PHYSIOLOGY

MD *in* Physiology

COURSE NAME
MD in Physiology

DURATION OF COURSE
3 years

ELIGIBILITY
MBBS

GOAL

The broad goal of the MD Physiology course aims at providing comprehensive training for teaching theoretical, practical and clinical aspects of Physiology as well as the research methodology.

OBJECTIVES

The candidate qualifying for the award of M.D. (Physiology) should be able to:

1. Demonstrate a comprehensive understandingof physiology as well as that of the applied disciplines;
2. Demonstrate adequate knowledge of the current developments in medical sciences as related to physiology;
3. Teach undergraduates and postgraduates in physiology;
4. Plan and conduct research;
5. Plan educational programs in physiology utilizing modern methods of teaching and evaluation;
6. Organize and equip physiology laboratories
7. Identify lacunae in the existing knowledge in a given area and be able to plan investigative procedures for research, analyze data critically and derive logical conclusions.

COURSE CONTENT

THEORY & PRACTICAL

The theory and practical syllabus are completed in four semesters. The department conducts the semester wise programme in a cyclic fashion so that no matter at what point a student joins the programme, he/she completes the course in two years. Besides the postgraduate students are expected to attend MBBS Theory classes in 1st year. The semester-wise programme is as follows:

SEMESTER 1

a. General & Cellular Physiology
b. Hematology
c. Renal Physiology & Fluid Balance
d. Basics of Research Methodology, biostatistics & Research Ethics

SEMESTER 2

a. Cardiovascular Physiology
b. Respiration
c. Environmental Physiology

SEMESTER 3

a. Nerve & Muscle Physiology
b. General, Sensory & Motor Physiology
c. Special Senses
d. Limbic System and Higher Nervous System

SEMESTER 4

a. Nutrition & Metabolism
b. Gastrointestinal System
c. Endocrines & Reproduction

SEMESTER 5

a. Thesis preparation and submission

SEMESTER 6

a. Clinical posting in different clinical departments

DISTRIBUTION OF THEORY: PAPER WISE

PAPER 1: General and Cellular Physiology including Genetic Basis and Historical perspectives

1. General & Cellular Physiology

a. The cell as the living unit of the body
b. The internal environment
c. Homeostasis
d. Control systems
e. Organization of a cell
f. The physical structure of a cell
g. Transport across cell membranes
h. Functional systems in the cells
i. Genetic code, its expression, and regulation of gene expression
j. Cell cycle and it's regulation

2. Signal
2. History of Medicine and Physiology

PAPER 2. Systemic Physiology (systems concerned with transport, nutrition, metabolism and energy) including comparative Physiology.

1. Hematology

- Plasma and Formed elements
- Erythrocytes
  - erythropoiesis
  - structure & function of RBCs
  - formation of haemoglobin
  - destruction & fate of RBCs
  - anaemias
  - polycythemias
- Leucocytes
  - general characteristics
  - genesis & life span of WBCs
  - classification & functions of each type of WBC
  - leukopenia
  - leukaemias
- Blood groups
  - classification
  - antigenicity
  - agglutination
  - blood typing
  - principles of transfusion medicine
- Hemostasis
  - components of hemostasis
  - mechanisms of coagulation
  - coagulation tests
  - anticoagulants
- Immunity
  - Innate immunity
  - Acquired immunity
  - Allergy, hypersensitivity and immunodeficiency
  - Psychoneuroimmunology

2. Cardiovascular Physiology

- Properties of cardiac muscle
- Cardiac cycle
- Heart as a pump
- Cardiac output
- Nutrition & metabolism of the heart
- Specialized tissues of the heart
- Generation & conduction of the cardiac impulse
- Control of excitation & conduction
- Electrocardiogram
- Arrhythmias
- Principles of Hemodynamics
- Neurohumoral regulation of cardiovascular function
- Microcirculation & lymphatic system
- Regional circulations
- Cardiac failure
- Circulatory shock

3. Respiration

- Functional anatomy of the respiratory system
- Pulmonary ventilation
- Alveolar ventilation
- Mechanics of respiration
- Pulmonary circulation
- Pleural fluid
- Lung oedema
- Principles of gas exchange
- Oxygen & carbon-dioxide transport
- Regulation of respiration
- Hypoxia
- Oxygen therapy & toxicity
- Artificial respiration

4. Environmental Physiology

- Physiology of hot environment
- Physiology of cold environment
- High altitude
- Aviation physiology
- Space physiology
- Deep-sea diving & hyperbaric conditions

5. Exercise Physiology & Yoga

5. Nerve & Muscle Physiology

- Resting membrane potential
- Action potential
- Classification of nerve fibres
- Nerve conduction
- Degeneration and regeneration in nerves
- Functional anatomy of skeletal muscle
- Neuro-muscular transmission and blockers
- Excitation-contraction coupling
- Mechanisms of muscle contraction
- Smooth muscle

6. Gastrointestinal System

- General principles of G-I function
- Mastication & swallowing
- Oesophagal motility
- Salivary secretion
- Gastric mucosal barrier
- Pancreatic & biliary secretion
- Gastrointestinal motility
- Digestion & absorption
- Functions of Colon
- Pathophysiology of peptic ulcer and diarrheal disease
- Liver functions

7. Nutrition & Metabolism

- Carbohydrates
- Fats
- Proteins
- Minerals
- Vitamins
- Dietary fibre
- Recommended Dietary Allowances
- Balanced diet
- Diet for infants, children, pregnant & lactating mothers, and the elderly
- Energy metabolism
- Obesity & Starvation

PAPER 3: Systemic Physiology (systems concerned with regulation, neural control, excretion and procreation,)

1. Endocrines & Reproduction

- Classification of Hormones
- Mechanism of Hormone action
- Measurement of hormones in Blood
- Endocrine functions of the hypothalamus
- Pituitary
- Thyroid
- Adrenals
- The endocrine pancreas
- Pathophysiology of diabetes
- Parathyroid, calcitonin, Vit D & calcium metabolism

- Pineal gland
- Testosterone & male sex hormones
- Spermatogenesis
- Hyper & hypogonadism
- Menstrual cycle
- Female sex hormones
- Pregnancy & Lactation
- Functions of Placenta
- Parturition
- Lactation

2. Renal Physiology & Fluid Balance

- Body fluid compartments
- Water balance; regulation of fluid balance
- Urine formation
- Regulation of extracellular sodium & osmolarity
- Renal mechanisms for the control of blood volume, blood pressure & ionic composition
- Regulation of acid-base balance
- Micturition
- Diuretics
- Renal failure

3. General, Sensory & Motor Physiology

- The general design of the nervous system
- Interneuronal communication
- Classification of somatic senses
- Sensory receptors
- Sensory transduction
- Information processing
- Dorsal column & medial lemniscal system
- Thalamus
- Somatosensory cortex
- Somatosensory association areas
- Pain
- Organization of spinal cord for motor function
- Reflexes & reflex arc
- Brain stem & cortical control of motor function
- Cerebellum
- Basal ganglia
- Maintenance of posture and equilibrium
- Motor cortex

4. Special Senses

- Optics of vision
- Receptors & neural functions of the retina
- Colour vision
- Perimetry
- Visual pathways
- Cortical visual function
- Functions of the external and middle ear
- Cochlea
- Semicircular canals
- Auditory pathways
- Cortical auditory function
- Deafness & hearing aids
- Primary taste sensations
- Taste buds
- Transduction & transmission of taste signals
- Perception of taste
- Peripheral olfactory mechanisms
- Olfactory pathways
- Olfactory perception

5. Limbic System and Higher Nervous System

- Autonomic nervous system
- The limbic system and hypothalamus
- EEG
- Sleep
- Emotions & Behaviour
- Learning & Memory
- Yoga

PAPER 4. Applied Physiology, pathophysiology including recent advances

Clinical correlations of altered physiological functions in different deviations from normal. Applications of knowledge of recent advances in physiology. These will include:

1. Pathophysiology pertaining to systemic Physiology
2. Physiological basis of various clinical problems and investigation tests
3. Recent advances relevant to systemic Physiology
4. Social responsibilities of physiologists

DISTRIBUTION OF PRACTICAL (SEMESTER-WISE)

Practical exercises are conducted every semester exclusively for M.D. students on systems scheduled for the semester. The results obtained in these exercises are presented in teaching meetings. Besides specially designed P.G. practical, M.D. students will have to perform all undergraduate practicals, and also teach some of these practicals to the undergraduates.

SEMESTER 1

Experiments on:

a. General & Cellular Physiology
b. Hematology
c. Renal Physiology & Fluid Balance
d. Medical Education and Ethics

These Includes:

1. Histology
2. Cell Culture
3. Protein quantification and separation
4. Immunochemical analysis
5. Bone marrow smear (Goat/Human)
6. Human peripheral blood and staining with different stains
7. All UG Haematological experiments along with
   - Eosinophil count
   - Reticulocyte count
   - Plasma prothrombin time
   - The haemoglobin content of the blood sample
   - Median corpuscular fragility
8. Water diuresis test
9. Microteaching
10. Hands-on activity: Preparing MCQs; Item analysis; Preparing SAQs
11. Hands-on activity: Preparing OSPEs
12. Visit different clinical laboratories

SEMESTER 2

Experiments on:

a. Cardiovascular Physiology
b. Respiration
c. Environmental Physiology

These Includes practicals on:

1. ECG and heart rate variability
2. Venous occlusion plethysmography
3. Phonocardiogram
4. Pulse-wave velocity and Ankle Brachial Index (ABI).
5. Cardiac output monitoring, BRS & BPV assessment
6. Demonstration of :
   - Cath lab procedures
   - Echo evaluation of cardiac function
   - Nuclear imaging of cardiac function
   - Exercise stress testing
   - Techniques utilized in cardiac radiology
7. Recording of the arterial BP, respiration and ECG of the rat.
8. Measuring Physiological dead-space in a subject.
9. Spirometric Lungs Function tests.

10. Recording respiratory-flow volume loop
11. Determination of diffusion capacity
12. Determination of respiratory impedance
13. Record of the in-vivo mechanical activity of the amphibian heart and demonstrating different physiological phenomena
14. Recording the mechanical activity of the isolated amphibian heart.
15. Clinical examination of CVS.
16. Clinical examination of the respiratory system
17. Cardiopulmonary resuscitation (CPR) and Artificial respiration
18. Treadmill test for determination of VO2 max

SEMESTER 3

Experiments on:

a. Nerve & Muscle Physiology
b. General, Sensory & Motor Physiology
c. Special Senses
d. Limbic System and Higher Nervous System

1. Different experiments on frog sciatic nerve-gastrocnemius muscle preparation
2. Tests to assess sensory and motor and higher function
3. Tests to assess the autonomic function of a human subject
4. Measuring the conduction velocity of sensory and motor nerve
5. Recording of different event-related potentials and reflexes in human subject
6. Neuroimaging studies
7. Recording of electromyography
8. Examination of cranial nerves
9. Record and interpret the EEG of a human subject
10. Recording of visual, auditory, motor and sensory evoked potentials
11. Evaluation of Reaction time (Visual, Auditory)
12. Audiometry tests
13. Clinical examination of the nervous system
14. Clinical examination of special senses

SEMESTER 4

Experiments on:

a. Nutrition & Metabolism
b. Gastrointestinal physiology
c. Endocrines & Reproduction physiology

1. Recording of mechanical activities of isolated segments of the mammalian small intestine.
2. Recording of electrical activities of gastric movements in the human subject (Electrogastrography).
3. Calculation of resting energy expenditure (REE)
4. Preparation of a diet chart for Pregnant & lactating lady; Paediatric age group; Geriatric age group and some disease condition
5. Determination of the blood lipid profile
6. Study of vaginal cytology in rat and human subject
7. Determination of the Cortisol level in human subject
8. Analysis of semen sample.
9. Determination of the status of pregnancy from the urine samples of a subject

Body Composition Analysis

SEMESTER 5

Thesis preparation and submission

SEMESTER 6

Clinical posting in different clinical departments

TEACHING & LEARNING METHODS

During the course, students have formal teaching and are trained for teaching and research.

The above topics are covered through a mix of self-learning and structured program. The structured program consists of various teaching-learning methodologies:

Teaching Learning Methodologies

I. Theory by:

- Seminars
- Journal club
- Group discussion
- Symposium
- Problem-based Learning

II. Practicals by:

- Demonstration and Hands-on training
- Clinical posting (last 6 months)

DEPARTMENTAL TRAINING SCHEDULE & ACTIVITY OF RESIDENTS:

1. Seminars every ~~Saturday~~ Wednesda

The seminars are on a topic belonging to a system scheduled for the semester. The topic is presented in-depth appropriate for postgraduates by one of the M.D. students and moderated by a faculty member. The seminars represent only a small and somewhat arbitrary selection of topics. They are not intended to cover an entire system. Their aims are to:

- Introduce the system
- Tune the students to the system
- Cover recent advances
- give students practice in the art of oral presentation

2. Journal Clubs/Symposium, every ~~Tuesday~~ Saturda

The journal clubs are on an article belonging to a system scheduled for the semester. The article is presented by an M.D. student or senior demonstrator, and moderated by a faculty member. The aims of journal clubs are to:

- Highlight recent advances
- Discuss classical papers
- Inculcate the faculty of critical appreciation of a research article
- Give students and senior demonstrators practice in the art of oral presentation

3. Group Discussions, every ~~Wednesday~~ Tuesda

The group discussions are on a topic belonging to a system scheduled for the semester. A group discussion aims at a structured exchange of knowledge, ideas, and perceptions among the participants on a given topic. The topics are chosen so as to bridge the gaps in coverage of entire system by seminars and journal clubs. Their aims are to:

- Cover historical perspectives along with recent advances
- Develop the understanding of the topic/ system in a wholesome manner with applied aspects
- Develop their skills in interpersonal communication and in expressing their views in a clear and succinct manner
- Give students the practice of group discussion and learn the group dynamics

4. Practicals

- Practical exercises are conducted every semester exclusively for M.D. students on systems scheduled for the semester. The results obtained in these exercises are presented in teaching meetings (see below).
- BesidesspeciallydesignedP.G.practicals,M.D. students should perform all undergraduate practicals, and also teach some of these practicals to the undergraduates.
- The logbook should be maintained and monitored periodically

5. Clinical postings.

During their last semester, M.D. students are posted for two weeks each in the

Departments of Medicine, Cardiology, Gastroenterology, Neurology, Endocrinology, Ophthalmology and Nephrology. In these postings, the students attend ward rounds and also observe the work going on in clinical physiology laboratories associated with these departments. The aim of these postings is to:

- Provide the students with concrete living examples of the application of physiology in the diagnosis and management of disease
- Illustrate through some living examples of how knowledge of physiology may grow through observations made on patients.

III. EVALUATION OF TRAINING

Written/practical assessment every semester. Feedback on teaching/training programmes.

IV. RESEARCH WORK

Writing Thesis protocol, Collection of data, Statistical analysis, Result submission

Progress monitoring of research work every semester,

Result presentation and submission at the end of 2 & ½ yrs

Presenting paper/poster at conferences

Preparing manuscripts for documentation/ publication

Design a project for research

ASSESSMENT

Examination on Research Methodology & Biostatistics

- Timing: End of 2nd Semester
- Total marks: 100
- Will be considered as an internal examination
- Candidate should pass to appear in Final examination
- No marks will be added to final/summative examination
- Will be conducted by Examination Cell in the month of June & December

Internal Examination

Examination on Research Methodology & Biostatistics at the end of the 2nd semester.

Internal examination: At the end of the 3rd, 4thand 5thsemester, pre-final (2 months before final examination).

Marks distribution:

Theory 100 marks,

Practical (As per semester schedule) with viva and logbook

(Practical – 70, viva – 20, logbook – 10).

The marks of the 4 internal examinations will be averaged to 100 each for theory and practical.

Summative/ Final Examinations

Final examination at the end of the course has theory, practical and viva-voce which will cover as follows.

Theory (MD Physiology)
4 papers (100 marks each)

Question Paper Format
One Long question – 20 marks
Eight Short question/notes – 8 x 10 = 80 marks

Total marks in theory: 500 marks
Theory papers in the final examination – 400 marks
Average of 4 internal examination – 100 marks

DISTRIBUTION OF TOPICS FOR THEORY

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

Paper-II: Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology.

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

Paper-IV: Applied Physiology, pathophysiology including recent advances

PRACTICAL AND VIVA

Practical examination

Total marks: 500

Practical and viva in the final examination – 400 marks

Average of 4 internals (practical + viva + logbook) exams – 100 marks

- The format of the practical examination (400 marks)

Part	Components	Marks allotted
Part A* 200 marks	Longcase (1 no.)	100
	Short cases (2 nos.)	50
	OSCE/OSPE (5-10 stations)	50
Part B 200 marks	Operative procedure/Pedagogy/Department specific activity	50
	Critical appraisal of a scientific paper	25
	Thesis presentation and evaluation	50
	Viva	75

* Students should pass (secure 50% marks) separately in Part A

Total marking scheme:

	1st Internal Examination	2nd Internal Examination	3rd Internal Examination	4th Internal Examination	Total Internal Marks (Average of 4 exams)	Final Examination	Total Marks
Time frame	End of 3rd semester	End of 4th semester	End of 5th semester	2 month before final			
Theory	100	100	100	100	100	400	500
Practical	100	100	100	100	100	400	500

RECOMMENDED BOOKS

1. Alberts B. Molecular Biology of the Cell: CRC Press; 2017.
2. Barrett KE, Barman SM, Boitano S, Brooks HL. Ganong's Review of Medical Physiology (Enhanced EB): McGraw-Hill Education; 2009.
3. Boron WF, Boulpaep EL. Medical PhysiologyE-Book: Elsevier Health Sciences; 2016.
4. Caligiuri M, Levi MM, Kaushansky K, Lichtman MA, Prchal J, Burns LJ, et al. Williams Hematology, 9E: McGraw-Hill Education; 2015.
5. Cotes JE, Chinn DJ, Miller MR. Lung Function: Physiology, Measurement and Application in Medicine: Wiley; 2009.
6. Kasper DL, Fauci AS, Hauser SL, Longo DL, Jameson JL, Loscalzo J. Harrison's Principles of Internal Medicine 19/E (Vol.1 & Vol.2) (ebook): McGraw-Hill Education; 2015.
7. Koeppen BM, Stanton BA. Berne & Levy Physiology: Elsevier; 2017.
8. Mack S, Kandel ER, Jessell TM, Schwartz JH, Siegelbaum SA, Hudspeth AJ. Principles of Neural Science, Fifth Edition: McGraw-Hill Education; 2013.
9. McArdle WD, Katch FI, Katch VL. Exercise Physiology: Nutrition, Energy, and Human Performance: Wolters Kluwer Health/ Lippincott Williams & Wilkins; 2015.
10. Owen J, Punt J, Stranford S, Jones P. Kuby Immunology: Macmillan Learning; 2018.
11. Podolsky DK, Camilleri M, Fitz JG, Kalloo AN, Shanahan F, Wang TC. Yamada's Textbook of Gastroenterology, 2 Volume Set: Wiley; 2015.
12. Shlomo Melmed MM, Polonsky KS, P. Reed Larsen MDF, Kronenberg HM. Williams Textbook of Endocrinology: Elsevier Health Sciences; 2015.
13. Vaz MD, Raj TD, Anura KD. Guyton & Hall Textbook of Medical Physiology - E-Book: A South Asian Edition: Elsevier Health Sciences; 2014.
14. Yu ASL, Chertow GM, Luyckx V, Marsden PA, Skorecki K, Taal MW. Brenner and Rector's The Kidney E-Book: Elsevier Health Sciences; 2019.

MODEL SAMPLE QUESTION PAPERS

PAPER 1

Max. Marks:100
Time: 3 hrs
Answer all questions
Illustrate your answer with suitable diagrams

1. Describe the impact of the human genome project and its application to any two disorders (10+5+5=20)
2. Describe the historical perspectives of phagocyte respiratory burst (10)
3. Explain the sequence of events that lead to the discovery of cardiac catheterization (10)
4. Illustrate the work was done that lead to the discovery of chemoreceptors (10)
5. Explain the negative and positive feedback mechanism with examples and relate its significance in homeostasis (10)
6. Describe the mechanism of aquaporin in the permeability of water (10)
7. Illustrate the mechanism of recycling of synaptic vesicles (10)
8. Explain the mechanism of insulin receptor signalling (10)
9. Describe the mechanism of apoptosis (10)

PAPER 2

Max. Marks:100
Time: 3 hrs
Answer all questions
Illustrate your answer with suitable diagrams

1. Describe the waves of an Electrocardiographic recording and the relationship of the ECG to the electrical axis of the heart. List the early and late ECG manifestations of myocardial infarction. Explain the early ionic changes that produce them. (6+6+8 = 20 marks)
2. Describe the mechanism of the hematopoietic inductive microenvironment (10)
3. Compare the electrical and mechanical events in smooth and cardiac muscle with those of skeletal muscle. (10)
4. Describe the special features of the coronary circulation. (10)
5. Describe and explain the ventilatory responses to increased carbon dioxide concentrations in inspired air. (10)
6. Describe the pressure-volume characteristics of the lung and the chest wall. Describe the changes in compliance of the lung and the chest wall in different physiologic and pathologic conditions. (10)
7. What are the tissue macrophages? What is their origin and how do they contribute to body defences? (10)
8. The bacteria in the colon exist in a symbiotic relationship with the host. How does the host benefit from this relationship? What are the harmful or potentially harmful effects of this relationship? (10)
9. The cholinergic division of the autonomic nervous system has been called the anabolic nervous system. Discuss the actions of the cholinergic division that justify this. (10)

PAPER 3

Max. Marks:100
Time: 3 hrs
Answer all questions
Illustrate your answer with suitable diagrams

1. Describe how skilled movements are planned and carried out. (10 +10= 20 marks)
2. Describe and explain the symptoms of Parkinson's disease. (10)
3. Describe how the countercurrent mechanism in the kidney operates to produce hypertonic or hypotonic urine. (10)
4. Describe the renal mechanisms of regulation of acid-base balance. (10)
5. Describe the role of chromosomes, hormones and related factors in sex determination and development. (10)
6. Trace the path of auditory impulses in the neural pathways from the cochlear hair cells to the auditory cortex. Explain how pitch, loudness and timbre are coded in the auditory pathways. (10)
7. List the hormones that affect plasma glucose concentration. Describe the action of each. (10)
8. Explain how the intensity, location and quality of stimuli are coded. (10)
9. Outline the steps involved in the biosynthesis of thyroid hormones. Describe the regulation of secretion and the mechanism of action of the same. State the actions of thyroid hormone. (10)

PAPER 2

Max. Marks:100
Time: 3 hrs
Answer all questions
Illustrate your answer with suitable diagrams

1. Describe the path that led to the discovery of place and grid cells (20)
2. Explain the pathophysiology of Downs Syndrome (10)
3. Describe the physiological basis of Nephrotic system (10)
4. Explain the Physiological Basis of Cushing's syndrome (10)
5. Explain "Transcranial Direct Current Stimulation (tDCS) " and its role in treating Alzheimer's disease (10)
6. Explain the physiological basis of treatment of cardiac failure. (10)
7. Explain the physiological basis of Gastro-oesophageal reflux disease (10)
8. Explain the mechanism of high altitude pulmonary Oedema (10)
9. Describe the energy system used in the 100-meter swim and a 200-meter dash (5+5)

ENTRUSTABLE PROFESSIONAL ACTIVITIES

S. No.	EPA	Competency Domains						Level of competency				MSF
		MK	PC	PBLI	SBP	P	ISC	Day 1 of residency	End of 1st year	End of 2nd year	End of 3rd year	
1	Should be able to teach Physiology to and allied health sciences.	*		*	*		*	-	III	IV	V	S,UG,PG,I
2	Should be able to teach Physiology to undergraduates (MBBS)	*		*	*		*	-	III	IV	V	S,UG,PG,I
3	Should be able to demonstrate hematology experiments in Physiology such as RBC count, WBC count, Haemoglobin estimation, DLC, AEC, PCV, ESR, BT, CT, Blood indices, blood grouping to undergraduate students.	*	*	*	*		*	I	III	IV	V	S,UG,PG,I
4	Should be able to perform hematology experiments in Physiology such as Osmotic fragility, Platelet count, reticulocyte count.	*	*	*	*			-	II	III	IV	S,UG,PG,I
5	Should be able to demonstrate clinical experiments in Physiology such as recording of BP, the examination of CVS, RS, CNS, spirometry, pulse wave recording, ECG.	*	*	*	*	*	*	I	III	IV	V	S,UG,PG,I
6	Should be able to perform clinical experiments in Physiology such as autonomic function testing, stethography, ECG, EEG, EMG studies, NCV, Evoked potentials, Mosso's ergography, perimetry, HRV.	*	*	*	*			-	II	III	IV	S,UG,PG,I
7	Should be able to perform mammalian experiments on uterine contraction, intestinal contraction, skeletal muscle contraction, mammalian heart.	*		*	*			-	II	III	IV	S,UG,PG,I

S. No.	EPA	Competency Domains						Level of competency				MSF
		MK	PC	PBLI	SBP	P	ISC	Day 1 of residency	End of 1st year	End of 2nd year	End of 3rd year	
8	Should be able to interpret the charts on amphibian experiments on nerve, muscle, and heart.	*		*	*			-	II	III	IV	S,UG,PG,I
9	Should be able to interpret the charts on dog experiments on nerve, muscle, heart and blood vessels.	*		*	*			-	II	III	IV	S,UG,PG,I
10	Should be able to maintain the record of all the experiments performed.	*		*	*			-	III	IV	IV	S,UG,PG,I
11	Should attend peripheral postings in the clinical departments.	*	*	*	*	*	*	-	III	III	III	S,UG,PG,I
12	Should update recent concepts in physiology.	*		*	*		*	-	II	III	IV	S,UG,PG,I
13	Should be able to handle small group teaching for under graduate students.	*	*	*	*	*	*	-	III	IV	V	S,UG,PG,I
14	Should involve in periodic assessment of students	*		*	*		*	-	II	III	IV	S,UG,PG,I
15	Should undergo a research methodology course.	*		*	*		*	-	II	III	IV	S,UG,PG,I
16	Should be able to present seminars and symposia in the department.	*		*	*		*	-	II	III	IV	S,UG,PG,I
17	Perform a critical appraisal of an article published in a journal.	*		*	*		*	-	II	III	IV	S,UG,PG,I
18	Should design and implement a dissertation research work, with periodic reports submitted to the head of the department.	*		*	*		*	-	II	III	IV	S,UG,PG,I
19	Design and implement an original research project and publish an article with the outcome.	*		*	*		*	-	II	III	IV	S,UG,PG,I

S. No.	EPA	Competency Domains						Level of competency				MSF
		MK	PC	PBLI	SBP	P	ISC	Day 1 of residency	End of 1st year	End of 2nd year	End of 3rd year	
20	Should be able to present oral and poster presentations in conferences, CME's conducted by physiological societies.	*		*	*		*	-	II	III	IV	S,UG,PG,I
21	Should maintain the daily log of activities.	*		*	*			-	III	IV	IV	S,UG,PG,I
22	Should design and implement a dissertation research work and publish	*		*	*		*	-	II	III	IV	S,UG,PG,I

Abbreviations:

MK: Medical knowledge

PC: Patient Care

PBLI: Problem Based Learning and Improvement

SBP: Systems-Based Practice

P: Professionalism

ICS: Interpersonal and Communication Skills

Levels of competence:

Level 1: Knowledge only; can observe

Level 2: Can do under strict supervision

Level 3: Can do under loose supervision

Level 4: Can do independently

Level 5: Has the expertise to teach others

Multisource feedback (MSF):

Supervisor: S

Patients/Relatives: P

Undergraduate students: UG

Peers: PG

Community: C

Other health professionals: H

Self: I