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 PHYSIOLOGY
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

- Introduction
- Aims and objectives of study
- Review of Literature
- Material and Methods
- Results
- Discussion
- Conclusion
- Summary
- References
- Tables
- 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 Physiology

Third semester

Theory		**Hrs**	**Credits**
Core P1	1.General Physiology 2.Blood	40	4
Core P2	1.Gastrointestinal system 2. Renal system	40	4
Core P3	Clinical postings – Pathology, Biochemistry	40	4
Practicals			
Module P1	Haematology experiments I	30	1
Module P2	Haematology experiments II	30	1

Non-Core			
Allied 1	Research Methodology & Bioethics	30	2
General Electives	Soft skills / Teaching & Learning methodology	30	2
Total		**240**	**18**

Fourth semester

Theory		**Hrs**	**Credits**
Core P4	1. Respiratory system 2.Cardiovascular system	40	4
Core P5	1. Endocrine system 2.Reproductive system	40	4
Core P6	Clinical postings – Pulmonology, Cardiology, Biochemistry	40	4
Practicals			
Module P3	Human & Clinical experiments of Respiratory system	30	1
Module P4	Human & Clinical experiments of Cardiovascular system	30	1
Non-Core			
Allied 2	Biostatistics	30	2
DSE	Molecular biology techniques / Heart Rate variability and its application	30	2
Total		**240**	**18**

Fifth semester

Theory		**Hrs**	**Credits**
Core P7	1. Nerve Muscle Physiology 2. Nervous system	40	4
Core P8	1.Special senses 2. Integrated Physiology	40	4
Core P9	Clinical postings – Medicine, Neurology, Ophthalmology, ENT	40	4
Practicals			
Module P5	Amphibian and mammalian experiments EMG	30	1
Module P6	Human & Clinical experiments of Nervous system	30	1
Non – Core			

Skill enhancement	Internship training	--	14
DSE	Animal study models & techniques/ Evoked potentials and its application	30	2
Total		**240**	**30**

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	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 Physiology

Third Semester- JSSAHER Examination				
Theory Examination				
Category	**Subjects**	**IA**	**Final Exam**	**Total**
Core P1	General Physiology, Blood	100	100	200

Core P2	Gastrointestinal system , Renal system	100	100	200
Core P3	Clinical postings – Pathology, Biochemistry	---	---	---
Practical				
Module P1 & P2	Haematology experiments I & II	100	100	200
Non -Core subjects				
		Theory	**Practical**	**Total**
Allied 1	Research methodology & Bioethics	50	---	50
Gene Electives	Soft skills / Teaching & Learning methodology	50	---	50

- There will be no separate examination for Core P3 - Clinical Laboratory postings.
- 10-15% of questions in theory paper shall be from clinical laboratory training material.

Fourth Semester- JSSAHER Examination				
Theory Examination				
Category	**Subjects**	**IA**	**Final Exam**	**Total**
Core P4	Respiratory system, Cardiovascular system	100	100	200
Core P5	Endocrine system, Reproductive system	100	100	200
Core P6	Clinical postings – Pulmonology, Cardiology, Biochemistry	---	---	---
Practicals				
Module P3 & P4	Human & Clinical experiments of Respiratory and Cardiovascular systems	100	100	200
Non -Core subjects				
		Theory	**Practical**	**Total**

Allied 2	Biostatistics	50	---	50
DSE	Molecular biology techniques/ Heart rate variability and its applications	50	---	50

- There will be no separate examination for Core P6 - Clinical Laboratory postings.
- 10-15% of questions in theory papers shall be from clinical laboratory training material.

Fifth Semester- JSSAHER Examination				
Theory Examination				
Category	**subjects**	**IA**	**Final Exam**	**Total**
Core P7	Nerve Muscle Physiology, Central Nervous system	100	100	200
Core P8	Special senses, Integrated Physiology	100	100	200
Core P9	Clinical postings – Medicine, Neurology, Ophthalmology, ENT	---	---	---
Practicals				
Module P5 & P6	Amphibian and mammalian experiments, EMG Human & Clinical experiments of Nervous system	100	100	200
Non -Core subjects				
		Theory	**Practical**	**Total**
Skill enhancement	Industry exposure report	---	---	50
DSE	Animal study models & techniques/ Evoked potentials and its applications	50	---	50

- There will be no separate examination for Core P9 - Clinical Laboratory postings.
- 10-15% of questions in theory papers shall be from clinical laboratory training material.

Fifth Semester- JSSAHER Examination	
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

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

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:

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

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 Physiology

Goal:

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

Course outcome

After completing the course the postgraduate should:

1. Have mastered most of the competencies, with awareness of the contemporary advances and developments in physiology.
2. Be a competent teacher in physiology, who shall have acquired the basic skills in teaching of the medical and paramedical professionals.
3. Be a researcher who shall have acquired a spirit of scientific inquiry and is oriented to the principles of research methodology.
4. Be able to interact with allied departments and render services in advanced laboratory investigations.

Objectives:

At the end of the course a post graduate student in physiology should be able to:

A. Cognitive Domain

1. Demonstrate comprehensive knowledge and understanding of general and systemic physiology.
2. Comprehend the physiological basis of health and disease affecting various organ systems.
3. Analyze the research work, publish scientific articles in peer reviewed journals and critically evaluate published journal literature.
4. Effectively use the library facilities including CD Rom and internet search.

B. Affective Domain

1. Communicate effectively with peers, students and teachers in various teaching - learning activities.
2. Function as an effective member of teaching team & / or research team.

C. Psychomotor Domain

1. Demonstrate and perform appropriate experiments in physiology
2. Effectively teach UG medical students the basic physiological mechanisms, pathophysiology of diseases and their management using appropriate teaching techniques and resources.
3. Acquire skills in conducting collaborative research in the field of physiology & allied sciences.

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 and explain the mechanism of muscle contraction
4. Describe the composition, functions and regulation of secretions of GIT and 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, Mechanism of clotting, Bleeding disorders, anticoagulants
8. 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

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

REFERENCE BOOKS

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

PRACTICAL MANUALS

1. G.K.PAL – **Textbook of Practical Physiology** – University Press, 4th edition
2. 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:

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 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
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

III REPRODUCTIVE SYTEM **06 Hours**

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

IV 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 **06 Hours**

Vision:

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

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

REFERENCE BOOKS

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

PRACTICAL MANUALS

1. G.K.PAL – **Textbook of Practical Physiology** – University Press, 4th edition
2. 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)

a. Carbohydrate
b. Lipids
c. Proteins
d. 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 cycle e. 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 P1: 40 hrs **04 credits**

Specific learning objectives:

At the end of the course of the study students should be able to

- Describe the structure and functions of cell, cell membrane & cell organelles, Transport across cell membrane, membrane potentials and applied aspects
- Describe the composition, formation and functions of different blood components and applied aspects

I. General Physiology **15 hrs**

1. History of Medicine with special reference to physiology
2. Cell physiology – Cell cycle, organization and physical structure of cell, apoptosis
3. Homeostasis: Internal environment, Control systems of body
4. Body fluids compartments and measurements, oedema and dehydration
5. Transport across cell membrane
6. Membrane potentials and its measurements
7. Genetics: Genetic code, its expression and regulation of gene expression
8. Biophysical principles

II.Blood **25 hrs**

1. Blood: composition and functions, Blood volume and its measurements
2. Plasma proteins: types, properties and functions
3. RBC's: formation, functions
4. Heamoglobin – structure, synthesis, types – normal & abnormal,
5. Fate of RBC's and haemoglobin, jaundice, Anemia's and Polycythemia
6. WBC's: Types, formation, structure and functions of each type
7. Leukocytosis, leucopenia and leukemia
8. Immunity: Reticuloendothelial system, Cell mediated, Humoral immunity and immune reactions
9. Platelets: structure, formation, functions
10. Haemostasis: Definition and Steps, coagulation, fibrinolytic system, anticoagulants and coagulation tests
11. Blood groups: Major and minor blood group systems
12. Blood transfusion and its hazards

13.Lymph: formation and functions

Core P 2:40 hrs **04 credits**

Specific learning objectives:

At the end of the course of the study students should be able to

- Describe the composition, functions and regulation of secretions of GIT and describe the movements of GIT and applied aspects
- Describe the mechanism of formation of urine, micturition process and applied aspects

I. Gastrointestinal system **20 hrs**

1. General overview of GI system - Organization of Gastrointestinal wall, Innervation of GIT
2. Oral Cavity: Mastication and digestion in mouth and its importance. Salivary secretion: mechanism, composition, functions and regulation.
3. Physiology of deglutition : Definition, stages, neural control and applied aspects.
4. Stomach : Overview of functions, gastric secretion – mechanism, composition, Function and regulation. Experimental procedures to elucidate and phases of gastric secretion.
5. Gastric motility – characteristics and control, gastric emptying and antral pump mechanism, peptic ulcer.
6. Pancreatic secretions: Composition, mechanism, functions and regulation.
7. Liver: Functions, Bile formation, secretion and regulation, Entero hepatic circulation.
8. Gall bladder: Functions, Mechanism and regulation of gall bladder contraction
9. Jaundice, Physiological basis of liver function tests
10. Small intestine: Secretion, movement and control.
11. Large intestine: Functions, secretions, movements.
12. Defecation: Mechanism and control.
13. Physiology of vomiting, diarrhoea, constipation.
14. Gastrointestinal hormones
15. Digestion and absorption.

II. Renal system **20 hrs**

1. Functional anatomy, Structure and function of a Juxta glomerular apparatus. Renal circulation.
2. Mechanism of urine formation involving processes of filtration, tubular reabsorption, secretion and concentration of urine.Water diuresis and osmotic diuresis.
3. Regulation of acid base balance.
4. Renal mechanisms for regulation of ECF volume, blood pressure and ionic composition.

5. Innervations of bladder, micturition and abnormalities of micturition.
6. Renal Function tests
7. Renal failure, Artificial kidney, dialysis and renal transplantation. Diuretics,
8. Integumentary system; Structure of Skin and its functions, sweat glands and thermoregulation

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

1. Clinical Postings to

1. Pathology – Haematology & Blood Bank 15 Hrs
2. Biochemistry – LFT, lipid profile, RFT 25 Hrs

Practical:

Module P1: 30 hrs **01 credit**

1. Study of the microscope and Effect of different concentrations of Saline on RBC.
2. Haemoglobin estimation
3. Enumeration of Red Cell Count
4. Demonstration of Packed cell volume, ESR and Blood Indices
5. Osmotic fragility of Red blood cells
6. Specific gravity of blood
7. Reticulocyte count

Module P2: 30 hrs **01 credit**

1. Total Leucocyte count
2. Differential leucocyte count
3. Arneth count
4. Absolute Eosinophil count
5. Platelet count
6.Bleeding time, clotting time
7. Blood grouping

RECOMMENDED TEXT AND REFERENCE BOOKS

TEXT BOOKS

1. A K JAIN - Complete Medical Physiology Avichal Publishers Delhi
2. INDU KHURANA - Textbook of Physiology for Undergraduates, Elsevier, 2nd edition
3. G K Pal - Text book of Medical Physiology, Elsevier, 3rd updated edition

REFERENCE BOOKS

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2. GANONG's Review of Medical Physiology, Lange Publications, 27th edition

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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
13	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 P4: 40 hrs **04 credits**
Specific learning objectives:

At the end of the course of the study students should be able to

- Describe the mechanics of breathing, diffusion & transport of gases,regulation of respiration and applied aspects.
- Describe the electrical events, mechanical events and haemodynamics of cardiovascular system and applied aspects

I. Respiratory system 15 Hrs

1. Functional anatomy of respiratory system
2. Mechanics of breathing: Movements of thoracic cage during respiration, intrapleural and pulmonary pressure and volume changes, pressure-volume inter-relationships, lung compliance, surfactant, airway resistance, work of breathing.
3. Spirometry, lung volumes & capacities: Definitions, normal values and its significance
4. Alveolar ventilation, Dead space ventilation, Ventilation perfusion ratio and its importance in respiratory diseases.
5. Diffusion of gases: Alveolar-capillary membranes, diffusion capacities, partial Pressure gradients and factors influencing diffusion of gases.
6. Gas Transport: Oxygen transport – oxygen dissociation curve- factors affecting its shift and Bohr's effect.
7. Carbon dioxide transport – tissue uptake, carriage in blood and release at the lungs importance of red blood cell, chloride shift, Haldane effect.
8. Regulation of respiration : Neural and chemical regulation, integrated responses.
9. Abnormal breathing : Apnoea, hyperpnoea, tachypnoea, dyspnoea, Chyne-stokes breathing and Biot's breathing- definition, features and physiological basis.
10. Hypoxia, cyanosis, asphyxia
11. Role of respiratory system in acid base balance
12. Pulmonary function tests
13. Artificial respiration: types, principles, indications, advantages and disadvantages.

II. Cardiovascular physiology 25 Hrs

1. Functional anatomy and innervations of heart
2. Properties of cardiac muscle

3. Electrical activity of the Heart – origin and spread of cardiac impulse. Electrocardiogram: Definition, waves and their explanations.ECG recording Techniques Cardiac arrhythmias and their ECG interpretation
4. Heart rate and its regulation
5. Cardiac cycle – Phases, pressure and volume changes, Heart sounds, JVP, Arterial pulse
6. Cardiac output: Definition, normal values and variations, major determinants of cardiac output and regulation, Heart-lung preparation, measurement of cardiac output.
7. Haemodynamics: General principles of circulation Blood flow - Laminar and turbulent flow, factors affecting blood flow and resistance, critical closing pressure. Regulation of blood flow
8. Arterial Blood Pressure : Definition, normal value, variations, measurement, mean arterial pressure (MAP) and its determinants. Regulation of blood pressure.
9. Regional circulation : Coronary, cerebral, cutaneous, capillary,splanchnic, skeletal muscle and foetal. Normal values, special features and regulation.
10. Cardiovascular changes during exercise.
11. Cardiac failure, circulatory shock.

Core P5: 40 hrs **04 credits**

Specific learning objectives:

At the end of the course of the study students should be able to

- Describe the synthesis, actions and regulation of secretion of various endocrine hormones and applied aspects
- Describe the structure and function of male & female reproductive system and applied aspects

I. Endocrine system **25 hrs**

1. General principles of endocrinology; Classification and mechanism of action of hormones
2. Functional anatomy, mechanism and actions of hormones and applied aspects of
    - Pituitary gland
    - Thyroid Gland
    - Parathyroid gland - Physiology of bone, Hormonal Control of Calcium Metabolism
    - Endocrine Pancreas &. Regulation of blood glucose level
    - The Adrenal Medulla & Adrenal Cortex
    - Pineal gland, Local hormones
    - Energy Balance, Metabolism & Nutrition

II. Reproductive system **15 hrs**

1. Sex determination and differentiation, Chromosomal disorders

2. Male reproductive system:
    - Primary and accessory organs and their functions
    - Puberty in males
    - Spermatogenesis and its regulation
    - Testosterone- secretion, transport, metabolism, mechanism and physiological
    - Actions. Control of testicular function
3. Female reproductive system:
    - Functional anatomy
    - Puberty in females
    - Ovarian hormones – Estrogen and progesterone, Mechanism and physiological actions, Control of ovarian function
    - Physiology of menstrual cycle: Ovarian cycle, uterine cycle, vaginal and cervical Cycle. Physiology of ovulation and its detection
    - Menopause and menstrual abnormalities.
    - Physiology of fertilization and implantation.
    - Physiology of pregnancy : Endocrine changes, foeto-placental unit, changes in mother during pregnancy, tests for pregnancy
    - Physiology of parturition and lactation
    - Contraception
    - Infertility and assisted reproduction

Core P 6:40 hrs **04 credits**

1. Clinical Postings to department of
    - Pulmonology
    - Cardiology
    - Biochemistry – hormonal assay, Diabetic profile,

Practical:

Module P3: 30 hrs **01 credit**

1. Stethography
2. Spirometry
3. Measurement of VO2 Max
4. Clinical examination of Respiratory system

Module P4: 30 hrs **01 credit**

1. Examination of pulse & Recording of pulse tracing
2. Recording of blood pressure
3. Effect of Posture & Exercise on blood pressure
4. Recording of ECG & Heart rate variability
5. Autonomic function tests

6. Clinical examination of Cardiovascular system

RECOMMENDED TEXT AND REFERENCE BOOKS

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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

Department Specific Electives

I. Molecular biology techniques

Learning objective

- Students will understand the structure of cell and various cellular events in the biological system.
- The student will be able to describe the general principles of gene organization and expression in both prokaryotic and eukaryotic organisms.
- The students will learn about importance of the molecular diagnostics in modern era, ethical issues molecular diagnosis in medical practise

MOLECULAR BIOLOGY TECHNIQUES **30 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

II. Heart Rate Variability and its applications

Learning objectives: Upon completion of the course student should be able to

- Explain the Heart Rate Variability, procedure of recording and its clinical application

Course contents:

1. Definition and clinical significance of HRV
2. Phenomenon and Variation of HRV
3. HRV and autonomic nervous system
4. Measurement of HRV
5. Artifact and analysis of HRV

- Time domain methods & Frequency methods
- Geometric methods & Non linear methods

6. Normal values of standard measures
7. HRV Changes in different clinical conditions
8. HRV modifications by specific intervention
    - Effect of exercise
    - Effect of Yoga
    - Autonomic tests
    - Drugs

Assessment Plan- Theory 50 marks

5 marks x 4 questions= 20 marks

2 marks x 15 questions=30 marks

V- SEMESTER

Specific learning objectives:

At the end of the course of the study students should be able to

- Describe the structure & properties of nerve and different types of muscle.
- Describe the mechanism of muscle contraction and applied aspects
- Describe the mechanism of perception of sensations and applied aspects
- Describe the different level of motor control and applied aspects
- Describe the different higher mental functions, its mechanism and applied aspects

Core P 7:40 hrs **04 credits**

I. Nerve Muscle Physiology **15 hrs**

1. Neuron, Neuroglia and Nerve fibres – Classification & properties
2. Degeneration and regeneration of nerve fibres, nerve growth factors
3. Neuromuscular transmission and its disorder, Drugs acting at Neuromuscular junction.
4. Skeletal muscle: Structure, Excitation and contraction coupling, molecular basis of contraction, Types of contraction Muscle types and properties and energy sources
5. EMG and Muscle disorders
6. Smooth muscle: Types, electrical activity and molecular basis of contraction Properties of smooth muscle
7. Cardiac muscle: Structure, properties, molecular basis of contraction

II. Central Nervous system **25 hrs**

1. Introduction: Organization of the nervous system
2. Synapse – electrical activities & properties
3. Sensory system – Receptors, ascending tracts, sensory cortex
4. Pain and other sensations
5. Motor system – Spinal cord, Reflexes, Motor cortex and descending tracts
6. Spinal cord lesions
7. Basal ganglia, Cerebellum and Vestibular apparatus
8. Control of voluntary and involuntary movements
9. Control of Posture and equilibrium
10. Thalamus, Hypothalamus and Autonomic nervous system
11. Cerebral cortex, Prefrontal lobe and Limbic system – Behavioral physiology
12. Cerebrospinal fluid and blood brain barrier
13. Reticular formation, Sleep & EEG
14. Higher cortical functions: Speech, learning and memory

Core P 8:40 hrs **04 credits**

Specific learning objectives:

At the end of the course of the study students should be able to

- Describe the structure, mechanism of special sensations and applied aspects
- Describe the physiological changes to exercise and its applied aspects
- Describe the physiological changes to different environmental conditions and its applied aspects
- Describe the physiological changes to yoga
- Describe the physiological functions during foetal life and aging

I. Special senses – 20 hrs

1. Vision: Functional anatomy, aqueous humor, IOP,
    - Optics of vision, errors of refraction
    - Photochemistry of vision, Light and dark adaptation
    - Neurophysiology of vision: Visual pathway and visual cortex
    - Color vision and applied aspects
    - Movements of eyeball and squint
2. Hearing: Functional anatomy, Auditory pathway and auditory cortex
    - Mechanism of hearing
    - Deafness, Test for hearing, Audiometry
3. Olfaction: Physiology of olfaction and its disorders
4. Gustation: Physiology of gustation and its disorders

II. Integrated Physiology – 20 hrs

A. Exercise and sports physiology

1. Types of exercise
2. Acute and chronic cardio respiratory changes during and after exercise
3. Physical fitness & its Benefits

B. Environmental Physiology

1. High altitude physiology: Acclimatization
2. Deep sea physiology: Dysbarism
3. Space physiology: Positive and negative g forces

C. Chronophysiology

1. Foetal physiology
2. Physiology of growth and development and its disorders
3. Physiology of Aging

D. Effect of sedentary life style

E. Yoga and meditation

1. Physiological changes to yoga and meditation

Core P 9:40 hrs **04 credits**

1. Clinical Postings – Department of Medicine, Neurology, ENT, Ophthalmology

Practicals:

Module P5: 30 hrs **01 credit**

1. Animal Experiments

Since animal experiments have been banned by the CPCSEA the practical will be held by way of interpretation of the pre-recorded graphs both for mammalian intact and isolated preparations and amphibian experiments listed in the respective sections. This section of the experiments will include asking questions as part of bench viva in the following areas:

- Animals commonly used: dogs rabbits, guinea pigs and rats
- Anesthesia: types of drugs used, advantages and Disadvantages, route of administration
- Equipment used for the experiments, their identification and uses.
- Dissection procedure
- Composition and preparation of various mammalian fluids.

a. Amphibian experiments (Simulated experiments)

i. Preload and after load
ii. Effect of continuous repeated stimulation (study of phenomena of fatigue)
iii. Length tension diagram.
iv. Properties of cardiac muscle: long refractory period, all or none law.
v. Extrasystole and compensatory pause, beneficial effect
vi. Regulation of heart, dissection of vagus nerve and effect of vagal stimulation.
vii. Actions of acetylcholine, adrenaline and nicotine on heart (Langley's)
viii. Perfusion of isolated frogs heart — role of Na+ K+ , Ca+
ix. Decerebrate and spinal frog.

b. Mammalian: (Simulated experiments)

General management of mammalian experiments

i. Rat/guinea pig ileum : intestinal movement recording
ii. Isolated rabbit heart perfusion

2. Recording of EMG

3. Examination of Higher mental functions

4. Examination of sensory system

Module P6: 30 hrs **01 credit**

1. Examination of Motor system
2. Examination of cranial nerves
3. Cerebellar function tests

4. Recording of EEG
5. Recording of Evoked potentials

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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.

Department Specific Electives

I. Animal model techniques **30 Hrs**

Learning Objectives

Upon completion of the course 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, common routes of drug administration in laboratory animals 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

II. Nerve Electro Diagnostic Techniques **30 Hrs**

Learning Objectives

Upon completion of the course the student shall be able to

- Appreciate the applications of various nerve electro diagnostic techniques
- Demonstrate the various methods used in preclinical research

The electro diagnostic techniques involve recording, display, measurement and interpretation of action potentials arising from CNS (Evoked Potentials), peripheral nerves (Nerve Conduction Studies) and muscles (Electromyography).

Evoked potentials include:

1. Visual evoked potential (VEP)
2. Brain stem auditory evoked potential (BAEP)
3. Somato sensory evoked potential (SSEP)
4. Motor evoked potential (MEP)

All these techniques have to be studied under following headings:

a. Definition
b. Procedure
c. Normal wave format
d. Requirement and precautions
e. Physio clinical significance
f. Physiological variations
g. Pathological variations