MD Physiology

Syllabus

Course contents:

A: Cognitive domain

Paper-I:

1. General and Cellular Physiology including Genetic Basis and Historical perspectives:
2. Physiology of cell, various cellular mechanisms and genetic control mechanisms.
3. Various principles of Physics and Physical Chemistry involved in physiological phenomenon e.g. haemo-dynamics, bio-electrical potentials, body fluids, methods of measurements.
4. History of Physiology, Nobel laureates and discoveries.
5. Biostatistics, Biophysics, Biochemistry, Micro-anatomy.
6. Growth and Development including aging.
7. Excretion, pH, water and electrolyte balance.
8. Comparative Animal Physiology Paper-II: Systemic Physiology (system providing transport, nutrition and energy

Paper-II:

Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology.

1. Blood and Immunity.
2. Cardiovascular System.
3. Respiratory System.

4. Gastro- Intestinal Tract (GIT) and dietary requirements.

Paper-III:

Systemic Physiology (system concerned with procreation, regulation and neural control)

1. Nerve-Muscle Physiology including muscle mechanics
2. Endocrine Physiology
3. Nervous System (Central, peripheral and autonomic)
4. Special Senses
5. Reproduction & family planning/fetal & neonatal Physiology

Paper-IV:

1. Applied Physiology including recent advances
2. Recent advances relevant to Physiology
3. Patho-physiology pertaining to systemic Physiology
4. Physiological basis of various clinical investigation tests
5. Interaction of human body in ambient environment- high altitude, space and deep sea
6. Exercise & Sports physiology
7. Transgender Physiology
8. Integrated Physiology
9. Yoga and Meditation
10. Social responsibilities of physiologists
11. Application of Artificial Intelligence in Physiology

B: Psychomotor domain:

A. The postgraduate student during the training period must PERFORM independently the following procedures:

- **Hematological profile**

1. Estimation of hemoglobin
2. Determination of Total Erythrocyte (RBC) Count and RBC Indices (Blood Standards)
3. Determination of Total Leucocytes (WBC) Count : TLC
4. Preparation of a peripheral Blood Smear and Determination of Differential Leucocyte Count: DLC
5. Determination of Arneth Count
6. Determination of Bleeding Time (BT) and Clotting Time (CT)
7. Determination of Blood groups (A, B,O and Rh system)
8. Determination of Erythrocyte Sedimentation Rate (ESR) and Packed cell volume (PCV)
9. Determination of Osmotic Fragility of Red Blood Cells
10. Determination of Platelet Count
11. Determination of Reticulocyte Count

ii. Human Physiology

Clinical Physiology

1. Physiological principle of clinical examination
2. General physical examination, physiological basis of some clinical symptom.

Nerve muscle physiology

1. Ergography and hand grip spring dynamography and study of human fatigue.

2. Recording of electromyography (EMG) and its application.
3. Recording of nerve conduction.

Cardiovascular system (CVS)

1. Clinical examination of CVS
2. Examination of arterial & venous pulses
3. Measurements of arterial blood pressure and effect of head-up/head-down tilt
4. Recording of 12 lead Electrocardiography (ECG) and its interpretation
5. Heart rate variability
6. Ambulatory Blood pressure monitoring

Respiratory system

1. Clinical examination of respiratory system.
2. Stethography – study of respiratory movements and effect of various factors.
3. Assessment of respiratory functions (spirometry, vitalography, and gas analysis).
4. Measurement of BMR.
5. Cardio pulmonary resuscitation (CPR) and Artificial respiration.

Gastrointestinal system:

1. Clinical examination of abdomen.

Integrative Physiology / Excretory system

1. Recording of body temperature/effect of exposure to cold and hot environment
2. Human studies involving sweat, salivation and urine

Reproductive system

1. Determination of ovulation time by basal body temperature chart and pregnancy diagnostic test - Immunological Tests.
2. Semen analysis: sperm count, motility and sperm morphology.

Nervous System including Special senses

1. Clinical examination of the nervous system and its physiological basis.
2. Examination of higher mental functions.
3. Examination of cranial nerves.
4. Examination of sensory system.
5. Examination of motor system including reflexes.
6. Clinical examination of special senses.

(i) Smell and Taste

(ii) Test for hearing to differentiate deafness

(iii) Physiology of eye:

(a) Clinical examination of the eye and pupillary reflex

(b) Visual acuity

(c) Perimetery – mapping out of visual field and blind spot

(d) Accommodation

(e) Fundoscopy

(f) Colour vision and colour blindness

7. Reaction (visual and auditory) and reflex time.

8. Electroencephalography (EEG) and Polysomnography

9. Autonomic Nervous System (ANS) Testing.

10. Neuro-electrodiagnostic techniques:

Nerve conduction study, Visual evoked potential (VEP), Brainstem auditory evoked potential (B.A.E.P), Somato-sensory evoked potential (SEP), Motor evoked potential (MEP.

Sports Physiology

Tests for physical fitness: Cardio – respiratory responses to steady state exercise using

1. Harvard step test
2. Bicycle Ergometry
3. Treadmill test for determination of VO2 max j.

Yoga and Meditation Physiology

1. Physical, Mental and Emotional well being
2. Effect of yoga and pranayama on physiological parameters
3. Mindfulness
4. Concentration, anxiety and stress
5. Counseling in health and diseases

Others

1. Construction of dietary chart for growing children, pregnant woman, elderly individuals, hypertensive patients, & diabetes mellitus patients.
2. Basic Life Support and Cardiac Life Support

Amphibian (Frog) Experiments

All animal experiments must be compliant with Govenment of India Regulations, notified from time to time). Experiments in Amphibian/Dog/Cat should be conducted by computer assisted simulation models/ facilities. Other experiments should be performed as permissible by CPCSEA guidelines.

1. Effect of temperature on simple muscle twitch.
2. Effect of two successive stimuli (of same strength) on skeletal muscle.
3. Effect of increasing strength of stimuli on skeletal muscle.

4. Effect of increasing frequency of stimuli on skeletal muscle (genesis of tetanus)
5. Effect of free load and after load on skeletal muscle.
6. Effect of repeated stimuli on skeletal muscle (study of phenomenon of Fatigue).
7. Study of isometric contraction in skeletal muscle.
8. Determination of conduction velocity of sciatic nerve and effect of variables on it.
9. Properties of cardiac muscle – Refractory period, All-or-None Law, extrasystole and compensatory pause, beneficial effect.
10. Regulation of Heart, Vagus dissection and effect of Vagal and WCL stimulation.
11. Effect of physiological and pharmacological variables on intact frog's heart.
12. Perfusion of isolated frog's heart-role of sodium, potassium, calcium ions and drugs.

The postgraduate student during the training period must ASSIST in the following procedures:

Human Physiology

- **Cardiovascular system (CVS)**
  1. Cardiac TMT Holter Monitoring
  2. Collection and Assessment of Arterial blood gas
- Nervous System including Special senses

1. Intra operative neuro monitoring (IONM)

The postgraduate student during the training period must OBSERVE the following procedures:

Hematological profile

- Determination of Absolute Eosinophil Count
- Study of Haemopoietic Cells present in the Bone Marrow

Human Physiology

Cardiovascular system (CVS)¬

- Echocardiography
- Central venous line insertion,
- CVP monitoring

Respiratory system¬

Introduction to working of continuous positive airway pressure and Bilevel positive airway pressure (CPAP & BiPAP) Therapy

Ventilator setting

Gastrointestinal system:¬

GI Manometry

Reproductive system¬

Ovulation study by using ultrasonography

Departmental resources

It is to be mandatory for the department to establish and develop the following laboratories. In addition to teaching, these laboratories should be involved in active research and in patient care services in one or more well defined fields.

1. **Clinical Neurophysiology Laboratory**

   The department should generate liaison with clinical department and provide services for health monitoring and diagnostics (disease).

   (i) Electroencephalography
   (ii) Evoked potential recording
   (iii) Electromyography
   (iv) Nerve conduction studies
   (v) Autonomic nervous system (ANS) testing
   (vi) Any other newer technology

2. **Cardio-Respiratory Laboratory**

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

(i) Electrocardiography
(ii) Blood-gas Analysis
(iii) Computerized multifunctional spirometry
(iv) Laboratory for measuring pulmonary diffusion capacity and functional residual capacity (FRC)
(v) Whole-body plethysmography
(vi) Laboratory for Blood flow measurements (Impedance plethysmograph/Laser flow meter/ Doppler flow meter)

3. **Exercise Physiology Laboratory**

The department should generate liaison with sports authorities and clinical departments to provide services for testing and grading exercise and physical efficiency for health monitoring and diagnostics (disease). This should be done by using the following techniques:

(i) Two step test exerciser

(ii) Bicycle Ergometry

(iii) Tread mill

(iv) Respiratory gas analysis and measurement of basal metabolic rate (BMR)

4. Metabolic/Endocrinology/Reproductive Bio-medicine laboratory

This laboratory should perform various tests pertaining to gastrointestinal, renal, metabolic, endocrinal and reproductive bio-medicine. The department should generate liaison with clinical departments and provide routine services for health monitoring and diagnostics (disease).

1. Body Fat Analysis
2. Spectrophotometer
3. pH meter
4. Elisa Reader/Washer
5. Luminometer
6. Semi-autoanalyzer

Post graduate students should be posted in the above laboratories and extend the required services on routine basis.

The Department should be equipped with general facilities like PG resource room with internet access and a departmental library with books

especially those related to pertinent higher studies in Physiology and field of research. The college/department should make important journals available (at least four Indian journals and two international journals – Online/Offline).

TEACHING AND LEARNING METHODS

Teaching methodology

Based on above laboratory facilities the department can prepare a list of postgraduate experiments pertaining to basic and applied physiology. Active learning should form the mainstay of postgraduate learning.

1. The postgraduate student should attend weekly group discussion and at least 2 symposia

2. There should be seminars at least once weekly along with symposia, group discussion, weekly journal club, microteaching. In journal club discuss articles published in indexed journals (National and international) focusing on their new methodology, interesting results etc.

3. The department should generate liaison with clinical departments and provide routine service for health monitoring and disease(diagnostics) and for periodical posting of physiology PGs in clinical setting
4. The postgraduate students in broad specialties would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should published/accepted for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.
5. The PG students should pay formal and scheduled visits to various hospital laboratories of interest for purpose of learning.
6. The postgraduate students shall be require to participate in teaching and training programme of undergraduate student and interns.
7. Logbooks shall be checked and assessed periodically by the faculty members imparting the training.

During the training programme, patient safety is the paramount importance, therefore, skills are to be learnt initially on models, later to be performed under supervision followed by performing independently; for this purpose, provision of skill laboratories in medical college mandatory.

Course content and description

Since the students would be working in the department for 3 years, the time plan & division of course content will be the following. The lists given below are not exclusive and the PG guide and Head of Department

may include any other new topic that they consider appropriate for the PG student to study. The posting should be as under:-

1- FIRST YEAR (I st & IInd Term) :-

THEORY : The PG student will : -

- Attend all UG lectures in Physiology and study in detail all aspects of systemic Physiology.
- Attend PG lectures at other PG Centers
- Attend and deliver seminars, journal club periodically on topics allotted by the PG guide.
- Visit the library to get acquainted with scientific journals.

2-RESEARCH

- Selection of thesis topic and collection of relevant references.
- And communicate it to the university within three months of registration. The topic should have the approval of institutional ethics committee
- Review the literature for the thesis in the 2nd half of 1st year.
- Get acquainted with the basic concepts of biostatistics.
- BCBR shoud be completed within six month of joining

Rotation and Posting:

Compulsory for MD Physiology students during their 1st year of study:

- Biochemistry – 15day
- Pharmacology- 20 day
- Pathology- 30day
- Microbiology- 10 day

3- PRACTICALS

The PG student will:-

- Attend all practicals and demonstrations taught by senior teachers to UG students.
- learn basic techniques and instruments used for UG practical's.
- Animal experiment: Interpretation of recorded graphs only for mammalian and amphibian experiments (in view of ban on animal experiments since June 2012)

Human experiments:

Following will be added:

- Record of autonomic function test
- Record of EMG
- PFT

4-MEDICAL EDUCATION TECHNOLOGY

The PG student will:

- Familiarize himself / herself with concepts of medical education technology.
- Understand evaluation techniques.
- Attend a medical education technology workshop.
- Attend Clinicopathological conference every Thursday

2 nd YEAR (IIIrd and IVth Terms): -

THEORY

The PG student will:-

- Study details of systemic physiology, comparative physiology and recent advances in all topics .
- Attend PG lectures, Journal club and seminars at other PG centers.

- Deliver Seminars, Journal club periodically on topics allotted by the PG guide.

PRACTICALS

The PG student will:-

- Perform human experiments including those based on biophysical principles and study mammalian and amphibian experiments by simulation software
- Posting in PG laboratries

Rotation and Posting:

compulsory for MD Physiology students during their 2ndyear of study:

- Ophthalmology – 15day
- Pulmonary Medicine-15 day
- ENT-15day
- Posting under District Residency Programme (DRP)

RESEARCH

The PG student will:-

1. Carry out research work related to the thesis.
2. Attend local and national conferences of professional bodies to understand how research work is presented.

MEDICAL EDUCATION TECHNOLOGY

The PG student will:-

1. Learn in detail the teaching learning methods and the methods of the evaluation in practicals and theory.
2. Undertake small group teaching in practicals, demonstrations and tutorials.
3. Learn to use audiovisual aids.

4. Undertake micro-teaching sessions for practicals and theory under supervision.
5. Attend Clinico-pathological Conference(CPC) every Thursday

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3 rd YEAR (V and VI Terms) : -

-RESEARCH

The PG student will:-

- Complete & submit thesis to the University at least 6 months before the commencement of the university examination.
- Begin writing articles for publication.

TEACHING

The PG student will:-

- Teach all practicals to UG students.
- Conduct microteaching sessions for 1st year PG students.
- Teach theory topics in small groups for UG students.

PRACTICALS

Rotation and Posting:

Compulsory for MD Physiology students during their 3rdyear of study:

1. General Medicine – 20day
2. Psychiatry-10 day
3. Casuality-15day

DETAILED SYLLABUS

In Addition to the UG syllabus the PG student is expected to study in detail the following: -

GENERAL PHYSIOLOGY

- Biological membranes with details of membrane receptors.
- Physiology of growth and aging.
- Principles & applications – genetics.

ENVIRONMENTAL PHYSIOLOGY

- Physiology of deep sea diving.
- Space physiology
- High altitude physiology Temp regulation – Hypothermia, hyperthermia.
- Pollution – air, noise.

NERVE

- Experimental techniques to study bioelectrical phenomena (voltage clamp technique, cathode ray oscilloscope, S. D. curve, nerve conduction studies)

MUSCLE

1. E.M.G.
2. Smooth muscle,cardiac and skeletal muscle.
3. Pathophysiology of muscle disorders.

BLOOD :

- Immunity – details .
- Plasmin system
- Tissue typing.
- Blood transfusion and its applied aspects

CARDIOVASCULAR SYSTEM:

- Echocardiography and vector cardiography .
- Electrocardiography & Stress test.
- Cardiac catheterization and other invasive procedures.
- Flowmeters.

RESPIRATORY SYSTEM :

- Lung function tests – details.
- Blood gas analysis.
- Hyperbaric oxygen
- Artificial respiration/Cardiopulmonary resuscitation

ENDOCRINES

- Radio-Immuno Assay

REPRODUCTIVE SYSTEM

- In vitro Fertilization
- Contraceptives – details
- Neonatal and Foetal Physiology

ALIMENTARY SYSTEM

- Gastrointestinal hormones – details
- Gastrointestinal motility – details
- Absorption of nutrients
- Obesity
- Metabolism in starvation

RENAL PHYSIOLOGY

- Artificial Kidney
- Acid-base balance – detail
- Cystometry
- Water and electrolyte balance

CENTRAL NERVOUS SYSTEM

- Higher functions (Speech, memory, learning, thought and consciousness, behavioral physiology, sleep and wakefulness)
- Voluntary movements
- Details of the following topics covering physiological anatomy, connections, methods of study of functions, diagnostic techniques, functions and physiological basis of manifestation of diseases - (i) Cerebral Cortex (ii) Basal ganglia (iii) Cerebellum (iv) Reticular formation (v) Thalamus (vi) Hypothalamus (vii) A.N.S. 16 (viii) Limbic System (ix) Electroencephalogram, MRI (x) Neurotransmitters

SPECIAL SENSES

- Audiometry
- Retinoscopy, fundoscopy, Computerised perimetry, phakoscopy
- Electrophysiology of retina, chochlea

EXERCISE PHYSIOLOGY

- Concept of health fitness
- Physical fitness, its components and evaluation
- Physical conditioning and anaerobic threshold

NUTRITION

- Relationship of diet & disease
- STRESS RELAXATION TECHNIQUE: Principles of various stages of yoga, breathing exercise, meditation and Others

APPLIED BIOCHEMISTRY, BIOSTATISTICS AND BIOPHYSICS

PRACTICALS

AMPHIBIAN EXPERIMENT:- In addition to U.G. Syllabus, the P.G. student will study and interpret the graphs recorded during various amphibian experiments by Animal simulation software.

CARDIAC MUSCLE EXPERIMENTS

Properties of cardiac muscle, nervous regulation of heart, effect of drugs, & effects of ions on isolated frog's heart.

SKELETAL MUSCLE EXPERIMENTS Effect of various strength of stimuli, effect of load, genesis of tetanus and phenomenon of fatigue, velocity of nerve impulse and effect of temperature.

MAMMALIAN EXPERIMENT:-

Study and interpret the recorded graph for perfusion of mammalian heart.

Effects of various factors (Ions and Drugs)

Study of graphs recorded for smooth muscle activities and effects of various factors

HUMAN EXPERIMENTS:- In addition to UG Experiment following things to be added in PG Practical

- To record autonomic function test.
- To record EMG.
- To record PFT

CLINICAL:- To examine the subject for various system.

HAEMATOLOGY:-

- In addition to U. G. Practicals Platelet count and reticulocyte count to be conducted.
- Interpretation of Biochemical reports

TEACHING LEARNING METHODS

The teaching learning activities would consist of

- Attending UG lectures.
- Attending PG lectures.

- Microteaching sessions
- Journal clubs moderated by teachers.
- Seminars, symposia, panel discussion of suitable topics moderated by teachers.
- Lectures and Practicals prepared and presented by students under supervision
- Attend and participates in conferences, workshops and share knowledge and experiences with others.
- Visit to various clinical departments to gain the knowledge of various techniques used to study the functions of various system during posting in each department .