THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY

No. 69, ANNA SALAI, GUINDY, CHENNAI – 600 032.

M.D. / M.S.

POST GRADUATE DEGREE COURSES

SYLLABUS AND CURRICULUM

2021 - 2022

M.D. PHYSIOLOGY

THE TAMIL NADU Dr. M.G.R MEDICAL UNIVERSITY, CHENNAI

COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN PHYSIOLOGY

GOAL

The purpose of this program is to train post graduate students in such a manner that the teaching of physiology and physiological research in the country are maintained at the highest standards. 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.

SUBJECT SPECIFIC 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).

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 LEARNING 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) 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 Cells10

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(new)

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. (Page No. 3, NMC)

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

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).
4. Measurement of BMR.
5. 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.
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-electro diagnostic 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 VO2 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.
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

IV. Research Skills

A. General research skills:

Generation of scientifically, clinically and socially relevant research questions, standardization of methodology to answer the question, grant-writing skills to develop project proposals, submission of project to institutional research committees, human and animal ethics committees as required, grant application to funding agencies, manuscript writing skills, identification of reputed journals to publish the research, manuscript submission, and publication. Students should compulsorily attend the research Methodology workshop conducted by the University within first six months of the M.D course.

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.

B. Specific technical skills: Clinical and animal research in the areas of expertise within a given institution.

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

1. Clinical Neurophysiology Laboratory

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

(i) Electroencephalography

(ii) Evoked potential recording

(iii) Electromyography

(iv) Nerve conduction studies

(v) Autonomic nervous system (ANS) testing

(vi) Any other newer technology

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) Lumino meter

(v) Semi-auto analyser

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 inter- national journals).

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.

LOG BOOK

A detailed log book should be maintained for the entire duration of the course. It should contain the following details.
Journal clubs
Seminars
Classes taken
Demonstrations performed
Clinical postings and elective postings attended
Training programs attended
Conferences, CMEs, work shops attended
Details of paper presentations – Oral/poster
Publication details

The post graduate students shall maintain a record(log)book of the work carried out by them and the training program undergone during the period of training.
Periodic review of Log book and Dissertation have to be done in the Department by guide / HOD once in every 6 months.

ASSESSMENT

FORMATIVE ASSESSMENT – (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**.**

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
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 in NMC).

FORMATIVE COMPETENCY ASSESSMENT:

1. Communication / commitment / Contribution / Compassion towards patient and Innovation	-	5 marks
2. Implementation of newly learnt techniques / Skills	-	5 marks
3. Number of cases presented in Clinical Meetings/ Journal Clubs/Seminars	-	5 marks
4. Number of papers presented in conferences/Publications / Research Projects/ No. of Medals / Certificates won in the conference / Quiz competitions and other academic meetings with details.	-	5 marks
		20 marks

FA SCHEDULE

Year of study	Period				Total Max.20 marks
I year	Upto Dec	10 marks	Upto June	10 marks	20 Marks
II year	Upto Dec	10 marks	Upto June	10 marks	20 Marks
III year	Upto Oct	10 marks	Upto Feb	10 marks	20 Marks
	AVERAGE				20 Marks

SUMMATIVE ASSESSMENT (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:

DISSERTATION AND UNIVERSITY JOURNAL OF MEDICAL SCIENCES

As per the 49th SAB Resolution under Point No. 2 and in the 52nd SAB it was reiterated regarding the topic for dissertation

The topic for the dissertation should be registered and sent to the University after Ethics Committee approval before 31st of December of the first Post Graduate Year. Only one change of topic with proper justification from the Head of the Department is permitted before 31st March of the first Post Graduate Year. The change of dissertation title will not be permitted after 31st March of the First Post Graduate Year. This modification in regulation will be scrupulously followed from the academic year 2015-16 admission onwards.

As per Medical Council of India Post Graduate Medical Education Regulations 2000 (amended upto 10th August 2016)clause 13.9 A Postgraduate student of a Postgraduate degree Course in broad specialties/Super Specialties would be required to present one poster presentation to read one paper at a National/State conference and to present one Research paper which should 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.

As per MCI Clause 14 (4)(a), thesis shall be submitted atleast 6 Months before the Theory and Clinical/Practical Examination.

A candidate shall be allowed to appear for the Theory and Practical/Clinical Examination only after the acceptance of the Thesis by the Examiners.

The periodical evaluation of dissertation/log book should be done by the guide / HOD once in every six months. The HOD should ensure about the submission of dissertation within the stipulated time.

Regarding submission of articles to the University Journal of Medical Sciences for all the PG Degree/Diploma courses, it is mandatory that the students have to submit at-least one research paper. Case Reports are not considered as Research Paper

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

Distribution of marks:

Structured essays	2 x 15 = 30 marks
Short notes	10 x 5 = 50 marks
Reasoning out	4 x 5 = 20 marks
Total	100 marks

3. Practical and oral examination

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

1. **OSPE** -Objective Structured Practical Exam (OSPE)/ Spotting. **(**5 stations x 4marks)
   - Solution preparation
   - Statistics
   - Histology slides
   - Instruments
   - Interpretation of investigations

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. **Pedagogy**- Micro-teaching session for assessing communication skills.

The teaching skills of the candidate will be assessed. The candidate will be given a topic by the 4 Examiners at the end of the first day of the practical examination for a Lecture presentation on the next day. The Examiners shall evaluate the candidate's ability (Trial class room lecture for under graduate students)to teach with chalk and board.

(8 minutes Presentation and 2 Minutes Q & Ans)

Demeanour	- 10
Audio visual Aids usage, voice modulation and Attitude	- 10
Subject Content	- 10
Q & Ans /Interaction	- 10
Total	40 Marks

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

PRACTICAL EXAMINATION SCHEDULE

DAY 1

ANIMAL LABORATORY – 70 Marks

Two animal experiments illustrating mechanisms, physiological concepts and their application to humans.(subject to current regulations of Government of India regarding animal usage). This is optional. It is advisable to use simulated experiments for this purpose.

Long Experiment (Mammalian) - 40 marks

Short Experiment (Amphibian) - 30 marks

HUMAN LABORATORY – 150 Marks

Dealing with clinical physiology as would have significant bearing on human health and patient care.

a) Clinical examination – 60 Marks

Long (Central Nervous System) - 35 Marks

Short (CVS/RS) - 25 Marks

b) Human Experiments - 60 Marks

Human Experiment Recording - 35 Marks

Interpretation of given recorded data - 25 Marks

c) Problem Solving Exercises - 30 Marks

Case scenario - 15 Marks

Laboratory Values - 15 Marks

DAY 2

HEMATOLOGY - 40 Marks

Major Experiment - 25 Marks

Minor Experiment - 15 Marks

OSPE (5 stations x 4 marks) - 20 Marks

Dissertation / Thesis - 20 Marks

PEDAGOGY - 40 Marks

Viva voce (including competency assessment) (40 + 20) - 60 Marks

PRACTICAL MARK DISTRIBUTION

ANIMAL LAB	70 MARKS
HUMAN LAB	150 MARKS
HAEMATOLOGY LAB	40 MARKS
OSPE 5 stations x 4 marks	20 MARKS
DISSERTATION / THESIS	20 MARKS
VIVA VOCE (including Competency assessment)	60 MARKS
PEDAGOGY	40 MARKS
TOTAL	400 MARKS
MINIMUM REQUIRED FOR PASS (50%)	200 MARKS

BOOKS & JOURNALS

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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