

JSS Academy of Higher Education & Research

(Deemed to be University)

Re-Accredited "A+" Grade by NAAC

Sri Shivarathreeshwara Nagara Mysuru - 570015, Karnataka

Regulation & Syllabus

MD PHYSIOLOGY

2020

MD PHYSIOLOGY

GOAL: The goal of postgraduate training in Physiology is to produce a competent physiologists equipped with necessary knowledge, skills and attitude to impart education, to carry out basic science research and be able to serve the community by rendering service to the subjects.

PROGRAM OUTCOMES

PO1: Demonstrate the acquisition of comprehensive knowledge about the basic physiological concepts, their clinical application and demands in special circumstances.

PO2: Demonstrate the acquisition of comprehensive knowledge of physiology of various organ systems with implications of pathophysiology of diseases.

PO3: Demonstrate the acquisition of comprehensive knowledge of physiology of specific organ systems to cater to the learning needs of specialized courses such as speech pathology, kinesiology, aerospace physiology etc.

PO4: Demonstrate the capability of disseminating the knowledge and skills of physiology and pathophysiology of various organ systems of the human body to the undergraduate students.

PO5: Demonstrate to capability to critically analyze and develop problem-solving cases to exhibit interactive teaching techniques and facilitate contextual study of physiology in various teaching learning sessions.

PO6: Demonstrate the acquisition of the comprehensive knowledge and skills required to participate in various TL methods.

PO7: Demonstrate the capability to conduct clinical and experimental research which have significant bearing on human health and patient care.

PO8: Demonstrate the capability to develop ideas and contribute towards generation of patents and copyrights related to the subject.

PO9: Demonstrate the acquisition of adequate management skills to lead the team engaged in teaching and research.

PO10: Demonstrate the ability to acquire new knowledge and skills to be a lifelong learner.

COURSE OUTCOMES

Paper I: General and Cellular Physiology including Genetic Basis and Historical perspectives

General physiology including membrane potential, transport across membrane, genetics biophysical principles, comparative physiology and history of medicine with special reference to physiology.

CO1: Demonstrate the acquisition of comprehensive knowledge of basic cellular physiology

CO2: Apply the analytical skills to correlate the variation in the normal cellular physiology

CO3: Demonstrate the acquisition of comprehensive knowledge about basic principles involved in genetics.

CO4: Demonstrate the acquisition of comprehensive knowledge about historical perspectives of the scientist involved in the physiology.

Paper II: Systemic Physiology (system providing transport, nutrition and energy)

Blood, cardiovascular physiology, respiratory physiology, Gastrointestinal system, Excretory system

CO1: Demonstrate the acquisition of comprehensive knowledge and skills related to hemodynamics of the circulatory system.

CO2: Demonstrate the acquisition of comprehensive knowledge and skills about the normal process involved in respiratory, Gastrointestinal and excretory system.

CO3: Capability to analyze and evaluate the disease process in respiratory, cardiovascular, Gastrointestinal and excretory system.

CO4: Demonstrate the acquisition of comprehensive knowledge, skills and advances related to various diagnostic tests in respiratory, circulatory, Gastrointestinal and excretory system.

Paper III: Systemic Physiology (system concerned with procreation, regulation and neural control) Nerve and muscle physiology, central nervous system, special senses, Endocrines, Reproductive physiology

CO1: Demonstrate the acquisition of comprehensive knowledge and skills related to the sensory and motor capability of the human body.

CO2: Demonstrate the acquisition of comprehensive knowledge and skills about the locomotive system of the body.

CO3: Demonstrate the acquisition of comprehensive knowledge about the procreation process in the humans.

CO4: Demonstrate the acquisition of comprehensive knowledge about the higher mental functions of the humans.

Paper IV: Applied Physiology including recent advances

Patho-physiology pertaining to systemic Physiology, Chronophysiology, Environmental physiology, Exercise & sports physiology, yoga & meditation. Recent advances relevant to Physiology, Social responsibilities of physiologists

CO1: Demonstrate the acquisition of analytical skills to describe the process of diseases in various organ systems of the body.

CO2: Demonstrate the acquisition of comprehensive knowledge about the physiological changes to age, environment, sports and yoga.

CO3: Demonstrate the skills to acquire the knowledge about the recent advances related to physiology.

CO4: Demonstrate the skills to develop the social responsibility in society.

OBJECTIVES

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 explain the conceptual knowledge of physiology that can be effectively used by the clinicians in various clinical settings to diagnose and treat the clinical conditions.
5. Be able to interact with allied departments and render services in advanced laboratory investigations.

After completing the three year course in MD Physiology the student should have achieved competence in the following:

1. Knowledge of Physiology

Acquire competencies related to basic and systemic physiology with the recent advances.

2. Practical and Procedural skills

Acquire mastery in clinical examination and diagnostic procedures of various systems of the body

3. Training skill in Research Methodology

- Acquire skills in teaching, research methodology, epidemiology & basic information technology.

- Acquire knowledge in the basic aspects of Biostatistics and research methodology.
- Has knowledge to plan the protocol of a thesis, carry out review of literature, execution of research project and preparation of report.
- Has ability to use computer applications Microsoft office (Microsoft word, excel, power point), Internet, Searching scientific databases (e.g. PubMed, Medline, Cochrane reviews).
- Acquire skills in paper & poster preparation, writing research papers and Thesis.

4. Professionalism, attitude and communication skills:

- Develop honest work ethics and empathetic behavior with students and colleagues.
- Acquire capacity of not letting his/her personal beliefs, prejudices, and limitations come in the way of duty.
- Acquire attitude and communication skills to interact with colleagues, teachers and students.

5. Teaching Physiology

- Practicing different teaching-learning methods.
- Making presentations of the subject topics and research outputs.

6. Problem Solving

- Demonstrate the ability to identify applied implications of the knowledge of physiology and discuss information relevant to the problem, using consultation, texts, archival literature and electronic media.
- Demonstrate the ability to correlate the clinical conditions to the physiological basis.
- Demonstrate the ability to evaluate scientific/clinical information and critically analyze conflicting data and hypothesis.

COMPETENCIES

At the end of the course, the student should have acquired following competencies:

A. Cognitive Domain

1. Demonstrate comprehensive knowledge and understanding of general, systemic and applied physiology.
2. Comprehend the physiological basis of health and diseases affecting various organ systems.
3. Conduct the research in core physiology and education, publish scientific articles in peer reviewed journals and critically evaluate research publications
4. Demonstrate skills to conduct collaborative research with allied sciences, clinical sciences and biomedical engineering and aid in advancement of physiology
5. Effectively use the library facilities including CD Rom and internet search.
6. Integrate physiology with Diagnostic, Therapeutic, Preventive and Rehabilitative Medicine.

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.
3. Carry out professional obligations ethically and keeping in view national health policies.
4. Demonstrate responsibility, professionalism, principles of integrity and social accountability as a teacher and researcher.
5. Mentor/ counsel students to facilitate their holistic development and provide effective feedback to students
6. Develop the capacity to self-reflect on academic progress, develop self- directed learning skills and assess own learning needs.

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.

Practice based Competencies

1. Haematology:

- a. Study of Haemocytometer
- b. Determination of RBC count
- c. Estimation of Haemoglobin
- d. Reticulocyte count
- e. ESR and PCV
- f. Osmotic fragility of Red blood cells
- g. Specific gravity of blood
- h. Total leucocyte count
- i. Differential count of WBC and Arneeth count
- j. Absolute eosinophil count.
- k. Platelet count
- l. Determination of bleeding time and clotting time
- m. Determination of Blood groups

2. Clinical Physiology:

- A. Elementary principles of clinical examination
- B. General examination

- a. Cardiovascular system
 - i. Examination of arterial pulses and measurements of blood pressure.
 - ii. Examination of heart
- b. Respiratory System
 - i. Examination of respiratory system
- c. Gastro-intestinal system
 - i. Examination of abdomen.
- d. Nervous System
 - i. Examination of higher mental functions.
 - ii. Sensory system
 - iii. Motor functions
 - iv. Examination of cranial nerves.
 - v. Cerebellar function tests

3. Human Experiments:

- a. Cardio vascular system:
 - i. Measurement of arterial blood pressure and effect of posture & exercise on BP.
 - ii. Electrocardiography — ECG & its interpretation.
 - iii. Heart Rate Variability (HRV)
 - iv. Treadmill Test
 - v. Cardiovascular autonomic function tests
 - vi. Measurement of blood flow
- b. Respiratory System:
 - i. Recording of lung function tests by computerized or electronic spirometer
 - ii. Stethography
 - iii. Endurance test – VO_2 max measurement
 - iv. Respiratory gas analysis
 - v. Measurement of BMR
 - vi. Artificial respiration
- c. Reproductive System:
 - i. Methods to determine ovulation time – Basal body temperature chart
 - ii. Cervical smear
 - iii. Pregnancy diagnostic test - immunological test
 - iv. Sperm count
- d. Gastro Intestinal System:
 - n. Endoscopy

- e. Muscle Physiology:
 - i. Ergography
 - ii. Recording of EMG
- f. Neurophysiology
 - i. Nerve conduction study
 - ii. EEG
 - iii. Evoked potentials
- g. Measurements of body composition

4. 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:

- i. Animals commonly used: dogs rabbits, guinea pigs and rats
- ii. Anesthesia: types of drugs used, advantages and Disadvantages, route of administration
- iii. Equipment used for the experiments, their identification and uses.
- iv. Dissection procedure
- v. 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

5. Tests for physical fitness

- a. Harvard step test
- b. Bicycle ergometry
- c. Treadmill protocols

6. Clinical Biochemistry:

- a. Examination of normal and abnormal constituents of urine
- b. Other kidney function tests
- c. Estimation of blood sugar
- d. Liver function tests
- e. Glucose tolerance test
- f. Blood gas analysis
- g. Molecular biology techniques
- h. Genetic screening and diagnostic techniques

Course content

A. Theory (Cellular, sub cellular and molecular levels)

1. General physiology

- 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
- 9. The concept of pH & Buffer systems in the body
- 10. The methods used to demonstrate the functions of the cells and its products, its communications and their applications in Clinical care and research.

2. Blood

- 1. Blood: composition and functions, Blood volume and its measurements
- 2. Plasma proteins: types, properties and functions

3. RBC's: formation, functions
4. Haemoglobin – 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, Applied aspects
9. Platelet's: 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, Blood banking
13. Lymph: formation and functions

3. Nerve Muscle physiology

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. Muscle disorders, EMG
6. Smooth muscle: Types, electrical activity and molecular basis of contraction
Properties of smooth muscle
7. Cardiac muscle: Structure, properties, molecular basis of contraction

4. Gastrointestinal physiology

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. Gastric function tests
6. Pancreatic secretions: Composition, mechanism, functions and regulation.
7. Liver: Functions, Bile formation, secretion and regulation, enterohepatic 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, diarrhea, constipation.
14. Gastrointestinal hormones
15. Digestion and absorption.

5. Excretory system

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. 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

6. Respiratory system

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: Apnea, hyperpnea, tachypnoea, dyspnea, Cheyne-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.

7. Environmental Physiology

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

8. Cardiovascular physiology

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. Applied aspects
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.

9. Exercise and sports physiology

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

10. Endocrinology

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

11. Reproductive system

1. Sex determination and differentiation, Chromosomal disorders
2. Male reproductive system:
 - a. Primary and accessory organs and their functions
 - b. Puberty in males
 - c. Spermatogenesis and its regulation
 - d. Testosterone- secretion, transport, metabolism, mechanism and physiological actions. Control of testicular function
3. Female reproductive system:
 - a. Functional anatomy
 - b. Puberty in females
 - c. Ovarian hormones – Estrogen and progesterone, Mechanism and physiological actions, Control of ovarian function
 - d. Physiology of menstrual cycle: Ovarian cycle, Uterine cycle, vaginal and cervical Cycle. Physiology of ovulation and its detection
 - e. Menopause and menstrual abnormalities.
 - f. Physiology of fertilization and implantation.
 - i. Physiology of pregnancy : Endocrine changes, foeto-placental unit, changes in Mother during pregnancy, tests for pregnancy
 - j. Physiology of parturition and lactation
 - k. Contraception
 - l. Infertility and assisted reproduction

12. Central nervous system

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

13. Special senses

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

14. Chronophysiology

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

15. Yoga and meditation

1. Physiological changes to yoga and meditation

Certifiable Skills

Demonstrate following predominant Psychomotor domain competencies

Perform Independently:

- Demonstrate the analytical skills related to diagnostic tests in various systems of the body.
- Demonstrate different methods of teaching-learning and assessments.
- Make presentations of the subject topics for teaching and research outputs. Independently

TEACHING & LEARNING METHODS

1. Didactic lectures

- Attend UG theory classes during first year

2. Teaching sessions

	ACTIVITY	FREQUENCY	MODERATOR
1.	PRACTICALS	Twice a week	Faculty
2.	SEMINAR	Once in a week	Faculty
3.	JOURNAL CLUB	Once in a week	Faculty
4.	REVIEW ARTICLE	Once in 3 months	Faculty
5.	SYMPOSIA	Once in 6 months	Faculty

The post graduate students should actively participate in departmental seminars and journal club. A record showing the involvement of the student shall be maintained and also in the PG diary.

3. Undergraduate teaching

- Postgraduate students shall participate in teaching undergraduate students in practical, tutorials and group discussions.
- The student shall participate in generating teaching resource material for UG and develop problem solving modules.

4. Clinical postings

The candidates shall attend all the undergraduate theory and practical classes regularly during the first year of course. During the second year of the course, they shall attend the clinical postings in co-ordination with concerned departments, only in the forenoon sessions as follows:

Plan of Clinical postings for MD Physiology

Prof Year	Department	Period of posting	Focus areas
1 st year	Biochemistry	15 days	1. Auto & Semi auto Analyzer, Electrophoresis, Chromatography, RIA, Study of serum chemistry (proteins, Lipid, glucose, electrolytes, enzymes etc.) – 8 days 2. Constituents of normal and abnormal urine, liver function tests, Renal function tests, Gastric function tests – 7 days
Ist year	Pharmacology	20 days	1. Animal House (to learn technique of Animal Handling, Blood sampling, anesthesia, Euthanasia, effective Analgesia and infection control after surgery. Study of Animal behavior like eating, drinking, locomotion, sexual activity etc.) 2. Experimental Pharmacology lab to study ongoing animal experimental procedures including dissection

			for rat phrenic nerve hemidiaphragm and others – 10 days Study various guidelines related to ethical use of animals in experiments. To study preparation of different animal models and various tests to study physiological parameters. – 15 days
I st year	Pathology	30 days	1. Blood bank - Cross matching, blood Storage, Immunohistochemistry, Immunological tests – 15 days 2. Central Lab. - Tests for bleeding & clotting disorders, study of Haemopoietic Cells present in the Bone Marrow – 10 days 3. Semen analysis, determination of ovulation time by basal body temperature chart and pregnancy diagnostic tests – 5 days
Ist year	Microbiology	10 days	1. Fluorescent microscopy, use of Elisa reader & Washer – 5 days 2. Immuno-physiology and other facilities available in the dept. – 5 days
IInd year	Ophthalmology	15 days	1. Direct and indirect Ophthalmoscopy, Retinoscopy – 8 days 2. Slit lamp microscopy, Tonometry, Pachymetry, Study of corneal topology, Optometry, Auto-refractometer – 7 days
IInd year	Tuberculosis & Chest Disease (Pulmonary Medicine)	15 days	1. Whole body plethysmography – 8 days 2. Bronchoscopy & other facilities available in the dept. – 7 days
IInd year	ENT	15 days	1. Audiometry – 7 days 2. Oto-rhino-laryngoscopy, direct and Indirect Laryngoscopy, BERA, BSAEP – 8 days
IIIrd year	General Medicine	20 days	1. TMT, Holter analysis, ABG, ECG – 10 days 2. EMG, NCV – 10 days
IIIrd year	Psychiatry	10 days	1. EEG 2. Biofeedback
IIIrd year	Casualty	15 Days	1. To know basics of how to handle emergency 2. Minor procedures

4. Attending Workshops, CME's and Conferences

- A postgraduate student should attend Workshops/ CME's/Conferences regularly.

A postgraduate student should present one poster, one oral paper at a national/state conference and one research paper should be published/accepted for publication/sent for publication during the period so as to make student eligible to appear for postgraduate degree examination

5. Research methodology and biostatistics.

6. Salient features of Undergraduate/Postgraduate medical curriculum.

7. Teaching and assessment methodology.

8. Interdepartmental colloquium: Monthly meetings between departments on topics of current/common interest

9. Posting under "District Residency Programme" (DRP):

Students shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum during 2nd year, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Rotation shall take place and the rotation shall be termed as "District Residency Programme" and the PG medical student undergoing training shall be termed as "District Resident".

10. Research/Dissertation: All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and generate the online certificate on successful completion of the course.

- Present one poster & one oral presentation at state/ national conference.
- One research paper should be published/ accepted/ sent for publication.
- During the course of study every candidate has to prepare a dissertation individually, on a selected topic under the direct guidance and supervision of a recognized postgraduate teacher as per JSSAHER regulations.
- Hands on Workshop on synopsis & dissertation writing, paper & poster presentation skills & writing research papers.

11. Training in Teaching skills: Participate in the teaching and training programme of undergraduate students. Preparation of Audio Visual aids for teaching, posters/manuscripts for presentation in conferences/workshops and publication in journals. Comprehend horizontal integration of various subdivisions of anatomy with relevant physiology and biochemistry. Participation in formulating evaluation methods: Setting objective questions, Short Answer Questions, Multiple Choice Questions and Objective Structured Practical Examination (OSPE).

12. Log Book: Maintenance of Log book and Practical record

1. A log book showing each day's work has to be maintained by the candidate, which shall be scrutinized by the Head of the Department every month.
2. A list of the seminars and journal reviews that have been attended and participated by the student has to be maintained which should be scrutinized by the Head of the Department.
3. A practical record has to 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.

13. Record Book: A practical record of work done in hematology, clinical, human and simulation lab has to be maintained by the candidate and duly scrutinized and certified by the head of the department and to be submitted to the external examiner during the final examination.

ASSESSMENT

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.

- Periodic Internal Assessment will be conducted frequently covering all domains of learning and feedback will be provided for improvement of the student.

B) SUMMATIVE ASSESSMENT

1. Dissertation Work

During the course of study every candidate has to prepare a dissertation individually on selected topic under the direct guidance and supervision of a recognized post graduate teacher.

The suggested time schedule for dissertation work is:

- Identification and selection of topic for dissertation - in first 4 weeks.
- Preparatory work for dissertation /synopsis including pilot study if necessary and submission of the synopsis to the University within first 6 months from the beginning of course or as per the dates notified by the University.
- Data collection for dissertation. Writing the dissertation in the following 1½ years.
- Submission of the dissertation six months prior to the final examination or as per the

dates notified by the University.

Registration of dissertation topic

Every candidate shall submit a synopsis in the prescribed proforma of the University for registration of dissertation topic. Subject of dissertation will be scrutinised by the PG training cum research committee and ethical committee of the institution. The synopsis shall be sent within first 6 months from the commencement of course as notified in the University calendar of events, to the Registrar (Academic).

Submission of dissertation

The dissertation shall be submitted to the Registrar (Evaluation) of the University six months before final examination or as per the dates notified by the University. Approval of the dissertation by the panel of examiners is a pre-requisite for a candidate to appear in the University examination.

Summative Assessment:

The examination for M.D shall be held at the end of 3rd academic year. It will be 3 parts- Thesis, Written exam and Practical with Viva Voce. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole.

Essential pre-requisites for appearing for examination include:

1. **Log book** of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.
2. At least **two presentations** at national level conferences. One research paper should be published / accepted in an indexed journal.

University Examination pattern:

MD (Physiology) Examination	Theory	Practical	Viva-voce (Pedagogy & Thesis discussion)	Total
Maximum marks	400	200	100	700

1. Thesis:

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A

post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Written Exam: Theory - 400 marks

The written examination consists of four papers, with maximum marks of 100 for each paper. Each paper will be of three hours duration.

Paper–I: General and Cellular Physiology including Genetic Basis and Historical perspectives

Paper–II: Systemic Physiology (system providing transport, nutrition and energy)

Paper –III: Systemic Physiology (system concerned with procreation, regulation and neural control)

Paper–IV: Applied Physiology including recent advances

Paper wise distribution of course contents

Paper–I: General and Cellular Physiology including Genetic Basis and Historical perspectives

General physiology including membrane potential, transport across membrane, genetics biophysical principles, comparative physiology and history of medicine with special reference to physiology.

Paper–II: Systemic Physiology (system providing transport, nutrition and energy)

Blood, cardiovascular physiology, respiratory physiology, Gastrointestinal system, Excretory system

Paper –III: Systemic Physiology (system concerned with procreation, regulation and neural control)

Nerve and muscle physiology, central nervous system, special senses, Endocrines, Reproductive physiology

Paper–IV: Applied Physiology including recent advances

Patho-physiology pertaining to systemic Physiology, Chronophysiology, Environmental physiology, Exercise & sports physiology, yoga & meditation. Recent advances relevant to Physiology, Social responsibilities of physiologists

**The topics assigned to the different papers are given as general guidelines. A strict division of subjects may not be possible. Some overlapping of topics is inevitable.* Students should be prepared to answer the overlapping topics.

Each Theory paper consists of:

Sl No	Type of Question	Marks
1	Long Essay (2)	2 X 20= 40
2	Short Essay (6)	6 X 10= 60
Total		100 marks

WEIGHTAGE OF MARKS IN EACH PAPER

	Topics	Marks
Paper I	Homeostasis	20
	Cell physiology & Body fluids	10
	Transport across cell membrane	20
	Membrane potentials	20
	Biophysical principles	10
	Genetics	10
	Comparative physiology	05
	History – Scientists	05
Paper II	Blood	20
	Cardiovascular system	25
	Respiratory system	25
	Gastrointestinal system	15
	Excretory system	15
Paper III	Nerve muscle physiology	10
	Central nervous system	35
	Special senses	15
	Endocrine system	25
	Reproductive system	15
Paper IV	Patho-physiology pertaining to systemic Physiology	20

	Chronophysiology	15
	Environmental physiology	15
	Exercise and sports physiology	20
	Yoga and Meditation	15
	Recent advances relevant to Physiology	10
	Social responsibilities of physiologists	05

Practical Examinations

200 marks

- i) Haematology based on clinical scenario **40 marks**
- ii) Human experiments based on clinical scenario **50 marks**
- iii) Clinical Physiology based on clinical scenario **50 marks**
- iv) Amphibian/Rabbit /Rat/Guinea pigs* **20 marks**
- v) Biochemistry **20 marks**
- vi) OSPE/OSCE **20 marks**

*** Interpretation of pre-recorded graphs or use of Simulation experiments**

Viva- voce – 100 marks

- a) The Viva-Voce would be on all components of syllabus including discussion on dissertation - **80 marks**
- b) Pedagogy/Microteaching - **20 marks**

X. Recommended Text, Reference books and Journals (latest edition)

1. Guyton, Text Book of Medical Physiology, 14th edition (2019), Elsevier publication.
2. Ganong, Review of Medical Physiology, 26th edition (2019), Mc Graw hill publications.
3. Berne and Levy, Principles of Physiology, 7th edition (2018), Mosby co publications.
4. Boron & Boulpaep, Medical physiology, 3rd edition (2020), Saunder's, Elsevier, Philadelphia.
5. Keele, Samson & Wright's, Applied Physiology, 13th edition (2006), ELBS, Oxford University Press.

6. Prof Dr G K Pal, Text book of medical physiology, 2nd edition (2015), Ahuja publications.
7. Indu khurana, Medical physiology, 2nd edition (2022), Elsevier publications.
8. JB West, Best & Taylor, Physiological basis of Medical Practice, 13th edition (1990), Williams & Wilkins publications.
9. Linda S Costanzo, COSTANZA Physiology 7th edition (2022), Elsevier publications.
10. Barbara J Bain, Dacie & Lewis, Practical Hematology, 12th edition (2017), Elsevier publications.
11. R K Marya, Postgraduate physiology recent advances, 1st edition (2020), CBS publications.
12. Williams, Text book of Endocrinology, 14th edition (2020), W.B. Saunders publications.
13. Peters dort, Adams, Braunwald, Issel Bacher, Matir, Wilson, Harrison's Principles of Internal Medicine, 21st edition (2022), Mc Graw hill publications.
14. Wintrobe, Clinical hematology, 14th edition (2018), Lea Febiger publications.
15. Kathryn L Mc. Cance Sue E Huether, Text Book of Pathophysiology, 8th edition (2019) Elsevier publications.

16. Journals:

1. Indian Journal of Physiology and Pharmacology, by APPI.
2. Physiological Reviews, By American Physiological Society
3. Annual review of Physiology, By American Physiological Society
4. Journal of Applied Physiology, By American Physiological Society
5. Advances in Physiology Education, By American Physiological Society
6. Recent advances in Physiology, By American Physiological Society
7. Journal of Physiology, British Publication
8. Indian Journal of Medical Research
9. Biomedicine, by Indian Association of Bio-medical Scientist.
10. News in Physiological Sciences
11. New England Journal Medicine
12. British Medical Journal
13. Nature
14. Lancet

ADDITIONAL READING (Latest edition)

1. Compendium of recommendations of various committees on Health and Development (1943- 1975). DGHS, 1985 Central Bureau of Health Intelligence, Directorate General of Health Services, Ministry of Health and Family Welfare, Govt. of India, Nirman Bhawan, New Delhi.
2. National Health Policy, Min. of Health & Family Welfare, Nirman Bhawan, New Delhi, updated
3. Santosh Kumar, The elements of Research, writing and editing, Dept. of Urology, JIPMER, Pondicherry
4. Srinivasa D K et al, Medical Education Principles and Practice, National Teachers Training Centre, JIPMER, Pondicherry
5. Indian Council of Medical Research, "Policy Statement of Ethical considerations involved in Research on Human Subjects", I.C.M.R, New Delhi.
6. Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956. Medical Council of India, Kotla Road, New Delhi.
7. Francis C M, Medical Ethics, J P Publications, Bangalore
8. Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, New Delhi.
9. Kirkwood B R, Essentials of Medical Statistics, Oxford: Blackwell Scientific Publications
10. Mahajan B K, Methods in Bio statistics for medical students, New Delhi, Jaypee The Brothers Medical Publishers
11. Raveendran, B Gitanjali, A Practical approach to PG dissertation, New Delhi, J P Publications

ANNEXURE I

Student appraisal form for MD in Preclinical/ Paraclinical											
Elements		Less than satisfactory			Satisfactory			More than satisfactory			Comments
1.Scholastic Aptitude & learning											
1.1	Has knowledge appropriate for level of training										
1.2	Participation										

2.5	Ability to record and document work accurately and appropriate for level of training										
3. Professional attributes											
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4. Space for additional comments											
5. Disposition											
	Has this assessment pattern been discussed with the trainee?	Yes					No				
	If not explain.										
	Name and Signature of the assessee										
	Name and Signature of the assessor										
	Date										