AIIMS Guwahati
MD Physiology Postgraduate Curriculum

1. Goal:

The goal is to set such standards to ensure availability of competent physiologists equipped with required skills for teaching, research and patient care (diagnostic, therapeutic and rehabilitative). The end point should be a competent physiologist who should be a good medical teacher in Physiology, should be capable of conducting independent research for the advancement of medical sciences and should be able to provide Physiology related clinical services.

2. Specific Objectives:

A candidate upon successfully qualifying in the MD (Physiology) examinations should be able to:

1. elaborate the knowledge on all aspects of general and systemic physiology.
2. work as an effective member of a teaching or research team and show team spirit and camaraderie.
3. teach undergraduate medical, paramedical and all other basic science students, the basic physiological mechanisms of the human body, with reference to their pathophysiology and the physiological basis of their management.
4. integrate the knowledge of physiology with Diagnostic, Therapeutic, Preventive and Rehabilitative Medicine.
5. conduct research in the field of Physiology and integrate it with other allied science disciplines.
6. demonstrate contemporary physiological diagnostic and interventional skills.
7. know the rationale of using various types of teaching techniques and resources.
8. use the internet search engines, social media, statistical software, image editing software for teaching and research.
9. prepare a manuscript and upload it using Manuscript submission software and navigate the publishing websites.
10. use all aspects of computational office tools (Microsoft Office) including but not limited to Word, PowerPoint and Excel.
11. Should be generative for creation of text, images and data processing in other applications.
12. explain the various facets of Artificial Intelligence (AI), Bioinformatics and machine learning tools. They should also be well conversed with application of virtual/augmented reality (VR/AR) in teaching research and patient care.
13. acquire the basic administrative skills to set up a new Physiology department and laboratories and initiate purchase procedures and procure necessary items from time to time for running such laboratories.
14. follow ethical guidelines with regards to research and publications.
15. mentor/ counsel students to facilitate their holistic development besides.

16. Be innovative and acquire a skill set for research and development in the field of biomedical engineering.

3. Training Program in Brief:

- The minimum expectation from postgraduates is to be completely fluent with the syllabus given below.
- The entire undergraduate curriculum in detail with recent advances in each topic is "*must know*" area for postgraduates.
- Postgraduates are expected to attend all undergraduate lectures, practicals & tutorials.
- Active learning by self-motivation rather than spoon feeding should be the basis of postgraduate training.
- The training program should consist of lectures (at least 20 per year, taken by faculty), practicals, seminars, symposia, journal clubs and group discussions. Details of the same are given in ***Annexure 1*** attached with this document.
- A practical file should be maintained and signed by the postgraduates from the faculty concerned after they conduct each practical in the Department.
- Based on the available equipment and laboratories, a list of post-graduate experiments pertaining to basic and applied physiology will be prepared and all postgraduates are expected to be well versed in conducting these experiments on their own.
- Research methodology and biostatistics must be made a part of the curriculum. There should be classes in Biostatistics and Research Methodology in the first six months in of postgraduate course. The students must read the current guidelines for the ethical use of animals in teaching and research. Students are also expected to read the ICMR guidelines for human studies.
- Postgraduates should be periodically assessed (both formative and summative) during their 3 years of MD by end semester examinations every six months.
- An electronic/ hardcopy log book should be maintained by the postgraduate students and it should be evaluated periodically and at the time of final examination.
- Postgraduates are expected to go to other Departments for a short period of rotation as per the schedule given below to achieve a Holistic training and integrate their knowledge of Physiology with other disciplines and also become aware of various techniques and Laboratories in the other Departments.
- Postgraduates are expected to conduct research culminating into submission of thesis and periodic presentation of data at the stipulated time period in their curriculum elaborated below.
- Postgraduates should learn how to use simulation models and software for various important physiological processes like ECG simulator.

4. General outline of sessionals

The duration of MD Physiology course is 3 years. It will be divided in to six sessionals. The detailed breakdown of the three tiers is detailed below which includes examinations, postings and thesis related work (Annexure ***1***). The distribution of various topics in each sessionals is also attached. As the Postgraduate students are admitted twice a year, they will repeat content of one sessional during their 5th sessional.

1. Distribution of Teaching learning activities over 3 years

MD Training year	January-June / July-December	July-December / January-June
1st	Attend Biostatistics & Biomedical research basic course in MEU Learns basics of Physiology dept Takes practical classes Attend teaching methods workshop Training in Microsoft Office and Literature searching Orientation to Department activities Presents his/her PG thesis protocol	Learns basics of Physiology dept Takes practical classes Initiates Thesis related work
2nd	Learns basics of Physiology dept Takes practical classes Works on his thesis data collection Presents his work in at least 1or 2 conferences	Learns basics of Physiology dept Takes practical classes Works on his thesis data collection
3rd	Posting in other departments*	Presents & submits his/her thesis in June end Learns basics of Physiology dept Takes practical classes Presents his work in at least 1or 2 conferences Publishes at least 1 article from thesis work Prepares for University exams

*Throughout the entire three years, depending on the convenience and logistic feasibility, planned visits to National Laboratories (CSIR/ICMR and others) and Open Day visits to IITs/ NITs and engineering institution/colleges, Joint seminars with clinical departments/ Technological/ Engineering institutions should be encouraged. At least one invited or visited lecture by IIT Guwahati faculty on Bioinformatics, AI, Machine learning and Biomedical Engineering will be arranged for the postgraduate student every two months. PG student will visit SAI Guwahati in the appropriate sessional to learn about athletic assessment of fitness for a week duration. PG student will also visit NIPER Guwahati to see and understand animal experiments demonstration physiological concepts in the appropriate sessional for a period of 2-3 days.

Broad division of core physiology topics distributed over 4 sessionals

1st Sessional	2nd Sessional	3rd Sessional	4th Sessional
• General Physiology • Cellular and Molecular Biology • Blood • Nerve muscle physiology • Renal Physiology	• Nutrition • Gastrointestinal Physiology • Endocrinology • Reproductive Physiology	• Cardiovascular Physiology • Respiratory Physiology • Environmental Physiology • Integrative Physiology	• Sensory & motor Physiology • Higher nervous Functions • Special Senses

2. Tentative Schedule Clinical and laboratory postings for MD Physiology

The clinical postings of the postgraduate student are scheduled to take place in the fifth sessionals. However, in case of thesis or student interest related need the timing of postings can be flexible. The clinical postings are supplementary to the academic course and it may be noted that the commitment of the PG student to the parent department, his/her thesis work and seminars and teaching activities are paramount.

The entire posting to be categorized into three broad headings, namely posting in laboratory departments, Clinical departments and 1 elective posting.

The objective of the clinical and laboratory postings is to achieve an ability to integrate knowledge of Physiology with other disciplines and also become aware of various techniques and Laboratories in the other Departments.

A. The laboratory departments will include the following

Biochemistry

Pathology

Pharmacology

Transfusion Medicine

B. The clinical departments will include the following

General medicine

Pulmonary medicine

Neurology

Cardiology

In addition, a week posting in **Casualty** will be incorporated to learn about the functioning and management strategies in the emergency. To **assess** these extra departmental postings, PG student will be assessed by the logbook signed by the Department of posting where they have to get the score (0-10) and signature for

each procedure/ skill that they have learnt signed by in charge Faculty of the said department in their logbook.

Biochemistry	7 days	Learn principles and analysis of reports of Auto & Semi auto Analyzer, Electrophoresis, Chromatography, RIA, Study of serum chemistry, Constituents of normal and abnormal urine, liver function tests, Renal function tests, Gastric function tests
Pharmacology	7 days	Learn about the Animal House (to learn technique of Animal Handling, Blood sampling, anesthesia, surgery. Study of Animal behavior like eating, drinking, locomotion, sexual activity), Experimental Pharmacology lab to study ongoing animal experimental procedures, Study various guidelines related to ethical use of animals in experiments.
Pathology	7 days	Observes basic procedures in histopathology, cytology and hematology
Transfusion Medicine	7 days	Learn about the working of Blood bank - Cross matching, blood Storage, Immunological tests, Central Lab. - Tests for bleeding & clotting disorders, Bone Marrow study.
Pulmonary Medicine	15 days	Observes and knows how to analyze the reports Whole body plethysmography, Bronchoscopy & other facilities available in the dept.
General Medicine	7 days	Observes the examination, observation, making of a patient file, laboratory investigations and arrival at a diagnosis and subsequent treatment in the OPD and Ward
Cardiology	15 days	Observes and knows how to analyze the reports of Holter analysis, ABG,ABPM, ECG analysis and Echocardiography.
Neurology	15 days	Observes standard electrophysiological procedures and knows how to analyze the reports of EEG, Biofeedback, NCV, CT, MRI of patients with neurological abnormalities.
Casualty	7 days	To know basics of how to handle emergency, Minor procedures
Elective posting	15 days	Department as per interest of the PG student including other institutes like IIT-G, NIPER, any other

Total duration: 102 days

3. Log book

During the training period, the postgraduate student should maintain a Log Book indicating the duration of the postings/work done in Wards, OPDs, Casualty and other areas of posting

The purpose of the Log Book is to:

a) help maintain a record of the work done during training,
b) enable Faculty to have direct information about the work done
c) provide feedback and assess the progress of learning with experience gained periodically.

The Log Book should be used in the internal assessment of the student and should be assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed log book in original at the time of final practical examination signed by the Head of the Department. The PG students shall be trained to reflect and record their reflections in log book particularly of the critical incidents. Quarterly assessment during the MD training should be recorded in the Log Book based on: Journal club: once a week, Seminar: once a week and Case/ Group discussions: once a week. With time the Logbook will be digitized using a learning module like Moodle to help in streamlining the records of the PG student and easy and remote access and retrieval.

4.Course content: Theory and Practical

Topic: General and Cellular Physiology	
Theory	**Practical**
Cell as the living unit of the body, The internal environment, Homeostasis, Control system Organization of a cell, Transport across cell membranes, Functional systems in the cells Genetic code, its expression, and regulation of gene expression, Cell cycle and its regulation	Immunohistochemistry, ELISA, Gel electrophoresis and other cell & molecular biology experiments.
Topic: Hematology	
Theory	**Practical**
Erythrocytes: Erythropoiesis, Structure and function of RBCs, Formation of hemoglobin, Destruction and fate of RBCs, Anemias, Polycythemias Leucocytes: General characteristics, Genesis and life span of WBCs, Classification and functions of each type of WBC, Leucopenia, Leukemias Blood Groups: Classification, Antigenicity, Agglutination, Blood typing, Principles of transfusion medicine	A. Psychomotor domain: 1.Hematology: Estimation of hemoglobin, Determination of total erythrocyte (RBC) count, Determination of RBC Indices (Blood standards) , Determination of total leucocytes (WBC) count : TLC , Preparation of a peripheral blood smear and determination of differential leukocyte count: DLC, Determination of Arneth count, Determination of bleeding time (BT) and clotting time (CT), Determination of blood groups (A,B,O and Rh system),

Hemostasis: Platelets, Components of hemostasis, Mechanism of coagulation, Coagulation tests, Anticoagulants Immunity: Innate immunity, Acquired immunity, Allergy, hypersensitivity and immunodeficiency	Determination of specific gravity of blood, Determination of erythrocyte sedimentation rate (ESR) and packed cell volume(PCV), Determination of osmotic fragility of red blood cells, Determination of platelet count, Determination of reticulocyte count, Determination of absolute eosinophil count, Study of haemopoietic cells present in the bone marrow.
Topic: Renal Physiology and Fluid balance	
Theory	**Practical**
Body fluid compartments, Water balance: regulation of fluid balance, Urine formation , Regulation of extracellular sodium and osmolarity , Renal mechanisms for the control of blood volume, blood pressure and ionic composition , Regulation of acid-base balance , Micturition , Diuretics , Renal failure and Kidney function tests	
Topic: Cardio-vascular Physiology	
Theory	**Practical**
Properties of cardiac muscle, Cardiac cycle , Heart as a pump , Cardiac output , Nutrition and metabolism of heart , Specialized tissues of the heart Generation and conduction of cardiac impulse , Control of excitation and conduction Electrocardiogram , Arrhythmias , Principles of hemodynamics ,Neurohumoral regulation of cardiovascular function , Microcirculation and lymphatic system , Regional circulations Cardiac failure , Circulatory shock , Exercise physiology	Clinical examination of CVS, Examination of arterial and venous pulses, Measurements of arterial blood pressure, Recording of 12 lead electrocardiography (ECG) and its interpretation, Ewing's battery of tests for Autonomic Function Testing, Head-up Tilt test, Heart rate variability test, NIBP recording, Vascular function testing. 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. Heart experiments: Properties of cardiac muscle: regulation of heart - effect of vagus nerve and WCL stimulation effect of variables. Perfusion of isolated mammalian heart and to study the effect of drugs and ions, **Animal experiments will be taught as historical perspectives as part of theory**

	class of NM physiology and demonstration will be done at NIPER Guwahati. Other animal experiments will be conducted within CPCSEA norms
Topic: Respiratory Physiology	
Theory	**Practical**
Functional anatomy of respiratory system, Pulmonary ventilation Alveolar ventilation , Mechanics of respiration , Pulmonary circulation , Pleural fluid , Lung edema , Principles of gas exchange , Oxygen and carbon-dioxide transport , Regulation of respiration , Hypoxia , Oxygen therapy and toxicity , Artificial respiration	Elementary principles of clinical examination, General physical examination, General principles of inspection / palpation / percussion / auscultation. Clinical examination of respiratory system, Stethography – study of respiratory movements and effect of various factors, Vitalography, Static, Dynamic and MVV Spirometry, Measurement of BMR, Cardio pulmonary cerebral resuscitation and artificial respiration.
Topic: Environmental Physiology	
Theory	**Practical**
Physiology of hot environment Physiology of cold environment , High altitude , Aviation physiology , Space physiology , Deep sea diving and hyperbaric conditions	Microgravity, LBNP , Space physiology, Cardio-respiratory responses to steady state exercise using Harvard step test, bicycle ergometry and treadmill test; determination of VO2 max and Lactate threshold.
Topic: Nerve and Muscle Physiology	
Theory	**Practical**
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	Ergography and hand grip spring dynamography – study of phenomenon of human fatigue, Recording and analysis of electromyography (EMG) and GSR response along with EOG. **Animal experiments:** (Please Note- 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.) Amphibian expriments: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 (Fatigue). 7. Study of isometric contraction in skeletal muscle. 8. Determination of conduction velocity of sciatic nerve and effect of variables on nerve***. Animal experiments will be taught as historical perspectives as part of theory class of NM physiology and demonstration will be done at NIPER Guwahati.***
Topic: CNS Physiology	
Theory	**Practical**
General, Sensory and Motor: General design of nervous system, Interneuronal communicatio, Classification of somatic senses , Sensory receptors, Sensory transduction , Information processing , Dorsal column and medial lemniscal system , Thalamus , Somatosensory cortex , Somatosensory association areas , Pain, Organization of spinal cord for motor function , Cerebellum , Basal ganglia, Maintenance of posture and equilibrium , Motor cortex	Clinical examination of the nervous system and its physiological basis - Examination of higher mental functions, Examination of cranial nerves, Examination of sensory system, Examination of motor system including reflexes EEG, QST.A
Topic: Special Senses	
Theory	**Practical**
Optics of vision , Receptors and neural functions of retina , Colour vision, Perimetry , Visual pathways , Cortical visual function , Functions of external and middle ear , Cochlea , Semicircular canals , Auditory pathways , Cortical auditory function , Deafness and hearing aids , Primary taste sensations , Taste buds , Transduction and transmission of taste signals, Perception of taste , Peripheral olfactory mechanisms , Olfactory pathways, Olfactory perception	Tests of Smell and taste, Clinical examination of the eye and pupillary reflex, Visual acuity, Perimetery –mapping out of visual field and blind spot, Accommodation, Fundoscopy, Colour vision and colour blindness, Reaction time (visual and auditory) and reflex time, Neuroelectro diagnostic techniques: Nerve conduction study, Visual evoked potential (VEP), Brainstem auditory evoked potential (BAEP), Somato- sensory evoked potential (SEP), Motor evoked potential (MEP). **Ophtalmology department posting**: Observes and knows how to analyze the reports of Direct and indirect Ophthalmoscopy, Retinoscopy, Slit lamp microscopy, Tonometry, Pachymetry, Study

	of corneal topology, Optometry, Auto-refractometer, Visual Field testing **ENT department posting**: Observes and knows how to analyze the reports Audiometry, Oto-rhino-laryngoscopy, Laryngoscopy, BERA, BSAEP.
Topic: Limbic System and Higher Nervous System	
Theory	**Practical**
Autonomic nervous system, Limbic system and hypothalamus, EEG, Sleep, Emotions and behavior, Learning and memory, Yoga and meditation	Physical, Mental and Emotional well-being, Effect of yoga and pranayama on physiological parameters, Mindfulness, Concentration, anxiety and stress, Counseling in health and diseases.
Topic: Physiology of Nutrition and Metabolism	
Theory	**Practical**
Carbohydrates, Fats, Proteins, Minerals, Vitamins, Dietary fibre, Recommended dietary allowances, Balanced diet, Diet for infants, children, pregnant and lactating mother and the elderly, Energy metabolism, Obesity and starvation.	Construction of dietary chart for growing children, pregnant woman, elderly individuals, hypertensive patients, & diabetes mellitus patients, Measurement of body composition.
Topic: Gastro-intestinal Physiology	
Theory	**Practical**
General principles of GI function, Mastication and swallowing, Esophageal motility, Salivary secretion, Gastric mucosal barrier, Pancreatic and billiary secretion, Gastrointestinal motility, Digestion and absorption, Functions of colon, Pathophysiology of peptic ulcer and diarrheal disease, Liver functions	Clinical examination of abdomen, EGG General management of mammalian experiments, Recordings of isolated intestine - movement & tone and to study the effect of drugs and ions. **Will de done in the dept using locally sourced intestine (slaughter house) in Dale's bath.**
Topic: Endocrine and Reproduction Physiology	
Theory	**Practical**
Classification of hormones, Mechanism of hormone action , Measurement of hormones in blood , Endocrine function of the hypothalamus , Pituitary , Thyroid , Adrenals , Endocrine pancreas , Pathophysiology of diabetes , Parathyroid, calcitonin, Vit D and calcium metabolism, Pineal gland, Testosterone and male sex hormones, Spermatogenesis, Hyper and hypogonadism, Menstrual cycle, Female sex	Determination of ovulation time by basal body temperature chart, cervical smear, Semen analysis: sperm count and motility and vaginal smear examination, detection of pregnancy**.**

hormones, Pregnancy and lactation, Functions of placenta, Parturition, Foetal and neonatal physiology, Physiology of growth	
Topic: Recent advances	
Theory	**Practical**
Bioinformatics, Biomedical engineering, Virtual reality in medicine. Machine learning in medicine, 3d printing in medicine, Gamification	Visit to various laboratories in IIT/ NIPER/IIIT Guwahati, VR lab at Dept. of Physiology. AIIMS Guwahati

The skill development by practical teaching should be divided in to various sections like recording, validation, digitizing of the records, creating publishable quality record, tables and graphs with ability to analyze the grouped data. PG students should always explore the opportunity to publish the practicals and graphs generated from the lab in various journals. PG students are expected to be able to conduct and report on the following laboratory tests by the end of their training independently.

1. Clinical Neurophysiology Laboratory including cognitive function testing.
2. Cardio-respiratory laboratory with Autonomic Function Testing
3. Metabolic/Endocrinology/Reproductive laboratory.

5. ASSESSMENT METHODS

FORMATIVE ASSESSMENT:

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills. Introduction of Peer based assessments. Novel method of assessment should be used (open book exam, assessment of creative thinking/ experimentation in physiology, exam based on a visit to teaching tours, question making quiz, physiology assessment through games(gamification). ALL seminars should be assessed best 3 can be included for internal assessment. Progress of thesis work will also be assessed in regular intervals

SUMMATIVE ASSESSMENT:
Essential pre-requisites for appearing for examination include:

1. Log book of work done during the training period
2. At least two presentations at national level conference. One research paper should be published / accepted in an indexed journal.

The theory examination shall be held in advance before the Clinical and Practical examination. The postgraduate examination shall be in three parts:

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 postgraduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. **Theory & Practical examination**: The examinations shall be on the basis of marking system ' to evaluate and to certify postgraduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory 'as well as 'Practical ' separately shall be mandatory for passing examination as a whole. The examination for M.D./ M.S shall be held at the end of 3rd academic year.

There shall be four theory papers.

Paper I General Physiology including History of Physiology.
Physiology of cell, Genetic control mechanisms.
Various principles of physics and physical chemistry involved in physiological phenomenon
Interaction of human body in ambient environment including high altitude and deep sea.
Sports physiology.
Yoga and meditation.
History of physiology

Paper II Systemic Physiology A
Blood and immunity
Cardiovascular system.
Respiratory system.
Gastro intestinal tract (GIT) and dietary requirements. o Excretion, pH, water and electrolyte balance.
Comparative physiology.

Paper III Systemic Physiology B
Reproduction and family planning/fetal and neonatal physiology. Nerve-muscle physiology including muscle mechanics.
Endocrine physiology.
Nervous system (Central, peripheral and autonomic)
Special senses.

Paper IV Applied Physiology including recent advances
Pathophysiology pertaining to systemic physiology
Physiological basis of various evaluation tests
Biostatistics, Biophysics, Recent advances in Physiology knowledge/ Concepts
Growth and development including ageing

3.**Practical/clinical and Oral/viva voce examination:**
Practical examination: Practical examination should be spread over two days and include various major components of the syllabus focusing mainly on the psychomotor domain.

Oral/Viva voce examination with Microteaching: Oral examination shall test the postgraduate student's overall knowledge of the subject focusing on psychomotor and affective domain on defined areas should be conducted by each examiner separately. All viva questions should not entirely be of descriptive type. There should be a balanced emphasis to test analytical thinking of students. As a significant number should include the action verbs like 'explain, justify, elaborate, generate'. The questions should encourage to use flow chart, graph line diagrams, knock-out designs. Opportunities should be given to use boards, electronic media for tests like Microteaching.

The practical examination should include:

A. Testing the various systems of the body using appropriate physiological techniques in response to a given case scenario or clinical history of subject/patient to be examined.
B. OSPE Stations to test important clinical, procedural and communication skills in physiology
C. Analyze various Animal graphs and Charts/ Mammalian Heart/ Intestine experiments and correlate them with physiological events in the body
D. Thesis evaluation and Microteaching sessions will be evaluated.
E. Log Book Records and reports of day-to-day observation during the training.
F. Including Simulation methods in assessment of practical skills.

6. Model question paper 1 Physiology of cell, Genetic control mechanisms. Various principles of physics and physical chemistry involved in physiological Phenomenon Interaction of human body in ambient environment including high altitude and deep sea. Sports physiology. Yoga and meditation. History of physiology

MD (Physiology) Max. Marks:100 (20 x5) Time: 3 hrs

Attempt ALL questions
Answer each question & its parts in SEQUENTIAL ORDER.
ALL questions carry equal marks.
Illustrate your answer with SUITABLE DIAGRAMS

1. Compare and contrast various primary and secondary active transport mechanisms with neat diagrams and suitable examples. (10+5+5)

2. A 62-year-old man comes to the ski resort clinic on a mountain peak (14,000 ft) complaining of dyspnea, headache, dizziness, and inability to sleep. He was short of breath while climbing the stairs at the lodge and noticed that he was breathing rapidly even when sitting down. The patient arrived at the resort from a sea-level town and reported no current health issues or medications. Physical examination revealed Temperature 37°C, Pulse 80 beats/min, Respiration 42 breaths/min, Blood Pressure 110/80 mm Hg, BMI 26 kg/m2, On physical examination patient has a rapid, shallow breathing pattern and the pulse is slightly elevated. Laboratory studies shows End-tidal gases: PO2 60 mm Hg, PCO2 30 mm Hg & Pulse oximetry: 70% saturated.

   Based on the above clinical case scenario answer the following questions

   a. What is the probable diagnosis? (1.0)
   b. Explain the pathophysiology of key symptoms. (9.0)
   c. Enumerate and justify the various tests used to diagnose the condition. (6.0)
   d. What is the role of Pulmonary function tests in the above scenario? (4.0)

3. Discuss in detail the cardiorespiratory physiological adaptations in a trained athlete. Enumerate the systemic effects of endurance training in the body. (15+5)

4. Describe in detail the short term and long-term benefits of Pranayama. Adda note on Yoga as an adjuvant therapy in treatment of hypertension. (15+5)

5. Write short notes on the following: (4X5 =20)

   a) Contribution of Kaitlin Kario and Drew Weismann in the development of m RNA vaccines against COVID19.
   b) Physiological basis of symptoms in Decompression sickness.
   c) Physiological significance of Apoptosis.
   d) Contribution of Claude Bernard and W.B .Cannon in Homeostasis.

6. Model question paper 2 **Blood and immunity Cardiovascular system. Respiratory system. Gastro intestinal tract (GIT) and dietary requirements. Excretion, pH, water and electrolyte balance. Comparative physiology.**

MD (Physiology) Max. Marks:100 (20 x5) Time: 3 hrs

Attempt ALL questions
Answer each question & its parts in SEQUENTIAL ORDER.
ALL questions carry equal marks.
Illustrate your answer with SUITABLE DIAGRAMS

1. Draw the Siggaard- Andersen curve, classify the different types of acid base disturbances on the basis of H^+, HCO_3^-, pCO_2 and mention how kidneys respond to acidosis and alkalosis in the body. (5+5+10)

2. A young boy of 8-year-old complained of a swollen knee after he fell from bicycle. He also complained of bluish discoloration of the skin of right arm. His past history is suggestive of prolonged bleeding even after minor injuries. On examination he was found to have a hematoma of the knee. His lab investigations showed prolonged CT, APTT with normal BT and PT. His Hb is 9.0 gm%.

   Based on the above clinical case scenario answer the following questions
   a. What is the probable diagnosis? (1.0)
   b. Explain the coagulation cascade with the help of flowchart. (9.0)
   c. Enumerate and justify the various tests used for testing hemostatsis. (6.0)
   d. Why is D-dimer estimation used as an index of hemostasis. (4.0)

3. Describe in detail the mechanism of urine formation with respect to concentration and dilution of urine. (20.0)

4. Discuss in detail the recent understanding in the application of chimeric antigen receptor T-cell therapy. Add a note on Immunological Tolerance. (15+5)

5. Write short notes on the following: (4 x5 =20)
   a) Draw the Pressure Volume Loop of the Left ventricle during Cardiac cycle.
   b) Role of Gut Microbiota in health.
   c) Physiological significance of J-reflex in the body.
   d) Evolution of Respiratory system in aquatic versus human habitat.

6. Model question paper 3 Reproduction and family planning/fetal and neonatal physiology. Nerve-muscle physiology including muscle mechanics. Endocrine physiology.
Nervous system (Central, peripheral and autonomic) Special senses**.**

MD (Physiology) Max. Marks:100 (20 x5) Time: 3 hrs

Attempt ALL questions
Answer each question & its parts in SEQUENTIAL ORDER.
ALL questions carry equal marks.
Illustrate your answer with SUITABLE DIAGRAMS

1. With the help of a flowchart describe in detail the events taking place during phototransduction in the Retina of the eye. Draw and explain the visual, magnocellular and parvocellular pathway. (10+5+5)

2. A 60-year-old male is suffering from difficulty in inhiation of motor activity. While sitting he is having tremor in his hands which stops during any activity. The physician also noted there is no change in facial and emotional expression of the patient.

   Based on the above clinical case scenario answer the following questions
   a. What is the probable diagnosis? (1.0)
   b. Explain the pathophysiology of the condition with the help of a diagram. (9.0)
   c. Differentiate between Rigidity and Spasticity. (6.0)
   d. Justify the rationale behind the use of various drugs used to treat this condition. (4.0)

3. Describe in detail with the help of suitable diagrams the various theories of skeletal muscle contraction. (10+10)

4. Discuss the pathophysiology of Diabetes Mellitus. Outline the recent advances in the drug therapy of DM. (10+10)

5. Write short notes on the following: (4X5 =20)
   a) Role of Fetoplacental unit during pregnancy.
   b) Physiological basis of Pregnancy detection tests.
   c) Physiological mechanism of action of Injectable contraceptives.
   d) Anti-inflammatory and Antiallergic actions of Cortisol.

6. Model question paper 4. Pathophysiology pertaining to systemic physiology Physiological basis of various evaluation tests Biostatistics, Biophysics, Recent advances in Physiology knowledge/ Concepts Growth and development including ageing

MD (Physiology) Max. Marks:100 (20 x5) Time: 3 hrs

Attempt ALL questions
Answer each question & its parts in SEQUENTIAL ORDER.
ALL questions carry equal marks.
Illustrate your answer with SUITABLE DIAGRAMS

1. Describe in detail the Starling Forces acting across a vessel wall in the body. Discuss the pathophysiology of edema. Add a note on Safety Factor for edema. (8+8+4)

2. A 20-year-old man is brought to the emergency department after camping in the winter with some friends. He became cold and wet during a rainstorm during the night and, in the morning, his friends had difficulty waking him. Physical examination showed vital signs: Temperature 32°C (rectal), Pulse 50 beats/min, Respiration 8 breaths/min, Blood Pressure 90/70 mmHg, BMI 26 kg/m2. Physical examination showed the patient was conscious but confused. His skin was pale and the lips, fingers, and toes were cyanotic and cold. Corneal reflexes were diminished. The patient was shivering uncontrollably and has difficulty speaking. Laboratory studies showed Sinus bradycardia in ECG.

   Based on the above clinical case scenario answer the following questions
   a. What is the probable diagnosis? (1.0)
   b. Explain the pathophysiology of key symptoms of the patient. (9.0)
   c. Enumerate the heat loss and heat gain mechanisms in the body. (6.0)
   d. Elaborate on the behavioral control of thermoregulation. (4.0)

3. What area the different types of sampling? Discuss any two methods of sampling with suitable examples. Discuss Null and Alternate Null hypothesis in a scientific research study. What are the methods to test for statistical significance in a scientific study? (5+5+5+5)

4. Justify the symptoms observed after bilateral temporal lobe removal with knockout of amygdala in a primate model. Write a note on the physiological role and functional significance of Papez Circuit. (10+10)

5. Write short notes on the following: (5x4=20)

   a) Contribution of B.K.Anand to the discipline of Physiology and science.
   b) Elaborate the various theories of aging
   c) Role of growth charts in assessing child development.
   d) Role of mirror neurons in human behaviour.

7. RECOMMENDED READING

1. Keel, Samson and Wright's Applied Physiology 13th edition.
2. Best and Taylor – Physiological Basis for Medical Practice 13th edition.
3. Guyton and Hall Textbook of Medical Physiology, International Edition, 14e.
4. Ganong's Review of Medical Physiology, Twenty sixth Edition
5. Textbook of Physiology Vol I & II 7th edition- Dr. A.K. Jain.
6. Hutchison's Clinical Methods: An Integrated Approach to Clinical Practice, International Edition, 25e
7. Understanding Medical Physiology- Dr. RL Bijlani 4th edition.
8. Clinical physiology- Campbell 3rd edition.
9. Medical Physiology-Vernon B Mount Castle, 13th edition.
10. Williams Textbook of Endocrinology -14E.
11. Harper's Illustrated Biochemistry Thirty-First Edition
12. Handbook of Physiology: Neurophysiology, Section 1, V3-John Field, Horace Magoun.
13. West's Respiratory Physiology, 10ed
14. Experimental Physiology for Medical Students, 1947- Harris D.T.
15. WINTROBE'S Clinical Hematology 14th edition
16. Cell Signalling: Biology and Medicine of Signal Transduction: v. 28,1993 (Advances in Second Messenger and Phosphoprotein Research) -Barry L. Brown
17. Berne & Levy Physiology, 8 Ed.
18. Harrison's Principles and Practice of Internal Medicine 19th Edition and Harrison's Principles of Internal Medicine Self-Assessment and Board Review, 19th Edition.
19. Principles of Neural Science, Sixth Edition- Eric R Kandel

JOURNALS

1. American Journal of Applied Physiology.
2. Annual Review of Physiology.
3. Advances in Physiological education and Recent advances in Physiology.
4. Journal of Physiology (British pub.)
5. Indian Journal of Physiology and Pharmacology.
6. Journal of Experimental Physiology.
7. Indian Journal of Medical Research.
8. Acta Physiologica Scandivinavia.
9. Indian J of Chest diseases and allied sciences.
10. J Sports Physiology.
11. Fundament of Exercise testing: WHO publications.
12. Brain
13. Nature
14. Science
15. Neuron
16. Frontiers in Physiology
17. Journal of Medical Education
18. Cureus
19. Other Indian Physiology journals of various societies and associations.
20. NML e resources
21. AIIMS Guwahati e-Library resources

ANNEXURE 1

Postgraduate Teaching
MD Physiology Teaching Modules

Topics should be covered with the use of the following learning methods:

1. Seminar
2. Symposium
3. Journal Club
4. Lectures: inhouse faculty or invited lectures
5. Group Discussion
6. Practical
7. Clinical immersions, Engineering immersions, Site visit coupled with teaching exercise
8. Quiz, Production workshops, interactive sessions
9. Innovative sessions

Seminar

Objective:
to learn about the topic and facilitate discussion, learn skill of searching information, using tolls like Powerpoint effectively and learn the skill of public speaking and responding to queries.
Role of student:
Meet the faculty in charge, prepare the material for 1 hour after multiple sessions of discussion and literature search with focus on discussion of concepts, applied aspects and experimental data about the topic.
Other PG students are supposed to read the topic before hand to gain clarity and to be able to discuss the same effectively in the seminar. Senior residents and Faculty are supposed to clarify the concepts as when needed during the seminar.

Symposium

Objective and Role of the student:
The guidelines are same as for the seminar, the difference being that it is a team effort of PGs, SRs and Faculty in charge where each member is supposed to be conversant with the topic allotted. This helps to develop time management skills, managerial skills and team skills.

Journal Club
Objectives: The aim of journal club is to inculcate paper reading habits , paper reviewing skills, understanding the research process and its evaluation and knowledge about various indexing databases and the various indices.

1. To improve the understanding on the process of research using one published research article as a base. Promote Self-learning guided by: learning of concepts and principles of methods employed, understanding of method of data presentation and statistical analysis,

understanding graphical methods of presentation, critical analysis of paper (IMRaD format) and peer review, citation method of references, research indices such as Impact Factor, Knowledge about research databases, expert databases (INFLIBNET, Google Scholar, ORCID, Scopus)

2. Development of information gathering skills and presentation skills (during the task given to various participants in JC discussion sessions) and collaborative learning and sharing of information. Elaborate discussion with respect to research question, reason the study was undertaken, significance of the research question, which methods were employed and analysis of results with discussion of conclusion and limitations

Group Discussion

Objective:
Free discussion space to clarify concepts not covered in the seminar. Session not more than 90 minutes
Role of students:
To read entire topic and Actively discuss the topic verbally avoiding use of Powerpoint, Books, digital devices with internet access are proffered during the group discussion.
Role of Moderator:
Ensure equal participation by all participants. Detect problems in Learning style.Ensure formative feedbacks. Make list of basic key concepts by reading relevant academic material and solving doubts as and when required. Provide additional academic material over and above the standard textbooks.

Practical

Significance: Practical teaching should comprise at least 50% of the entire teaching course. Practical examination shall test the postgraduate student's overall knowledge of the subject focusing on psychomotor and affective domain on defined areas should be conducted by each examiner separately. All viva questions should not entirely be of descriptive type. There should be a balanced emphasis to test analytical thinking of students. As a significant number should include the action verbs like 'explain, justify, elaborate, generate'. The questions should encourage to use flow chart, graph line diagrams, knock-out designs OSPE and OSCE should also be used to teach and assess practical skills.
Objective:
To demonstrate the knowledge and attain skills required during the conduct of experiments in terms of measurement, analysis and interpretation of the topics covered in the respective semesters.
Role of Students
To read the topic from standard text & material provided, if any
To know the learning objectives and develop standard operating procedure during the conduct of the experiment
To have knowledge of the equipment (software/setting/specifications) and chemicals required for the conduct of the the experiment.
Perform and discuss the findings with the faculty moderator(chief duty: share relevant material relate to experiment at hand)
To detect and correct wrong setting of the device/equipment/software.

REFERENCES:

1. Delhi University- Post-graduate curriculum for Physiology: M.D. PHYSIOLOGY.

Link: https://www.fmsc.ac.in/curriculum/curriculum-for-pg-physiology.pdf

2. National Medical Commission- Postgraduate Medical Education Board- Guidelines for Competency Based Postgraduate Training Programme for MD in Physiology Ref no-D 11011/1/22/AC/Guidelines/13, Dated: 05-08-2022.

Link: https://www.nmc.org.in/wp-content/uploads/2022/revised/MD_Physiology_(%20revised%20).pdf

3. Introduction to PG Teaching in Physiology AIIMS New Delhi.

Links:

https://www.aiims.edu/aiims/academic/aiims-syllabus/Syllabus%20-%20md%20ms%20mds%20mha.pdf
https://www.aiims.edu/aiims/academic/aiims-syllabus/Syllabus%20-%20M%20Sc%20&%20M%20Biotech.pdf

4.King's College London- Human & Applied Physiology MSc.
Link: https://www.kcl.ac.uk/study/postgraduate-taught/courses/human-and-applied-physiology-msc