M Devlin, 1997 4th edition ,A John Wiley, In
6. Principles of Biochemistry , Garrette & Grisham, 1994. Saunders college Publishing
7. Harper's Biochemistry, R.K. Murray and others, 25 ed 2009. Appleton and Lange, Stanford
8. Regulation in Metabolism , E.A.Newshome ,C. Start, John Wiley & Sons.

Non Core subjects

General electives- Humanities/Health economics
Humanities

Specific Learning objectives: At the end of this paper the student should be able to,

1. Discuss concept and importance of health humanities in patient care practices
2. Describe various principles of health humanities in health care delivery
3. Demonstrate different components of health humanities in patient care
4. Develop and demonstrate the skills of reflective practice in health care delivery

Syllabus and teaching plan of health humanities

Sl No	Title of the topic	No of hours	Method of instruction
1.	Introduction to health humanities	01	Lecture
2.	History of medicine	02	Lecture
3.	Understanding the self- What is me?	01	Games and discussion
4.	How to interpret situations	01	Games and discussion
5.	What it means to be sick	01	Role play Group discussion
6.	What it means to be a patient	01	Role play Group discussion
7.	What it means to be an attendant	01	Role play Group discussion
8.	Team building	01	Games and discussion
	Trusting the team	01	Games and discussion
9.	Communication skills – Verbal	02	Video, group discussion
10.	Communication skills – Non verbal	01	Video, group discussion
11.	Empathy – module 1	01	Games and discussion
12.	Empathy – module 2	01	Games and discussion
13.	Breaking the bad news	01	Video, role play, discussion
14.	Interpersonal relationships	02	Lecture, video, group discussion

15.	Leadership module -1	01	Video, group discussion
	Leadership module – 2	01	Role play and discussion
16.	Developing professional identity	02	Lecture
17.	Reflective thinking for action	02	Lecture and group discussion
18.	Ethics and humanities	02	Lecture and group discussion
19.	Practicing professionalism	02	Lecture and group discussion
20.	Theatre and Humanities	02	Theatre

Assessment plan
Formative: Reflective writing and active participation in the session

Summative examination for 50 marks

- MCQ – 10 Marks
- Reflective writing on a given scenario – 10 marks
- Short essays –3 questions of 5 marks each=15marks
- Short answers – 5 questions of 3 marks each=15marks

Health economics

Specific learning objectives: At the end of the course, the student will be able to

- Explain basic economic theories and models of regulation which are applied to health care Sector
- Interpret and appropriately apply the key concepts of economics within the context of the health system
- Describe and apply key steps in critically reviewing economic evaluations and to understand their use in the decision-making process
- Understand and describe the main features of the Indian health system- in particular how it differs from other salient national health systems according to how services are delivered and purchased

Module 1 - Introduction to Economics
Introduction to economics, definition, scope, basic assumptions, economic analysis-micro, macro, positive and normative, short run, long run, equilibrium-partial, and general. Basic questions of economics, economic model-circular flow of economics, Production Possibility Curve.

Module 2 - Health Economics

Introduction, area of health economics, importance of health economics, scope, concept of health and health characteristics, need of health economics, uniqueness of health as goods and service, health and economic development, causes of health problems in India, economics evaluation methods-cost benefit, cost minimization, cost utility analysis.

Module 3 - Law of Demand

Introduction to demand, law of demand, demand in health care, elasticity in demand for health care, determinants of health care demand.

Module 4 - Law of Supply

Supply in health, law of supply, determinants of supply, elasticity of supply, relation of demand and supply.

Module 5 - Healthcare Innovation

Recent trends in Healthcare market, Start ups in Healthcare- Concepts and Cases, Health care technology from a business perspective.

Books for Reference:

1. Economics Principles and Applications (Indian Edition)-Gregory Mankiw
2. Managerial Economics Principles and World wide Applications- Dominic Salvatore, Sidhartha K Rastogi
3. Health Economics- N.K Anand and Shikha Goel
4. Health Economics for Hospital Management- Shuvendu Bikash Dutta

Assessment Plan- Theory 50 marks

5 marks x 4 questions= 20 marks

2 marks x 15 questions=30 marks

III - SEMESTER

Theory:
Core –PH 1 GENERAL PHARMACOLOGY

Learning objective

The student will be able to study about

1. History, definitions and sources of drugs,
2. PK, PD & Adverse drug reactions
3. Drugs used in Special age group- Geriatric, paediatric and pregnancy
4. Students will learn to identify & estimate unknown concentration of a given compound using various instruments HPLC, Spectrophotometer, Flame photometer, RIA, ELISA, CEDIA with different methods Bioassay, Chemical assay & Immunoassay.

UNIT 1

History, definitions and sources of drugs **2 hrs.**

a) Definitions in Pharmacology
b) Pharmacopoeias
c) Essential medicines and Orphan drugs
d) Sources of drugs

UNIT 2

Routes of drug administration; 3 hrs

a) Factors governing choice of route of drug administration
b) Classification- Local and Systemic routes. Advantages and disadvantages of different routes.
c) Local routes- Topical, Deeper tissues and Intra-arterial
d) Systemic routes-

- Oral, Sublingual, Rectal, Cutaneous- Transdermal therapeutic systems (TTS)
- Inhalation, Nasal, Parenteral-Subcutaneous, Intramuscular, Intravenous and Intradermal injections

UNIT 3

Pharmacokinetics; 5 hrs.

a) Drugs transport across membranes
b) Absorption, Distribution, Metabolism, Excretion
c) Prolongation of drug action and Targeted drug delivery devices

UNIT 4

Pharmacodynamics; 5 hrs.

a) Mechanism of Drug Action,
b) Receptors- Types of Receptors and Regulation of Receptors
c) Transducer Mechanisms

d) Receptors regulating gene expression (Transcription factors, Nuclear receptors)
e) Dose-response curve (DRC)- Drug potency and efficacy
f) Combined effect of drugs

UNIT 5

Adverse drug reaction; 2 hrs

a) Types and Severity of Adverse drug reactions
b) Pharmacovigilance- Causality assessment of adverse drug reactions

UNIT 6

Factors modifying drug action; 2 hrs

a) Factors modifying drug action
b) Pharmacogenetics & Pharmacogenomics.

UNIT 7

Drug interaction; 2 hrs

a) Mechanism of Drug Interactions
b) Pharmacokinetic interactions
c) Pharmacodynamic interactions

UNIT 8

Drugs used in Special age group- Geriatric, paediatric and pregnancy ; 4 hrs

a) Principles of prescribing, Pharmacokinetic and pharmacodynamics, Variation of efficacies, adverse drug reactions in paediatric and geriatric age groups
b) Prescribing criteria for rational drug use in geriatric population
c) Categorization of drugs according to increasing order of risk documentation during pregnancy
d) Choice of drugs for common problems during pregnancy

UNIT 9

Bioassay; 7 hrs.

a) Bioassay: principles and methods
- Direct assay
- Indirect assay, interpolation, matching, bracketing, three-point assay, and four-point assay.

b) Alternative to animal experimentations –
- In vitro cell culture techniques and
- In -Silico computer simulation.

UNIT 10

Chemical assay: 5 hrs.

Principle, Procedure and applications -
a) Chromatography: Definition and types with principle, procedure, applications, advantages and Disadvantages -paper, TLC, ion exchange, affinity, gel filtration,

gas liquid, HPLC.

b) Electrophoresis: Agarose, Paper. PAGE, SDS-PAGE, Immunoelectrophoretic, Isoelectric focusing, Blotting techniques - principle, procedure and applications.

c) Spectrophotometer,

d) Flame photometer

UNIT 11

Immunoassay (RIA, ELISA, CEDIA); 3 hrs

Principles and Applications of

a) Radioimmunoassay

b) ELISA

c) CEDIA

Core - PH 2 CLINICAL PHARMACOLOGY

Learning objective

1. Students will know about Principles of drug development preclinical & clinical trials and regulation, need of acute & chronic toxicity studies.
2. Students will learn about therapeutic index, therapeutic window phenomenon, types of drug requiring Therapeutic drug monitoring.
3. Essential drug concept, P drug concept, Rational drug prescribing, Pharmaco economics, Pharmaco vigilance, Pharmaco epidemiology & Pharmaco genomics and genetics.
4. Ethics (IEC, IAEC) institutional ethics committee, institutional Animal committee, need & Roles these committees.
5. Students will learn to screen & identify naturally occurring & synthetic compounds using cell line studies, Exvivo - isolated tissues &In vivo animal models with various methods, to know Dose, efficacy, MOA, Pharmacological actions, Pharmacokinetics & AEs of unknown or new compounds.
6. Students will know applications of Bio statistics to carryout Research activities, to know various tests, methods, P values & its significance.

UNIT 1

Principles of drug development and regulation, toxicity studies 3 hrs

a) New drug development **-**Stages in new drug development

b) Approaches to drug discovery / invention

c) Exploration of natural sources, Random or targeted chemical synthesis, Lead optimization Rational approach, Molecular modelling, Combinatorial chemistry, Biotechnology,

d) Preclinical studies**:** types of tests are performed

   1. Screening tests,
   2. Tests on isolated organs, bacterial cultures, etc.,

3. Tests on animal models of human disease
4. Confirmatory tests and analogous activities,
5. Systemic pharmacology
6. Quantitative tests
7. Pharmacokinetics
8. Toxicity tests. Acute toxicity, Sub acute toxicity, Chronic toxicity,
9. Reproduction and Teratogenicity, Mutagenicity, Carcinogenicity:

e) Clinical trials:
Good Laboratory Practices' (GLP), Good Clinical Practice' (GCP)
Phase 0: Micro dosing study
Phase I: Human pharmacology and safety,
Phase II: Therapeutic exploration and dose ranging
Phase III: Therapeutic confirmation /comparison
Phase IV: Post marketing surveillance /studies.

UNIT 2
Therapeutic drug monitoring **2hrs**
a) Methods and Clinical Application

UNIT 3
Essential drug concept **2hrs**
a) Criteria for selecting essential drugs
b) WHO recommended Essential Drug List
c) National essential medicine list

UNIT 4
P drug concept **2 hrs**
a) Selecting P drugs for various diseases.

UNIT 5
Rational drug prescribing **2hrs**
a) Factors influencing prescribing,
b) Irrationalities in prescribing
c) Process of rational prescribing,
d) Impact of irrational prescribing

UNIT 6
Pharmacoeconomics **3hrs**
a) Pharmacoeconomic analysis

UNIT 7
Pharmacovigilance **3hrs**

a) Role of Pharmacovigilance in India
b) Roles & Responsibilities of the Functional Units,
c) Pharmacovigilance Programme of India (PVPI).

UNIT 8

Pharmacoepidemiology **3 hrs**

a) Descriptive epidemiology,
b) Analytical Epidemiology.

UNIT 9

Pharmaco genomics and genetics **2 hrs**

a) Purpose and applications of pharmacogenetics and pharmacogenomics testing

UNIT 10

Ethics - (IEC, IAEC); 3 hrs

a) IEC

1. Ethics Committee, responsibilities of an IRB IEC
2. Function of an ethics committee
3. Members of Ethics Committee
4. Institutional Review Board / Independent Ethic Committees.

b) IAEC

1. Composition
2. Functions
3. Roles & Responsibilities

UNIT 11

Toxicity studies; 3 hrs

Acute, subacute, chronic toxicity studies (OECD guidelines-423 &425)

UNIT 12

Screening methods – In vivo, Ex vivo, Invitro methods; 08 hrs

Screening methods for various group of drugs

Analgesic Antipyretic , Anticonvulsant , Sedative-hypnotics, Anti-psychotic, Anti-depressant, Anti-parkinsonian, Anti-diabetic, Anti-anginal , Anti-arrhythmic , Hypotensive , Diuretic, Hypoglycaemic, Anti-inflammatory, Anti-secretory, Anti- allergic , Local anesthetic, Anti-fertility, Anti-cancer

UNIT 13

Bio statistics; 4 hrs

a) Introduction to Biostatistics
b) Principles and methods
c) Levels of measurement – nominal, ordinal, interval and ratio scales;
4. Types of Data- quantitative and qualitative

d) Tests of significance – Parametric tests: requirements, "t" test, normal z – test , and "F' test including post – hoc tests, one – way and two-way analysis of variance, analysis of covariance, repeated measures analysis of variance, simple linear correlation and regression.

Core PH 3:40 hrs **04 credits**

A. Animal House postings (4x 10 hrs)

1. Learning Objectives

Upon completion of the postings the student shall be able to

- Appreciate the applications of various commonly used laboratory animals.
- Appreciate and demonstrate the various screening methods used in preclinical research

Course contents:

Laboratory Animals: 10 Hrs

- Study of CPCSEA and OECD guidelines for maintenance, breeding and conduct of experiments on laboratory animals
- Common lab animals: Description and applications of different species and strains of animals
- Popular transgenic and mutant animals
- Techniques for collection of blood and common routes of drug administration in laboratory animals, Techniques of blood collection and euthanasia.

Recording of cardiovascular activity in animal models 06 Hrs

Assessment of motor activity in animal models 06 Hrs

Assessment of cognition in animal models 08 Hrs

Animal toxicity (acute, subacute, chronic) studies 10 Hrs

Total **40** Hrs

SEMESTER III – PRACTICALS

Module PH 1 (30 hrs)

SI. NO	TOPIC	HOURS
01	Pharmacokinetic problems	10 hrs
02	Pharmacoeconomic problems	10 hrs
03	Dosage forms	10 hrs
	Total	**30hrs**

UNIT 1

Pharmacokinetic problems; 10 hrs

a) Pharmacokinetic calculation:

1. Anaphylactic shock- adrenaline
2. Bupivacaine and Adrenaline in combination
3. Strength of Dextrose solution
4. 0.9% Sodium chloride solution
5. Mannitol percentage
6. Erythromycin suspension
7. Pregnancy & Anaemia- Iron requirement
8. Strength of Diazepam and Thiopentone sodium
9. Calculation of Heparin and Dopamine dosages
10. Ringer lactate – in dehydration
11. Lignocaine –Ventricular arrhythmias
12. Xylocaine with adrenaline
13. Paediatric dose – INH and Rifampicin, Paracetamol and Metronidazole
14. Dosage calculation of gentamycin
15. Calculation of creatinine clearance

UNIT 2

a) Pharmacoeconomic problems; 10 hrs

Pharmacoeconomic analysis of prescribed drugs and to compare alternative drugs for the treatment of various clinical condition:

1. Diabetes mellitus
2. Streptococcal tonsillitis
3. Hypertension
4. Headache in Peptic ulcer patient
5. Typhoid fever
6. Uncomplicated Chlamydial urethritis
7. HIV infection
8. Anti-pylori treatment in Peptic ulcer patient

UNIT 3

a) Dosage forms; **10 hrs**

1. Solid dosage forms
2. Liquid dosage forms
3. Inhalational dosage forms
    - Various formulations of different dosage forms
    - Advantages and disadvantages of each dosage

Module PH 2 (30 hrs)

SI.NO	TOPIC ANIMAL EXPERIMENTS	HOURS
01	Demonstration of instruments	10 hrs
02	Short technique demonstration in animals	10 hrs
03	Screening methods in animals	10 hrs
	Total	**30hrs**

UNIT 1

Demonstration of instruments; **10 hrs**

a) Demonstration/ SOPs of instruments used-

1. Electroconvulsiometer
2. Eddys hot plate
3. Rotarod
4. Y Maze
5. Flame photometer
6. Actophotometer
7. UV-Visible spectrophotometer
8. Mercury/water plethysmograph
9. Pole climbing apparatus
10. Histamine chamber
11. Diuretic cage

UNIT 2

a) Short technique demonstration in animals; **10 hrs**

b) Demonstration of animal techniques in small animals (Rats, mice, rabbits, guinea pigs)

1. Animal handling
2. Intravenous and intragastric drug administration
3. Blood drawing techniques

UNIT 3

Screening methods in animals; **10 hrs**

a) Animal Screening methods in animals for:

1. Antiepileptic agents
2. Anti inflammatory agents
3. Analgesic agents
4. Motor co-ordination.

Pattern of theory question paper

Theory			
Type of Questions	**Number of Questions**	**Marks for each question**	**Total**
Long Essay	2	10	20
Short Essay	10	5	50
Short Answer	10	3	30
Total Marks			**100**

Practical Examination: Module1 & Module 2 (100 marks)

Part A:

1. Pharmacokinetic problems – 20 marks
2. Pharmaco-economic problems 10 marks
3. Dosage forms – 20 marks

Part B:

1. Demonstration of instruments – 10 marks
2. Short technique demonstration in animals – 20 marks
3. Screening methods in animals-20

RECOMMENDED TEXT AND REFERENCE BOOKS

1. Essentials of Medical Pharmacology 8th Edition 2018 By KD Tripathi
2. Daniel, W.W. (2005). Biostatistics: a foundation for analysis in health sciences (8^{th} ed.) New York: John wiley and Sons.
3. Practical manual of Experimental & Clinical Pharmacology. Bikash Mehdi & Ajay Prakash. 2^{nd} edn 2017.
4. Fundamentals of Experimental Pharmacology, M.N. Gosh. 6^{th} edn

Non - Core Subjects
Allied-1- Research Methodology & Bioethics

Specific Learning objectives

At the end of this paper the student should be able to,

1. Describe the concept, uses and types of biomedical research
2. Discuss various steps involved in conducting the biomedical research
3. Describe various steps in developing research protocol and scientific communication
4. Describe concept and principles of ethics in biomedical research

Theory: 30hrs

Sl No	Title of the topic	No of hours	Method of instruction
1.	Introduction to health research	01	Lecture
2.	Identifying research topics	01	Lecture + Group discussion
3.	Literature search with Hands on activity	02	Lecture Hands on exercise
4.	Literature matrix	01	Lecture Hands on exercise
5.	Writing research question and objectives	01	Lecture Hands on exercise
6.	Study designs -1 – Descriptive studies	01	Lecture
7.	Study designs -2 – Analytical studies	01	Lecture
8.	Study designs -3 – Experimental studies	01	Lecture
9.	Diagnostic validation studies	01	Lecture
10.	Sampling techniques	01	Lecture Hands on exercise
11.	Sample size estimation	01	Lecture Hands on exercise
12.	Tools for data collection	01	Lecture
13.	Designing and validation of a questionnaire	01	Lecture Hands on exercise
14.	Describing study designs in molecular studies	01	Lecture
15.	Animal experiments	01	Lecture

16.	Role of statistics in research methodology	01	Lecture
17.	Role of computers in health research	01	Lecture
18.	Designing a research protocol	02	Workshop
19.	Research to publication	01	Lecture
20.	Funding opportunities and requirements	01	Lecture
21.	Introduction to Bio ethics	01	Lecture
22.	History and Principles of ethics	01	Lecture
23.	Guidelines for research ethics	02	Lecture
24.	ICH-GLP- GCP Guidelines	02	Lecture
25.	Institutional Ethics Committee	01	Lecture
26.	Informed consent	01	Lecture

Assessment plan

Formative : MCQ Based Tests, Unit tests

Summative examination for 50 marks

- MCQ – 10 Marks
- Writing research protocol for given problem statement – 20 marks
- Short essays –2 questions of 4 marks each=08marks
- Short answers – 4 questions of 3 marks each=12 marks

General electives
Soft skills/ Teaching learning Methodology

Soft skills

Specific learning objectives:

At the end of this elective, the student should be able to,

1. Understand the importance of soft skills in health profession
2. Demonstrate the attributes of professionalism and soft skills in working environment
3. Understand the methods of problem solving and conflict management in work place
4. Understand and demonstrate the leadership skills in health care setting

Hrs: 30

Sl No	Title of the topic	No of hours	Method of instruction
1	Introduction to soft skills	01	Lecture
2	General soft skills	02	Lecture Video
3	Technical soft skills	01	Case scenario based Group discussion
4	Communication skills, written communication skills, skills of writing email	01	Video Group discussion
5	Critical and structured thinking, scientific presentation skills.	02	Group discussion
6	Problem solving skills	01	Case scenario based Group discussion
7	Creativity	01	Case scenario based Group discussion
8	Team work capabilities Negotiating skills	02	Game based exercises
	Self management Time management	01	Lecture
9	Conflict management Cultural awareness	02	Role play Lecture
10	Common knowledge Responsibility	02	Lecture
11	Etiquette and good manners Courtesy	01	Role play Group discussion
12	Self esteem Sociability	02	Role play Group discussion

	Integrity/honesty Empathy	01	Role play Group discussion
14	Work ethics ; work attitude and professionalism Business management	02	Case scenario based Group discussion
15	Leadership skills	02	Video Role play followed by discussion
16	Networking skills, public speaking skills	03	Lecture
17	Flexibility and adaptability Organizational skills, emotional intelligence	03	Role play followed by discussion

Assessment plan

Formative : Reflective writing and active participation in the session

Summative examination for 50 marks

- MCQ – 10 Marks
- Reflective writing on a given scenario – 10 marks
- Long essay of Problem solving- One question of 10 marks.
- Short essays – 2 questions of 4 marks each=8 marks
- Short answers – 4 questions of 3 marks each=12 marks

Teaching learning Methodology

Specific learning objectives:

At the end of completing this elective the student should be able to

1. Understand and apply adult learning principles in teaching learning methods
2. Enlist and apply the interactive teaching learning methods at classroom and clinical setting
3. Describe and use the techniques of self-directed learning
4. Understand the concept of E learning in health professional education

Hrs: 30

Sl No	Title of the topic	No of hours	Method of instruction
1	Introduction to Teaching Learning Methodologies	01	Lecture
2	Androgogy and Pedagogy	02	Small Group Discussions

3	Large Group Teaching; Lectures (Dydactic lectures and interactive lectures)	02	Lecture and demonstrations
4	Flipped Class Rooms	01	Instructional directives and discussion
5	Small Group teaching (Tutorials, seminars)	02	Instructional directives and discussion
6	Brainstorming / Snow Balling/ Role Playing	02	Role play Group discussion
7	Journal Clubs/ Problem based learning (PBL)	01	Group discussion
8	Clinical teaching (Bed side teaching)	01	Role play Group discussion
9	Team-based learning (TBL) and Case – based Learning (CBL)	02	Role play Instructional directives and discussion
10	Independent Learning; Self-Directed Learning (SDL)	02	Instructional directives and discussion
11	Teaching of Procedural skills: Learn, see, practice, prove, do and maintain	02	Video, group discussion
12	Simulators (Mannequins and models)	02	Instructional directives and discussion
13	Simulated patients and virtual patients	01	Instructional directives and discussion
14	e-learning	02	Instructional directives and discussion
15	Innovative Teaching-Learning Methods : Pecha-Kucha Technique, Cine-meducation.	02	Video, role play, discussion
16	Collaborative Learning: Peer assisted Learning System (PALS), Peer to peer learning (P2P)	02	Lecture, video, group discussion
17	Massive Open Online Courses (MOOCs)	03	Lecture and group discussion Instructional directives and discussion

Assessment plan

Formative : Reflective writing and active participation in the sessions

Summative examination for 50 marks

- MCQ – 10 Marks
- Reflective writing on a given scenario – 10 marks
- Long essay of Problem solving- One question of 10 marks.
- Short essays – 2 questions of 4 marks each
- Short answers – 4 questions of 3 marks each

IV - SEMESTER

Theory:
Core PH4: 40 hrs **04 credits**

Pharmacology of Autonomic Nervous System, Respiratory System, Renal System, Cardiovascular System, Autacoids, Haematopoietic System– (40 HRS)

Learning objective

- Students will understand the synthesis, storage, release and degradation of the neurotransmitters of autonomic nervous system. cholinergic and adrenergic receptors and drugs
- Students will learn about mechanism of action, uses and adverse effects of drugs used in bronchial asthma and cough.
- Students will understand the drugs targeting the Renin-Angiotensin System-ACE inhibitors, Angiotensin receptor blockers- their pharmacological actions, indications and adverse effects.
- Students will learn about drugs for congestive cardiac failure, Angina pectoris, anti-arrhythmic drugs. antihypertensive drugs. different drugs used, their mechanism of action and adverse effects.
- Students will understand about different autocoids- Histamines, antihistamines serotonin (5-HT), prostaglandins, leukotrienes, platelet activating factor (PAF) - synthesis, storage, release and degradation and drug therapy of migraine.
- Students will understand the mechanism of action, clinical uses and adverse effects of different Nonsteroidal antiinflammatory drugs.
- Students will understand the haematinics,coagulants and anticoagulants, thrombolytics hypolipidaemic drugs and Plasma expanders their mechanism of action and adverse effects

UNIT 1

Pharmacology of Autonomic Nervous System; 1 hrs

a) General considerations, Organization and function, neurohumoral transmission

UNIT 2

Cholinergic system and drugs: 2 hrs

a) Cholinergic transmission, cholinergic receptors ,Cholinergic agonists, cholinomimetic alkaloids, anticholinesterases, pharmacological actions, pharmacokinetics, uses and adverse effects of individual drugs.
b) Anticholinesterase poisoning treatment

UNIT 3

Anticholinergic drugs and drugs acting on autonomic ganglia; 2 hrs

a) Anticholinergic drugs Classification ,pharmacological actions ,pharmacokinetics, atropine substitutes, uses, side effects and toxicity.
b) Drugs acting on autonomic ganglia, ganglionic stimulants, ganglion blocking agents

UNIT 4

Adrenergic system and drugs; 2 hrs

a) Adrenergic transmission, adrenergic receptors, types of receptors,
b) Classification based on action and on therapeutic uses.Pharmacological actions, pharmacokinetics, uses, side effects and contraindications of individual drugs

UNIT 5

Antiadrenergic drugs (adrenergic receptor antagonists) and drugs for glaucoma; 2 hrs

a) α adrenergic & β adrenergic, blocking drugs , classification, pharmacological actions, pharmacokinetics, interactions, adverse effects and contraindications
b) Drugs for glaucoma, open angle (wide angle, chronic simple) glaucoma, angle closure(narrow angle, acute congestive) glaucoma

UNIT 6

Drugs for Cough and Bronchial Asthma; 2 hrs

a) Drugs for cough, Pharyngeal demulcents, Expectorants (Mucokinetics), Antitussives Adjuvant Antitussives.
b) Drugs for Bronchial Asthma, classification, Sympathomimetics
c) Methylxanthines, Anticholinergics, Leukotriene Antagonists, Mast cell Stabilisers.
d) Corticosteroids, Anti IgE antibody, mechanism of action, uses, adverse effects of all the drugs. Treatment of status asthmaticus

UNIT 7 ;

Diuretics & Antidiuretics; 3 hrs

a) Relevant Physiology of Urine Formation
b) Classification, High ceiling(loop) diuretics, Thiazide and related diuretics, Carbonic anhydrase inhibitors,
c) Potassium sparing diuretics. Osmotic diuretics. Mechanism of action, uses, adverse effects and contraindications of all the drugs
d) Antidiuretic hormone(Arginine Vasopressin-AVP) ADH(Vasopressin) receptors, pharmacological actions, Vasopressin Analogues, uses, adverse effects, vasopressin antagonists.

UNIT 08

Cardiac Electrophysiological Considerations; 1 hrs

a) Impulse generation, Conduction, Excitability, Refractory period

b) Autonomic influences on cardiac electrophysiology and contractility

UNIT 09

Drugs Affecting Renin-Angiotensin System and Plasma Kinins ; 1 hrs

a) Renin- Angiotensin System (RAS),Circulating RAS, Tissue RAS, Actions of Angiotensinogen II, Angiotensin receptors and transducer mechanisms, Pathophysiological Roles

b) Angiotensin Converting Enzyme Inhibitors, Actions, pharmacokinetics, adverse effects, interactions, uses. Angiotensin Antagonists (Angiotensin receptor blockers or ARBs),uses. Direct Renin Inhibitor – Aliskiren

UNIT 10

Cardiac Glycosides and Drugs for Heart Failure; 1 hrs

a) Chemistry, Pharmacological actions, Mechanism of action, Pharmacokinetics, adverse effects, interactions of Cardiac glycosides, Vasodilators, b-Adrenergic blockers,

b) Aldosterone antagonist, Sympathomimetic inotropic drugs, Phosphodiesterase 3 inhibitors.

UNIT 11

Antiarrhythmic Drugs; 2 hrs

a) Types of cardiac arrhythmias, classification of drugs used in arrhythmias

b) Mechanism of action , uses, adverse effects of important drugs in each group

UNIT 12

Antianginal and Other Anti-ischaemic Drugs; 2 hrs

a) Types of Angina, classification of antianginal drugs. Nitrates, b blockers, calcium channel blockers, Potassium channel openers pharmacological actions, mechanism of actions, uses , pharmacokinetics, interactions, adverse effects.

UNIT 13

Antihypertensive Drugs; 2hrs

a) Classification of antihypertensive drugs.

b) Role of diuretics and desirable properties of thiazide as antihypertensive, Aldosterone antagonists, ACE inhibitors, ARBs, Calcium channel blockers

c) b-Adrenergic blockers, α adrenergic blocking drugs, Central sympatholytics , Vasodilators. Hypertension in pregnancy, hypertensive emergencies and urgencies

UNIT 14

Histamine and Antihistaminic; (2hrs)

a) Histamine- Histamine receptors, pharmacological actions, pathophysiological

roles, Uses of Histamine Analogues

b) Antihistaminics:- Classification, Pharmacological actions , Pharmacokinetic , Adverse effects , Therapeutic uses. Newer Antihistamines

UNIT 15

5-Hydroxytryptamine, its Antagonists and Drug Therapy of Migraine; (2hrs)

a) 5-Hydroxytryptamine, 5 HT Antagonists :5 HT Receptors, pharmacological actions, pathophysiological roles, Drugs affecting 5 HT system

b) Drug Therapy of Migraine

UNIT 16

Prostaglandins, Leukotrienes (Eicosanoids) and Platelet Activating Factor; (2hrs)

a) Prostaglandins, Leukotrienes, Platelet Activating Factor - Mechanism of action, Pathophysiological Roles, Preparations and Therapeutic uses.

UNIT 17

Nonsteroidal Anti inflammatory Drugs and Antipyretic-Analgesics; (2 hrs)

a) Classification, MOA, Pharmacological actions , Pharmacokinetics , Adverse effects , Contraindications, Therapeutic uses of NSAIDs ,Selective COX 2 Inhibitors & Paracetamol

UNIT 18

Antirheumatoid and AntigoutDrugs; (2hrs)

a) Anti rheumatoid and Antigout Drugs – MOA, AE of individual Drugs and their importance in treatment of RA

UNIT 19

Haematinics and Erythropoietin; (2 hrs)

a) Iron - Preparations and dose - Adverse effects, Therapeutic Uses, Indications of Parenteral Iron , Acute Iron Poisoning

b) Maturating Factors :- Vitamin B12 & Folic Acid - Preparations, dose, Therapeutic Uses , Adverse effects

c) Erythropoietin- AE, Therapeutic uses

UNIT 20

Drugs Affecting Coagulation; (2 hrs)

a) Coagulants and anticoagulants Pharmacokinetic , Adverse effects , Therapeutic uses.

UNIT 21

Drugs Affecting Bleeding and Thrombosis; (2 hrs)

a) Fibrinolytics, Antifibrinolytics , Antiplatelet Drugs - MOA, Classification, Pharmacological actions.

UNIT 22

Hypolipidaemic Drugs and Plasma Expanders; (1 hr)

a) Types of Hypolipoproteinaemia's, Classification & Therapeutic Uses of Hypolipidemic drugs,

b) Plasma Expanders: Therapeutic Use & AE

Core – 05 Drugs Acting On Peripheral Nervous System, Central Nervous System, Gastrointestinal System (40 Hrs)

Learning objective:

- Students will understand the different types of Skeletal Muscle Relaxants, Local Anaesthetics, general anaesthetic agents, Sedative-Hypnotics drugs,antiepileptic drugs, different drugs used to treat parkinsonism, antipsychotics, antidepressants, antimanic and antianxiety drugs, opioid drugs, CNS stimulants and cognition enhancers. their mechanism of action, therapeutic uses and adverse effects of the drugs.
- Students will understand the different drugs used in the treatment of peptic ulcer, vomiting, diarrhoea and constipation, the mechanism of action, uses and adverse effects of each group of drugs.

UNIT 1

Skeletal Muscle Relaxants; 2 hrs

a) Classification of Peripherally Acting Muscle Relaxants

MOA, Pharmacological actions, adverse Effects and Therapeutic Uses of competitive, Non competitive NMB Drugs –Directly acting Muscle relaxants Centrally acting Muscle relaxants.

UNIT 2

Local Anaesthetics; 2 hrs

Classification , common MOA ,Pharmacological action – Local Actions & systemic Actions , Pharmacokinetics & AE of Individual Drugs

Therapeutic Uses and Techniques of LA, Complication of Spinal Anaesthesia

UNIT3

General Anaesthetics; 3 hrs

Properties of Ideal GA, Classification , Inhalational and Intravenous General Anaesthetics- Advantages and Disadvantage &AE of each Drug.. Preanaesthetic Medication

UNIT 4

Ethyl and Methyl Alcohols; 1hrs

Ethyl alcohol: MOA, Pharmacological Actions, Pharmacokinetics , Drug interactions, AE Contraindications , Therapeutic uses Methyl alcohol: Treatment of Methanol poisoning

UNIT 5

Sedative-Hypnotics; 2 hrs

Definition of Sedative-Hypnotics, Classification, MOA, Pharmacological Actions, Pharmacokinetics , Drug interactions , AE , Contraindications , Therapeutic uses of Barbiturates and Benzodiazepines and Newer Non BZD's

UNIT 6

Antiepileptic Drugs; 3 hrs

Classification of Antiepileptic Drugs, MOA, Pharmacological Actions, Pharmacokinetics, Drug interactions, Adverse Effects, Therapeutic uses of conventional antiepileptics and Newer drugs in treatment of epilepsy

UNIT 7

Antiparkinsonian drugs - 3hrs

a) Classification of antiparkinsonian drugs, pharmacological actions, pharmacokinetics, adverse effects, interactions of Levodopa, Peripheral Decarboxylase Inhibitors, Dopaminergic Agonists, MAO-B Inhibitor, COMT Inhibitors
b) Central Anticholinergics in Parkinson's disease.

UNIT 8

Drugs Used in Mental Illness: Antipsychotic and Antimanic Drugs ; 3 hrs

a) Classification of antipsychotics, pharmacological actions, pharmacokinetics, distinctive features of neuroleptics, adverse effects ,interactions and uses of antipsychotics,
b) Atypical antipsychotics and their advantages over conventional neuroleptics ,
c) Lithium carbonate ,its mechanism of actions, pharmacokinetics and adverse effects

UNIT 9

Drugs Used in Mental Illness: Antidepressant and Antianxiety Drugs; 3 hrs

a) Classification of antidepressants, Pharmacological actions, mechanism of actions, pharmacokinetics, adverse effects and uses of Tricyclic Antidepressants, Selective Serotonin Reuptake Inhibitors, Serotonin And Noradrenaline Reuptake Inhibitors and atypical antidepressants.
b) Classification of anti anxiety drugs, Benzodiazepines, Buspirone, b blockers, role of these drugs in anxiety treatment.

UNIT 10

Opioid Analgesics and Antagonists ; 4hrs

a) Opioid alkaloids: pharmacological actions, pharmacokinetics, adverse effects, precautions and contraindications of morphine.

b) Complex action opioids and opioid antagonists, endogenous opioid peptides.

UNIT 11

CNS Stimulants and Cognition Enhancers; 2hrs

a) Classification of CNS Stimulants, Convulsants, Analeptics, Psychostimulants
b) Cognition Enhancers in the treatment of Dementia and Alzheimer's disease.

UNIT 12

Drugs for Peptic Ulcer and Gastroesophageal Reflux Disease; (4hrs)

a) Physiology of Gastric acid secretion, , Classification of drugs used in Peptic ulcer
b) In peptic ulcer:- MOA, Pharmacological actions , Pharmacokinetic , Adverse effects , Therapeutic uses of H2 receptor Blockers, Proton Pump Inhibitors, Antacids
c) Anti-Helicobacter Pylori Drugs and Drugs used in GERD

UNIT 13

Antiemetic, Prokinetic and Digestant Drugs; (4hrs)

a) Classification of Antiemetics,Prokinetic Drugs - Enumerate , MOA, Pharmacological actions , Pharmacokinetic , Adverse effects , Therapeutic uses.
b) 5-HT3 Antagonists-Enumerate, MOA, Pharmacological actions, Pharmacokinetic, Adverse effects , Therapeutic uses.

UNIT 14

Drugs for Constipation and Diarrhoea; (4hrs)

a) Purgatives and laxatives:- Classification, MOA, AE and Therapeutic uses of Bulk forming & Stimulant Purgatives, Osmatic Purgatives
b) Pathophysiology od Diarrhoea , Management of diarrhoea – IV fluids , ORT, Drug Therapy of Diarrhoea – Role of Antimicrobials and Antimotility drugs

CORE PH 6

Molecular Biology and Research lab postings 40 hrs (10x4 =40 hrs)

1. Isolation and purification of genomic DNA
2. Isolation and purification of plasmid DNA
3. Isolation of total RNA
4. Molecular hybridization- Southern blotting (DNA), Northern blotting (RNA), Western blotting (proteins)
5. Amplification of DNA by Polymerase chain reaction (PCR)
6. Restriction digestion and DNA Ligation
7. Preparation of genomic DNA from whole blood by CTAB method
8. Isolation of DNA from blood samples by Phenol-Chloroform method
9. Qualitative and quantitative determination of DNA
10. Denaturation of DNA

SEMESTER 4 - PRACTICALS

Module PH 3 **(30 hrs)**

SI. NO	TOPIC ANIMAL SIMULATION EXPERIMENT	HOURS
01	Bioassay	15 hrs
02	Interpretation of graphs using animal simulation and charts	15 hrs
	Total	**30hrs**

ANIMAL SIMULATION EXPERIMENT

UNIT 1

Bioassay : 15 hrs

a) Interpolation
b) 2 point assay
c) 3 point assay

UNIT 2

Interpretation of graphs using animal simulation and charts: 15 hrs

a) Effects of drugs on isolated frog's rectus abdominus (skeletal)muscle.
b) Effects of drugs on isolated frog's heart.
c) Effects of drugs on rabbit eye (mydriatics, miotics, local anaesthetics)

Module PH 4 (30 hrs)

SI. NO	TOPIC QUALITATIVE & QUANTITATIVE ANALYSIS OF DRUGS	HOURS
01	Chemical tests- alkaloids, glycosides, steroids, acids.	10 hrs
02	Total phenol content and protein estimation	10 hrs
03	Antioxidant activity- FRAP, DPPH, TBARS methods	10 hrs
	Total	**30 hrs**

QUALITATIVE & QUANTITATIVE ANALYSIS OF DRUGS

UNIT 1

Chemical tests- **10 hrs**

a. Identification of alkaloids, glycosides, steroids, acids in extractions & solutions by using various reagents
b. Quantitative estimation of alkaloids, glycosides, steroids, acids by using spectrophotometer.

UNIT 2

Total phenol content and protein estimation: **10 hrs**

a. Total phenol estimation in an extraction using colorimeter
b. Estimation of protein concentration in a solution using colorimeter

UNIT 3

Antioxidant activity- FRAP, DPPH, TBARS methods: **10 hrs**

a. Estimation of antioxidant activity using FRAP – Ferric reducing antioxidant power.
b. Estimation of antioxidant activity using DPPH – 2,2-diphenyl-1-picrylhydrazyl method
c. Estimation of antioxidant activity using TBARS -Thiobarbituric acid reactive substances

Practical Assessment. **Max Marks 100**

a) Bioassay	30
b) Graphs.	20
c) Chemical testing	20
d) Colorimetric assay	10
e) Estimation of Antioxidant activity	20

Allied 4 – Biostatistics

Specific learning objectives: The course will enable the student to understand how to effectively collect data, describe data, and use data to make inferences and conclusions about real world phenomena. After finishing this course, students should be able to

1. Recognize the importance of data collection and its role in determining scope of inference.
2. Demonstrate a solid understanding of interval estimation and hypothesis testing.
3. Choose and apply appropriate statistical methods for analyzing one or two variables.
4. Use technology to perform descriptive and inferential data analysis for one or two variables.
5. Interpret statistical results correctly, effectively, and in context.
6. Understand and critique data-based claims.
7. Appreciate the power of data.
8. Apply the basic terminology and definitions of epidemiology

Unit – I : **2 Hours**

Introduction :Introduction to Biostatistics; levels of measurement – nominal, ordinal, interval and ratio scales; Types of Data- quantitative and qualitative

Unit –II : **2 Hours**

Descriptive statistics – central tendency, dispersion, skewness and kurtosis.

Unit – II: **3 Hours**

Sampling : Probability and non-probability; simple random, stratified, systematic, cluster and multistage sampling; sampling and non – sampling errors

Unit III : **3 Hours**

Sample size estimation : Sample size determination for estimation : sample size determination for estimation of mean, estimation of proportion, comparing two means and comparing two proportions.

Unit – IV : **5 Hours**

Hypothesis testing : formulation and types; null hypothesis, alternate hypothesis, type I and type II errors, level of significance, power of the test, p –value , concept of standard error and confidence interval . Concept of Probability "probability distribution – normal, poisson, binomial

Unit – V: **3 Hours**

Epidemiological studies : Rates – Prevalence and incidence; types – Prospective and retrospective studies; Diagnostic Efficiency Statistics (Sensitivity, specificity, predictive values); Risk Estimation – odds ratio and survival analysis.

Unit – V : **4 Hours**

Tests of significance – Parametric tests: requirements, "t" test, normal z – test , and "F' test including post – hoc tests, one – way and two-way analysis of variance, analysis of covariance, repeated measures analysis of variance, simple linear correlation and regression.

Unit – VI: **3 Hours**

Test of significance – Non – parametric tests: Assumptions; one – sample tests (sign test, McNemar test); two – sample test (Mann whitney U test, Wilcoxon rank sum test); k –sample tests (Kruskal wallies test, and Friedman test) and chi-square test.

Unit – VII : **5 Hours**

Multivariate analysis : Introduction, Multiple regression, logistic regression, factor analysis, cluster analysis,

Essential references :

- B.L (2007). Qualitative Research : Methods for the social sciences (6th ed.) New york: Pearson education.
- Daniel, W.W. (2005). Biostatistics: a foundation for analysis in health sciences (8th ed.) New York: John wiley and Sons.

- Dillon, W.R. & Goldstein, M. (1984). Multivariate analysis: Methods & Applications. New York: John Wiley & Sons.
- Hassart, T.H (1991). Understanding Biostatistics. ST. Louis: Mosby year Book.
- Kerlinger, F.N. (1995). Foundations of Behavioral research. New York: Holt Rineheart & Winston.
- Kothari, C.R.(2003) Research Methodology. New Delhi: Wishwa Prakshna.
- Siegal, S. & castellan, N.J (1988). Non – parametric statistics for the behavioral sciences. McGraw Hill: New Delhi

Assessment Plan- Theory 50 marks

5 marks x 4 questions= 20 marks

2 marks x 15 questions=30 marks

Discipline Specific Electives

I. Pharmacoeconomics **30 hrs**

Learning objectives :

- Students will understand to reduce monetary burden on the consumers by insuring global pricing strategy for the effective management of health care system and to make more efficient use of limited resources for maximization of health care benefit at lower cost
- Students will be able to determine which healthcare alternatives provide the best healthcare outcome in terms of money spent
- To improve the allocation of resources for pharmaceutical products and services

METHODS OF PHARMACOECONOMIC EVALUATION

Students will study about four types of Pharmacoeconomic studies

a) Cost-minimization analysis (CMA)

b) Cost-effectiveness analysis (CEA)

c) Cost-utility analysis (CUA)

d) Cost-benefit analysis (CBA

OUTCOMES : The principles and methods of Pharmacoeconomics provide the means to quantify the value of pharmacotherapy through balancing costs and outcomes. By understanding the principles, methods, and application of Pharmacoeconomics, healthcare professionals will be prepared to make better, more informed decisions regarding the use of pharmaceutical products and services**.**

Reference Books: Essentials of Pharmacoeconomics by Karen L Rascati, Pharmacoeconomics: Principles & Practice by Lorenzo Pradelli

Assessment Plan- Theory 50 marks

5 marks x 4 questions= 20 marks

2 marks x 15 questions=30 marks

II. Pharmacovigilance 30 hrs

Learning objectives :

The student should be able to understand regarding

- Adverse drug reactions
- ADR form filling
- Causality assessment

Outcomes: The student will gain knowledge about ADR detection, assessment, understanding & prevention

Reference Books: Text book of Pharmacovigilance by SK Gupta, Mann's Pharmacovigilance- A comprehensive textbook

Assessment Plan- Theory 50 marks

5 marks x 4 questions= 20 marks

2 marks x 15 questions=30 marks

V- SEMESTER

Specific learning objectives:

CORE- PH 7: Drugs Related To Endocrines & Miscellaneous (40 Hrs)
Learning objectives

- Students will understand the synthesis, storage, release and regulation of secretion , classification, mechanism of action, adverse effects and therapeutic uses of anterior pituitary hormones. thyroid hormones and thyroid inhibitors, insulin and its preparations, oral hypoglycemic agents, corticosteroids, sex steroids, uterine stimulants and uterine relaxants, Calcium, Vit D and Bisphosphonates
- Students will learn about different groups of antiseptics and disinfectants, chelating agent and vitamins and vaccines and sera.

UNIT 1
Anterior pituitary hormones; (3 hrs)

a) Growth Hormone and Growth hormone inhibitors Preparations , uses and adverse effects
b) Prolactin- physiological function, Prolactin Inhibitors ; Uses and adverse effects
c) Gonadotropins and Gonadotropin releasing hormone agonists physiological functions, Preparations, Uses and adverse effects

UNIT 2
Thyroid hormone and Thyroid inhibitors: (3 hrs)

a) Thyroid hormone- Synthesis, Transport, Mechanism of action
b) Pharmacokinetics and Interactions, Uses of thyroid hormone.
c) Thyroid inhibitors-Classification, Antithyroid drugs Pharmacokinetics, Adverse effects, Preparations and Uses.

UNIT 3
Insulin, oral hypoglycemic drugs and glucagon; (5 hrs)

a) Diabetes mellitus- Introduction and types of diabetes mellitus
b) Insulin: -Actions of insulin, Mechanism of action
c) Preparations of insulin, Types of Insulin preparations, Adverse reactions to insulin, Drug Interactions, Uses of Insulin, Newer insulin delivery systems
d) Classification of Oral Hypoglycemic drugs
e) Sulfonylureas- Meglitinides, Glucagon-like peptide 1 receptor agonists, DPP4 inhibitors, Biguanides- Metformin, Thiazolidinediones, Alpha- Glucosidase inhibitors Mechanism of action, Pharmacokinetics, Interactions, Adverse effects .
f) Glucagon- Regulation of secretion, Actions, Mechanism of action and Uses.

UNIT 4

Corticosteroids; (4 hrs.)

a) Biosynthesis, Actions of steroids, Mechanism of action at cellular level
b) Pharmacokinetics, Relative activity of systemic corticosteroids and uses
c) Replacement therapy and Pharmacotherapy of Non Endocrine Diseases
d) Adverse effects, Contraindications.

UNIT 5

Androgens and Anabolic steroids (3 hrs.)

a) Natural androgens, Synthetic androgens, Regulation of secretion, Actions, Mechanism of action, Pharmacokinetics, Preparations, Side effects and Uses
b) Anabolic steroids- Preparations, Side effects and Uses
c) Anti-androgens-Uses and side effects
d) 5 alpha reductase inhibitors- Finasteride, Dutasteride
e) Drugs for erectile dysfunction- Androgens, Phosphodiesterase -5 inhibitors.

UNIT 6

Estrogens, Progestins and contraceptives; (5 hrs.)

a) Estrogens- Natural and synthetic estrogens, Regulation of secretion, Actions, Mechanism of action, Pharmacokinetics, Preparations, adverse effects and uses.
b) Antiestrogens and selective estrogen receptor modulators (SERM)- adverse effects and uses.
c) Aromatase inhibitors- adverse effects and uses.
d) Progestins- Natural and synthetic progestins, Actions, Mechanism of action, pharmacokinetics, Preparations, adverse effects and uses.
e) Antiprogestins- Mifepristone- Mechanism of action, pharmacokinetics and uses.
f) Hormonal Contraceptives- Female Contraceptives-Types of methods, Mechanism of action, practical considerations, adverse effects, Contraindications, Interactions, Health benefits and uses.

UNIT 7

Oxytocin and other drugs acting on uterus; (3 hrs.)

a) Uterine stimulants- Oxytocin- actions, Physiological role, Pharmacokinetics, uses and adverse effects.
b) Ergometrine & Methylergometrine- Pharmacokinetics, adverse effects and uses.
c) Uterine relaxants (Tocolytics)-Adrenergic agonists, Calcium channel blockers, Magnesium sulphate, oxytocin antagonists.

UNIT 8

Drugs affecting calcium balance; (3 hrs.)

a) Calcium- Physiological roles, Plasma calcium levels, Calcium absorption and

excretion, Preparations, Side effects and Uses.

b) Parathyroid Hormone- Actions, Mechanism of action and uses

c) Calcitonin- Actions, Preparations and uses.

d) Vitamin D- Actions, Vit D deficiency, Hypervitaminosis D, Pharmacokinetics, Uses

e) Bisphosphonates- Classification, Mechanism of action, Uses

UNIT 9

Drugs acting on skin and mucous membranes; (2 hrs.)

a) Demulcents, Emolients, Adsorbants and protective,Astringents.

b) Irritants and Counter irritants, Caustics and Escharotics.

c) Keratolytics, Anti seborrheics, Melanizing agents, Demelanizing agents, Sunscreens.

d) Drugs for psoriasis, Topical steroids.

e) Drugs for acne vulgaris-topical and systemic therapy.

UNIT 10

Antiseptics, disinfectants and ectoparasiticides ; (3 hrs)

a) Definition of antiseptics and disinfectants, Ideal properties of antiseptics and disinfectants, Spectrum of activity, Mechanism of action, Factors which modify the activity of germicides.

b) Classification of antiseptics and disinfectants,

c) Ectoparasiticides: Permithrin, lindane, Benzylbenzoate, Crotamiton, Sulfur, Dicophane(DDT) , Ivermectin.

UNIT 11

Chelating agents ; (2 hrs.)

a) Definition, Ideal properties of chelating agents, Dimercaprol-Adverse effects and uses. Disodium EDTA, Calcium di sodium EDTA-uses and adverse effects.

b) Penicillamine –uses and adverse effects, Desferrioxamine and Deferiprone –Uses and adverse effects.

UNIT 12

Vitamins ; (2 hrs.)

a) Definition, Fat soluble vitamins Vitamin A –Chemistry and sources, physiological role and actions, deficiency symptoms and therapeutic uses

b) Vitamin C: Chemistry and sources, physiological role and actions, deficiency symptoms and therapeutic uses.

c) Water soluble vitamins (B - Complex group) Thiamine, Riboflavin, Niacin, Pyridoxine, Pantothenic acid, Biotin : Chemistry and sources, physiological role and actions, deficiency symptoms and therapeutic uses of vitamins.

UNIT 13

Vaccines and Sera; (2 hrs.)

a) Definitions of Vaccine, Antisera & Immunoglobulins, Active immunization and passive immunization.
b) Vaccines- Killed vaccine & Live attenuated vaccines.
c) Bacterial vaccines & Viral vaccines.
d) Toxoids**,** Antisera and Immune globulins.

Core – PH 8 General and Systemic Chemotherapy, Cancer Chemotherapy, Immunotherapy (40 Hrs)

Learning objectives:

- Students will know the different groups of Antimicrobial drugs, their mechanism of action, important adverse effects and its prevention and management
- Students will learn the classification of different types of antibiotics ,sources , spectrum of activity ,mechanism of action, therapeutic uses, side effects contraindications - Sulfonamides, Beta lactam antibiotics, Fluoroquinolones, Broad spectrum antibiotics, Macrolides, Aminoglycosides
- Students will know the treatment of Tuberculosis, Leprosy,
- Students will learn classification of Antifungal Drugs, Antiviral Drugs , Antimalarial Drugs, Anti amoebic and Other Antiprotozoal Drugs & Anthelmintic Drugs, their mechanism of action, therapeutic uses, adverse effects, resistance development & advantages of combined drug therapy.
- Students will know the different groups of anticancer drugs, their mechanism of action, important adverse effects and its prevention and management
- Students will learn about different immunomodulators like immunostimulants and immunosuppressants, their uses in different clinical conditions and their adverse effects.

UNIT 1

Antimicrobial Drugs: General Considerations; 2 hrs.

a) Definitions of antibiotics, chemotherapeutic agent, antimicrobial agent. etc…
b) Classification of antimicrobial drugs based on various characteristics.
c) Mechanism of action of various antibacterial drugs
d) Drug resistance, Superinfection, Choice of an antimicrobial agent
e) Advantages & disadvantages of combined use of antimicrobials
f) Prophylactic use of antimicrobials, Failure of antimicrobial therapy

UNIT 2

Sulfonamides, Cotrimoxazole and Quinolones; 2 hrs.

a) Classification, antibacterial spectrum, mechanism of action, pharmacokinetics, adverse effects & uses of various Sulphonamides
b) Antibacterial spectrum, mechanism of action, adverse effects, preparations & uses

UNIT 3

Beta-Lactam Antibiotics; 3 hrs.

a) Definition, classification & mechanism of action of Beta-Lactam Antibiotics
b) Antibacterial spectrum, mechanism of resistance, pharmacokinetics, preparations & dose, adverse effects & uses of Penicillin – G (Benzyl Penicillin) Cephalosporins, Monobactams & Carbapenems

UNIT 4

Tetracyclines and Chloramphenicol (Broad-Spectrum Antibiotics); 2 hrs.

a) Tetracyclines – names, mechanism of action, antimicrobial spectrum, mechanism of resistance, pharmacokinetics, administration, preparations & dose, adverse effects, precautions & uses
b) Tigecycline - antibacterial spectrum, pharmacokinetics, adverse effects & uses
c) Chloramphenicol - mechanism of action, antimicrobial spectrum, mechanism of resistance, pharmacokinetics, preparations, dose, administration, adverse effects & uses

UNIT 5

Aminoglycoside Antibiotics; 2 hrs.

a) Names & common properties of Aminoglycosides
b) Mechanism of action, mechanism of resistance, shared toxicities, precautions & interactions, pharmacokinetics & dosing regimens of Aminoglycosides
c) Antimicrobial spectrum & uses of individual/each aminoglycoside

UNIT 6

Macrolide, Lincosamide, Glycopeptide Antibiotics; 2 hrs

a) Macrolide antibiotics – names & mechanism of action
b) Lincosamide antibiotics – names, mechanism of action, antimicrobial spectrum, pharmacokinetics, adverse effects, drug interactions & uses of Clindamycin
c) Glycopeptide antibiotics - mechanism of action, spectrum of activity, adverse effects & uses of Vancomycin & Teicoplanin

UNIT 7

Oxazolidinones, Miscellaneous, Polypeptide Antibiotics, Urinary Antiseptics; 2 hrs.

a) Linezolid & Tedizolid – antibacterial spectrum, mechanism of action, pharmacokinetics, adverse effects & uses
b) Miscellaneous antibiotics – Spectinomycin, Quinupristin/Dalfopristin, Daptomycin, Mupirocin, Fusidic acid
c) Prophylaxis for urinary tract infection – indications, drugs used, dose & route of administration
d) Treatment of sexually transmitted diseases (STDs) - causative agents &

drugs used with their dose & route of administration

UNIT 8

Antitubercular Drugs; 3 hrs.

a) Classification of antitubercular drugs
b) antibacterial spectrum, mechanism of action, pharmacokinetics, interactions, dose & adverse effects
c) Short course chemotherapy – treatment regimens with the dose & route of administration
d) Treatment of drug sensitive TB, multidrug resistant TB, rifampin resistant TB, mono resistant TB, poly drug resistant TB, INH resistant TB, extensive drug resistant TB
e) Treatment of TB in special conditions & comorbid conditions – pregnant women, breast feeding women, patients with adverse drug reactions to antitubercular drugs, latent tubercular infection, AIDS patients
f) Mycobacterium avium complex (MAC) infection – therapy & prophylaxis

UNIT 9

Antileprotic Drugs; 1 hr.

a) Classification of antileprotic drugs
b) mechanism of action, pharmacokinetics, dose, adverse effects, contraindications & uses
c) Reactions in leprosy and their treatment – lepra reaction & reversal reaction

UNIT 10

Antifungal Drugs ; 3 hrs.

a) Classification of antifungal drugs
b) antifungal spectrum, mechanism of action, pharmacokinetics, interactions, preparations, administration & dose, adverse effects & uses
c) Topical antifungal agents (Tolnaftate, Ciclopirox olamine, Butenafine, Undecylenic acid, Benzoic acid) – uses & adverse effects

UNIT 11

Antiviral Drugs; 3 hrs.

a) Classification of Non-Retroviral drugs
b) Anti-Herpes virus drugs – spectrum of activity, mechanism of action, pharmacokinetics, interactions, preparations, administration & dose, adverse effects & uses
c) HIV treatment principles & guidelines
d) Therapeutic regimens
e) Prophylaxis of HIV infection (pre-exposure, post-exposure, after sexual exposure, perinatal HIV prophylaxis. Etc.)

UNIT 12

Antimalarial Drugs; 3 hrs.

a) Classification of Antimalarial drugs
b) Objectives & use of antimalarial drugs
c) Causal prophylaxis, Suppressive prophylaxis
d) Clinical cure, Radical cure, Gametocidal action
e) mechanism of action, pharmacokinetics, interactions, preparations, administration & dose, adverse effects & uses
f) Treatment of severe & complicated falciparum malaria
g) Treatment of uncomplicated malaria

UNIT 13

Ant amoebic and Other Antiprotozoal Drugs; 3 hrs.

a) Classification of Ant amoebic drugs
b) spectrum of activity, mechanism of action, pharmacokinetics, adverse effects, contraindications, interactions, preparations, administration & dose, & uses

UNIT 14

Anthelmintic Drugs; 2 hrs.

a) Classification of Anthelmintic drugs
b) Choice of drugs for helminthiasis

UNIT 15

Chemotherapy of neoplastic diseases; 4 hrs.

a) Anticancer drugs- Introduction, Classification, General Toxicity of cytotoxic drugs.
b) General principles in chemotherapy of cancer.

UNIT 16

Immunosuppressant drugs; 3 hrs.

a) Classification of immunosuppressant drugs.
b) Calcineurin Inhibitors- Cyclosporine, Tacrolimus.

Core PH 9 Geriatric postings 40 hrs

The student should be able to understand regarding

a. Drug utilization studies
b. PK variations
c. PK & PD drug interactions
d. Polypharmacy & adverse outcomes in elderly patients.

SEMESTER -05

Practicals

Module - 05 **30hrs**

SI. NO	TOPIC MOLECULAR TECHNIQUES FOR DRUG IDENTIFICATION AND ESTIMATION	HOURS
01	Electrophoretic separation of proteins and DNA	10 hrs
02	DNA fragmentation assay	10 hrs
03	HPLC, column chromatography, UV-visible spectrophotometry	10 hrs
	Total	**30 hrs**

Module – 5 (30 hrs)

a) Spectrophotometry: **3 hrs**

Definition, principle, types, device, procedure, objectives.

b) DNA fragmentation assay: **6hrs**

Principle, materials and reagents, procedure, calculation, application.

c) HPLC: **5hrs**

Definition, principle, types, instrumentation, preparation and procedure, application, disadvantages.

d) Column chromatography: **8hrs**

Definition, principle, packing the column, procedure, application.

e) Electrophoretic separation of DNA and proteins: **8hrs**

Introduction, principle, apparatus, support medium, stains, reagent, procedure, interpretation, application.

Module- 06 **30 hrs**

SI. NO	TOPIC DRUGS STATIONS FOR VARIOUS DISEASES	HOURS
01	NSAIDs, Antiplatelet drugs, Anticoagulant drugs, Corticosteroids, Haematinics, Antiviral drugs, Antifungal drugs, Sedatives and hypnotics	15 hrs
02	Hypertension, Angina and MI, Epilepsy, Diabetes mellitus, Tuberculosis, Leprosy, Migraine, Bronchial asthma, Peptic ulcer	15 hrs
	Total	**30 hrs**

Module – 6 **(30 hrs)**

a) Drugs stations: **15 hrs**

Students should be able to (a) identify the various drugs belonging to different groups (b) classify them, write their mechanism of action, pharmacological actions, pharmacokinetics, uses, adverse effects, contraindications & any important drug interactions.

NSAIDs, Antiplatelet drugs, Anticoagulant drugs, Corticosteroids, Haematinics, Antiviral drugs, Antifungal drugs, Sedatives and hypnotics.

b) Disease stations: **15 hrs**

Students will be provided with case scenarios. They should be able to (a) analyse the case scenario (b) write the various groups of drugs available for the particular disease (c) write their mechanism of action, pharmacological actions, pharmacokinetics, adverse effects & contraindications

Hypertension, Angina and MI, Epilepsy, Diabetes mellitus, Tuberculosis, Leprosy, Migraine, Bronchial asthma, Peptic ulcer

SEMESTER V

Theory Examination (100 marks)

Assessment Plan

20 marks x 2 questions	= 40 marks
10 marks x 4 questions	= 40 marks
5 marks x 4 questions	= 20 marks

Practical Assessment (Modules 5 and 6)	100 marks
Identify various chemical bonds in a given test solution.	10 marks
Separate the pharmacological constituents in the given mixture.	20 marks
Separate the given solution using agarose gel electrophoresis and identify the bands.	30 marks

1) Identify the various drugs belonging to different groups. Classify them, write their mechanism of action, pharmacological actions, pharmacokinetics, therapeutic uses, adverse effects, contraindications & any important drug interactions. **20 marks**

2) Analyse the case scenario, write the various groups of drugs available for theparticular disease, write their mechanism of action, pharmacological actions, pharmacokinetics, adverse effects & contraindications. **20 marks**

Skill enhancement-Internship training

Students will be trained in reputed laboratories/industries for a period of 2 months. Only those students who have passed all the courses in all the semesters can enter

the industry internship. The student must maintain the logbook which has to be certified by the concerned authority in the industry on a daily basis. At the end of the internship, the student should have attained the defined competencies and write his reflection which will be certified by the Laboratory/industry authorities along with their feedback. This will be submitted to the head of the department. Based on the logbook, his/her reflection and the feedback from the laboratory/ industry marks will be allotted from a maximum mark of 50.

5th SEMESTER

Discipline Specific Electives

I. Dermatology postings **30 hrs**

Learning Objectives: The student should be able to

- Explain the pharmacotherapy of topical & systemic drugs used for various dermatological conditions

Outcomes: Analyse prescribing pattern & drug interactions .

Reference Books: A manual of dermatology by Zohra Zaidi, Text book of dermatology by Ramji Gupta

Assessment Plan- Theory 50 marks

5 marks x 4 questions= 20 marks

2 marks x 15 questions=30 marks

II. Clinical trial study **30 hrs**

Learning Objectives: The student should be able to

- Prepare protocols for preclinical & various phases of clinical trials & monitor ADR during clinical trials.
- Critically evaluate drug formulation
- Gain knowledge about PK studies & clinical rials
- **Outcomes:** Assimilate information on pharmaceutical preparations & evaluate the ethics & modalities involved in the development & introduction of new drugs
- **Reference Books:** Text book of Clinical trials by David Machin, Text book of clinical research by Dr. Vikas Dhikav

Assessment Plan- Theory 50 marks

5 marks x 4 questions= 20 marks

2 marks x 15 questions=30 marks