

## *Syllabus*

### **Course contents:**

#### **A: Cognitive domain**

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

1. Physiology of cell, various cellular mechanisms and genetic control mechanisms.
2. Various principles of Physics and Physical Chemistry involved in physiological phenomenon e.g. haemo-dynamics, bio-electrical potentials, body fluids, methods of measurements.
3. History of Physiology, Noebl laureates and discoveries.
4. Biostatistics, Biophysics, Biochemistry, Micro-anatomy.
5. Growth and Development including aging.
6. Excretion, pH, water and electrolyte balance.
7. Comparative Animal Physiology

#### **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: *Applied Physiology including recent advances***

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

**B: Psychomotor domain:**

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

**i. 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 Arneith 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**

### **a. Clinical Physiology**

1. Detailed clinical examination of various systems.

### **b. 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.

### **c. 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. Measurement of blood flow
6. Heart rate variability
7. Ambulatory Blood pressure monitoring

### **d. 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).
5. Measurement of BMR.
6. Cardio pulmonary resuscitation (CPR) and Artificial respiration.

### **e. Gastrointestinal system:**

1. Clinical examination of abdomen.

### **f. Integrative Physiology / Excretory system**

1. Recording of body temperature/effect of exposure to cold and hot environment

### **g. 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.

## **h. 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) Perimetry – 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).
11. Use of various test batteries for psychological evaluation of subject.

## **i. Sports Physiology**

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

- (i) Body Composition
- (ii) Conducting the Clinical Exercise Test
- (iii) Harvard step test
- (iv) Bicycle Ergometry
- (v) Treadmill test for determination of VO<sub>2</sub> max

**j. Yoga and Meditation Physiology**

- i. Physical, Mental and Emotional well being
- ii. Effect of yoga and pranayama on physiological parameters
- iii. Mindfulness
- iv. Concentration, anxiety and stress
- v. Counseling in health and diseases

**k. 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
3. Effective Digital presentation, medical photography, Good Clinical Practice, Humanities and Bioethics.

**iii. Amphibian (Frog) Experiments**

**All animal experiments must be compliant with Government 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, extra-systole 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.

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

**Human Physiology**

**i. Cardiovascular system (CVS)**

- Cardiac TMT Holter Monitoring
- Collection and Assessment of Arterial blood gas

**ii. Nervous System including Special senses**

- Intra operative neuro monitoring (IONM)

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

**i. Hematological profile**

- Determination of Absolute Eosinophil Count
- Study of Haemopoietic Cells present in the Bone Marrow
- Other high end hematological investigations (specify):  
Flowcytometry, Platelet functions, D Dimers, coagulation profile etc.

**ii. 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
  - o Ventilator setting

- **Gastrointestinal system:**
  - GI Manometry
- **Reproductive system**
  - Ovulation study by using ultrasonography
- **Integrative Physiology / Excretory system**
  - Pressure and PH studies in esophagus, stomach, intestine and rectum
- **Others**
  - Genetic testing and introduction to procedural skills for clinical genetics/ prenatal diagnosis/ adult genetics - birth defects, genetic hematology, dysmorphology, skeletal dysplasia, neurological and muscular disorders, primary immunodeficiency diseases, autoimmune and multi-factorial disorders, biology and genetics of cancer.
  - Interaction of human body in ambient environment - high altitude, space and deep sea
  - Exercise & Sports physiology
  - Integrated Physiology
  - Yoga and Meditation
  - Social responsibilities of physiologists
  - Application of Artificial Intelligence in Physiology

### iii. **Mammalian Experiments (Dog/Rabbit/Guinea pig/Rat/Mice)**

- General management of mammalian experiments.
- Recording of heart rate, blood pressure and respiration and study the effects of various factors; drugs; asphyxia; occlusion of common carotid artery.
- Effect of stimulation of central and peripheral end of vagus on arterial blood pressure and respiration after vagotomy.
- Effect of stimulation and distension of carotid sinus on blood pressure and respiration.
- Effect of stimulation of splanchnic nerve.
- Effect of stimulation of peripheral somatic nerve (sciatic nerve).

- Study of hypovolemic shock and its reversal.
- Perfusion of isolated mammalian heart and study the effects of drugs and ions.
- Recording of Isolated Intestinal movement and tone and studying the effect of drugs and ions.
- Study of various stages of menstrual cycle, cervical smear and vaginal smear.

### **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 routine 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 like Functional Near infrared spectroscopy (fNIRS), Intra operative neuro monitoring (IONM), polysomnography
- (vii) Diabetic neuropathy assessment kit
- (viii) Reaction time apparatus
- (ix) Electroretinography

#### **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)
- (vii) Ankle brachial pressure index/ Vascular Doppler

### **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
7. Artificial reproductive techniques/ semen laboratory/ infertility laboratory

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).

### **PHYSIOLOGY**

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|--------------------|---------------------|
| <b>Course Code</b> | <b>Course Title</b> |
| <b>01190301</b>    | MD Physiology       |

### **PROGRAMME OUTCOMES**

| <b>CO No.</b> | <b>At the end of the course, the learners should be able to:</b>   | <b>Mapped Programme Outcomes</b>            |
|---------------|--|---|
| CO 1          | Deal and understand all aspect of general and applied physiology and general principles of medical education.  | PO1, PO2, PO3, PO5, PO7, PO8, PO9           |
| CO 2          | Teach effectively the basic physiological mechanisms of human body with reference to their implications in the pathophysiology of diseases, their diagnosis, treatment and management.                               | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9 |
| CO 3          | Conduct clinical and experimental research and interpret relevant findings.  | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9 |
| CO 4          | Acquire skills in conducting collaborative research with allied sciences, clinical sciences and biomedical engineering.  | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9 |
| CO 5          | Acquire administrative skills to set up departmental laboratories and initiate purchase procedure.   | PO1, PO2, PO3, PO5, PO6, PO7, PO8, PO9      |
| CO 6          | Function as a member of a teaching, administrative or research team.   | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9 |
| CO 7          | Carry out all human and animal experiments by computer assisted simulation models / facilities as permissible by Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) guidelines. | PO1, PO2, PO3, PO4, PO5, PO9                |