SYLLABUS PRIOR REVISION FOR MD PHYSIOLOGY

SUSHIL KUMAR THAKUR
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GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN PHYSIOLOGY

Preamble

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

The purpose of the training in Physiology is to produce experts with necessary knowledge, skills and attitude to impart education and to carry out research in Physiology, be able to serve the community as competent physiologists and render appropriate advice/service to the clinicians as and when it is required.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by various subject-content specialists. The Reconciliation Board of the Academic Committee has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

SUBJECT SPECIFIC LEARNING OBJECTIVES

Programme Objectives

Goal:

The goal is to have uniform standards in the teaching of Physiology at Postgraduate level throughout the country. The guidelines will help achieving such standards which will in ensure availability of competent physiologists equipped with required skills for teaching and applied research.

Learning Objectives

A post graduate student having qualified the MD (Physiology) examination should be able to:

1. Understand and deal with all aspects of general, systemic and applied Physiology.
2. Teach effectively the basic physiological mechanisms of human body with reference to their implications in the pathogenesis of diseases (pathophysiology) affecting various organ systems and the physiological basis of their management to undergraduate medical, paramedical and all other basic science students.
3. Understand general principles of medical education (use of appropriate teaching techniques and resources).

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4. Explain how the knowledge of physiology can be effectively used in a various clinical settings to solve diagnostic and therapeutic problems.
5. Interpret and evaluate research publications critically.
6. Use the library facilities (Literature database using computer, CD ROM, internet search and any other available newer techniques).
7. Conduct relevant clinical/experimental research which may have significant bearing on human health and patient care.
8. Interpret the research findings in the light of its basic and applied significance.
9. Acquire skills in conducting collaborative research in the field of physiology with allied sciences, clinical sciences and biomedical engineering.
10. Interact with the allied departments and render services in advanced laboratory investigations.
11. Serve as interface with society at large.
12. Acquire administrative skills to set up concerned department / laboratories and initiate purchase procedure and procure necessary items for running such laboratories.
13. Function as a member of a teaching or research team.

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive Domain

1. Able to teach the basic physiological mechanisms of human body with reference to their implications in the pathogenesis of diseases (pathophysiology) and their management to undergraduate medical and paramedical students.
2. Conduct such clinical and experimental research, as would have a significant bearing on human health and patient care.
3. Interact with other departments by rendering services in advanced laboratory investigations and relevant expert opinion.
4. Participate actively in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.
5. Contribute to society by imparting physiological understanding of health problems.
6. Plan a research study and conduct basic and clinical systemic investigations.

B Affective domain

1. Demonstrate self-awareness and personal development in routine conduct. (*Self-awareness*)
2. Communicate effectively with peers, students and teachers in various teaching-learning activities. (*Communication*)
3. Demonstrate
    a. Due respect in handling human body parts & cadavers during dissection (*Ethics & Professionalism*)

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b. Humane touch while demonstrating living surface marking in subject/patient (*Ethics & Professionalism*)

4. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
5. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure (*Equity and social accountability*)

C. Psychomotor Domain

The student should acquire competencies in the following tasks:

I. Hematology Experiments

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
12. Determination of Absolute Eosinophil Count
13. Study of Haemopoietic Cells Present in the Bone Marrow

II. Animal Experiments (All animal experiments must be compliant with Govt. 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.

A. ***Amphibian (Frog) Experiments***

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.

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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.
13. Perfusion of blood vessels in the frog.
14. Capillary circulation (Frog Web).
15. Postural and protective reflex in the frog.

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

1. General management of mammalian experiments.
2. Recording of heart rate, blood pressure and respiration and study the effects of various factors; drugs; asphyxia; occlusion of common carotid artery.
3. Effect of stimulation of central and peripheral end of vagus on arterial blood pressure and respiration after vagotomy.
4. Effect of stimulation and distension of carotid sinus on blood pressure and respiration.
5. Effect of stimulation of splanchnic nerve.
6. Effect of stimulation of peripheral somatic nerve (sciatic nerve).
7. Study of hypovolemic shock and its reversal.
8. Perfusion of isolated mammalian heart and study the effects of drugs and ions.
9. Recording of Isolated Intestinal movement and tone and studying the effect of drugs and ions.
10. Study of various stages of menstrual cycle, cervical smear and vaginal smear.

III. Human Physiology

Clinical Physiology

1. Physiological principles of clinical examination.
2. General Physical examination, physiological basis of some clinical symptoms and signs.
3. General principles of Inspection/Palpation/Percussion/Auscultation.

Nerve muscle physiology

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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. Measurement of blood flow.

Respiratory system

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

***Gastrointestinal system*:** Clinical examination of abdomen.

Integrative Physiology / Excretory system

1. Recording of body temperature/effect of exposure to cold and hot environment
2. Studies in stimulated environment - microgravity; high altitude; hot and cold environment.
3. 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 and motility.

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.

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6. Clinical examination of special senses:
    (i) Smell and Taste
    (ii) Test for hearing to 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:
    (i) Nerve conduction study.
    (ii) Visual evoked potential (VEP).
    (iii) Brainstem auditory evoked potential (B.A.E.P).
    (iv) Somato-sensory evoked potential (SEP).
    (v) Motor evoked potential (MEP).

Others

1. Construction of dietary chart for growing children, pregnant woman, elderly individuals, hypertensive patients, & diabetes mellitus patients.
2. Tests for physical fitness: Cardio – respiratory responses to steady state exercise using
    (i) Harvard step test
    (ii) Bicycle Ergometry
    (iii) Treadmill test for determination of VO_2 max

Syllabus

Course contents:

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.
4. Biostatistics, Biophysics, Biochemistry, Micro-anatomy.
5. Growth and Development including aging.

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6. Excretion, pH, water and Electrolyte balance.

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/foetal & neonatal Physiology

Paper-IV: ***Applied Physiology including recent advances***

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

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

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(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 spirometery
(iv) Laboratory for measuring pulmonary diffusion capacity and functional residual capacity (FRC)
(v) Whole-body plethysmography
(vi) Laboratory for Blood flow measurements (Impedence plethysmograph/Laser flow meter/ Doppler flow meter)

3. Exercise Physiology Laboratory

The department should generate liaison with ports 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 Ergometery
(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).

(i) Spectrophotometer
(ii) pH meter
(iii) Elisa Reader/Washer
(iv) Luminometer

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(v) Semi-autoanalyser

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).

TEACHING AND LEARNING METHODS

Teaching methodology

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

- There should be seminars (at least 30 per year) along with symposia, group-discussions and weekly Journal clubs. Each Journal Club should run for 4 weeks (4 turns) and discuss articles published in indexed journals focusing on their new methodology, interesting results etc. PG student should attend at least six such journal clubs every year.
- The Post graduate student should attend at least, 2 symposia every year and weekly group discussions.
- The department should generate liaison with clinical departments and provide routine services for health monitoring and diagnostics (disease) and for periodical posting of Physiology PGs in clinical settings.
- The PG students should render special investigative services in their respective area of specialization. In consultation with the concerned clinical departments a 3 month roaster should be made for the post-graduate students to attend the ward rounds of selected cases of pathophysiologic interest for PG teaching.
- A postgraduate student in broad specialities/super specialities 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 be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.
- The PG students should pay formal and scheduled visits to various hospital laboratories of interest for the purpose of learning.
- The student should be trained to generate teaching resource material for UG and develop problem solving modules.
- Department should encourage e-learning activities.

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- The postgraduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.
- Log books shall be checked and assessed periodically by the faculty members imparting the training.

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

Rotation:

Each post graduate student should undergo minimum of six terms training spread over a period of 03 years. The postings should be as under:-

1. **I semester**: Department of Physiology to cover (i) General aspects of UG teaching, (ii) Selection of thesis topics and collection of relevant references
2. **II Semester**: (i) submission of thesis synopsis (ii) Posting in departmental UG – PG laboratories
3. **III semester**: Posting in clinical departments: Medicine and allied disciplines.
4. **IV, V & VI** semesters: (i) UG-PG teaching (ii) thesis work.

Note: (1) UG, PG teaching and thesis work to continue throughout the course.
(2) 50% of time during III and IV Semester should be spent in the department of Physiology.

ASSESSMENT

FORMATIVE ASSESSMENT ie., during the training

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system.

General Principles

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. The Internal Assessment should be conducted in theory and clinical examination.

Quarterly Assessment during the MD training programme should be based on:

1. **Journal based / recent advances learning**
2. **Patient based /Laboratory or Skill based learning**
3. **Self directed learning and teaching**

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4. **Departmental and interdepartmental learning activity**
5. **External and Outreach Activities / CMEs**

The student to be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT ie, assessment at the end of training

The summative examination would be carried out as per the Rules given in **POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.**

The post-graduate examinations should be conducted in 3 parts:

1. **Thesis**

   Every post graduate student shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

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

2. Theory Examination

The examinations shall be organised on the basis of ‘Grading’or ‘Marking system’ to evaluate and to certify post graduate 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./ MS shall be held at the end of 3rd academic year. An academic term shall mean six month's training period.

There should be 4 theory papers:

Paper I: General Physiology including history of Physiology

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

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

Paper IV: Applied Physiology including recent advances

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3. Practical and oral examination

Practical examination should be spread over two days and include the following components:

1. Objective Structured Practical Exam (OSPE)/ Spotting
2. Problem solving exercises pertaining to Clinical Physiology
3. Performing and reporting two special laboratory investigations
4. Two animal experiments (one long and one short) illustrating mechanisms, physiological concepts and their applications to humans. (Subject to current regulation of Government of India regarding animal usage). This is optional. It is advisable to use simulated experiments for this purpose.
5. Two human experiments (one long and one short), dealing with clinical physiology as would have significant bearing on human health and patient care.
6. Micro-teaching session for assessing communication skills.

Viva-voce examination should include the following components:

(i) Theoretical discussion (General and systemic Physiology)
(ii) Teaching techniques
(iii) Thesis
(iv) Eminent Physiologists (Foreign/Indian)
(v) Journals (Indian/Foreign)
(vi) Recent advances

Recommended Reading

Books (latest edition)

1. A.C. Guyton – Text book of Medical Physiology
2. W.F. Ganong – Review of Medical Physiology
3. Vernon B. Mountcastle– Medical Physiology Vol. I & II
4. William's Textbook of Endocrinology
5. J.E. Cotes- Respiratory Physiology
6. D.T. Harris – Experimental Physiology
7. Wintrobe's – Clinical Hematology
8. Brown B.L. – Cell signaling, Biology and medicine of signal transudation
9. Berne and Levy- Medical Physiology
10. Textbook of Medicine by Harrison
11. API Textbook of Medicine

Journals

03-05 international Journals and 02 national (all indexed) journals

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Annexure 1

Postgraduate Students Appraisal Form
Pre / Para /Clinical Disciplines

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM……TO……

Sr. No.	PARTICULARS	Not Satisfactory	Satisfactory	More Than Satisfactory	Remarks
		1 2 3	4 5 6	7 8 9	
1.	Journal based / recent advances learning				
2.	Patient based /Laboratory or Skill based learning				
3.	Self directed learning and teaching				
4.	Departmental and interdepartmental learning activity				
5.	External and Outreach Activities / CMEs				
6.	Thesis / Research work				
7.	Log Book Maintenance				

Publications **Yes/ No**

Remarks*_____
_____
_____
_____

***REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.**

SIGNATURE of ASSESSEE **SIGNATURE OF CONSULTANT** **SIGNATURE OF HOD**

Medical Council Of India

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