

M. D. PHYSIOLOGY

I. Goals:

The Postgraduate course in M.D. Physiology should enable a medical graduate to be:

- i. A competent Physiologist.
- ii. A good medical teacher in Physiology, Practicing the required skills of teaching.

II. Objectives:

At the end of the course a post graduate student in Physiology should be able to:

1. Demonstrate comprehensive knowledge and understanding of general and systemic Physiology.
2. Comprehend and understand physiological basis of health and disease affecting various organ systems.
3. Select and use appropriate teaching techniques and resources.
4. Critically evaluate published journal literature and to effectively use the library facilities including computer, C.D. Rom and Satelite search.
5. Carryout relevant research.
6. Function as an effective member of teaching team or research team.
7. Carryout professional obligations ethically and keeping in view national health policy.

III. Outline of course contents

Theory

1. History of Medicine with special reference to physiology
2. Comparative Physiology
3. Systemic Physiology
4. General Physiology at Cellular, Sub Cellular and Molecular level.
5. Clinical and Applied Physiology.
6. Exercise and Sports Physiology.
7. Environmental Physiology, including effects of change in altitude temperature,

humidity & space travel

8. Thermal and humidity changes
9. Chrono Physiology – New born, adult and old age Physiology.
10. Effects of stress, Behavioral Physiology --Yoga, Meditation.
11. Physiology of growth and development
12. Laboratory animal ethics - Guidelines for care and use of animals in scientific research.
- Breeding of and Experiments on animals (control and supervision) rules, 1998 under prevention of cruelty to animals Act 1960.

Practical Training

A. Animal Experiments¹

i. *Amphibian experiments* (for demonstration only)

1. Freeload and After Load
2. Effect of continuous repeated stimulation (study of phenomena of fatigue)
3. Length tension diagram.
4. Properties of Cardiac Muscle: Long refractory period, All or None Law.
5. Extrasystole and Compensatory Pause, Beneficial effect
6. Regulation of Heart, Vagus dissection and effect of vagal stimulation.
7. Actions of acetylcholine, Adrenaline and Nicotine on Heart (Langley's)
8. Perfusion of isolated frogs heart – Role of Na⁺, K⁺, Ca⁺
9. Decerebrate and Spinal frog.

ii. *Mammalian*

To be performed by students

- ✓ 1. Rat/guinea pig ileum : Intestinal movement recording
- ✓ 2. Rabbit heart : Langend preparation

To be demonstrated if animals are available and have been procured as per CPCSCA guidelines:

3. General Management of Mammalian experiments.
4. Recording blood pressure and respiration on dog and also the effects of various factors.
5. Recording the effect of stimulation of Vagus nerve on blood pressure and respiration on dog
6. Stimulation of central and distal end of the vagus on arterial pressure after vagotomy
7. Effect of drug – Adrenaline and Acetylcholine on blood pressure and respiration on dog.
8. Adrenal extract on intestinal movement and tone.
9. Effect of Occlusion of the Carotid arteries on blood pressure and respiration.
10. Stimulation of Splanchnic nerve (distal end) on arterial pressure

B. Human Physiology

I Clinical Physiology

- i. Elementary principles of clinical examination
- ii. Methods of Inspection / palpation / percussion / auscultation
- iii. Plan of conduction and scheme of recording
- iv. General examination

2. Cardiovascular system

- i. Clinical examination of circulatory system
- ii. Examination of the pulse, blood vessels and measurements of blood pressure.

3. Respiratory System

- i. Clinical examination of respiratory system

4. Gastro-intestinal system

- i. Clinical examination of abdomen.

5. Central Nervous System

- i. Clinical examination of the central nervous system and autonomic nervous system and its physiological basis
- ii. Examination of higher mental functions.
- iii. Clinical examination of the special senses. Outline of the examination of cranial nerves.

- iv. Tests of hearing and deafness
- v. Motor functions
- vi. Reflex functions
- vii. Sensory function

6. *Ophthalmology*

- ✓ i. Clinical examination of the eye and pupillary reflex
- ✓ ii. Visual acuity
- ✓ iii. Perimetry
- ✓ iv. Accommodation
- ✓ v. Colour vision and colour blindness
- vi. Fundoscopy

C. Laboratory Procedures (Normal human subjects)

1. *Haematology:*

DLC, APTT, Platelet, RBC

- i. Haemocytometry
- ii. Determination of Reticulocyte count, platelet count, WBC count, RBC count and absolute eosinophil count in normal and diseased states.
- iii. Differential count of WBC
- iv. Haemoglobinometry, spectroscopy
- v. Blood grouping and cross matching
- vi. Determination of bleeding time, clotting time
- vii. Haemolysis & Fragility test
- viii. Examination of normal bone marrow aspiration smear

2. *Cardio vascular system :*

- i) Electrocardiography – ECG & its interpretation.

3. *Respiratory System :*

- i. Mechanical spirometry
- ii. Recording of lung function tests by computerised or electronic spirometer
- iii. Breath holding and endurance tests
- iv. Blood gas analysis

- v Stethography
- vi Resuscitation and artificial respiration.

4. *Reproductive System :*

- i. Methods to determine ovulation time –
 - a) Basal body temperature chart,
 - b) Cervical smear
 - c) Vaginal smear
- ii. Pregnancy diagnostic test - Immunological test
- iii. Sperm count

5. *Gastro Intestinal System :*

- i) Endoscopy

6. *Nerve Muscle Physiology :*

- i. Ergography
- ii. Recording of EMG – Nerve conduction, both sensory and motor

7. *Others :*

- i. Construction of Dietary chart for -
 - 1) Growing Children
 - 2) Hypertensive patients
 - 3) CAD
 - 4) Diabetes mellitus patients
- ii. Tests for physical fitness –
 - 1) Field 2 km. walk
 - 2) Lab Harvard step test
 - 3) Bicycle ergometry
 - 4) Treadmill protocols leading to determination of vo₂ max.
 - 5) Cardio respiratory response to whole body exercise.

D. *Clinical Biochemistry:*

- i. Examination of normal and abnormal constituents of urine
- ii. Other kidney function tests

- iii. Estimation of blood sugar
- iv. Liver function tests
- v. Glucose tolerance test

IV Time Schedule and Rotation postings

The candidates shall attend all the undergraduate theory and practical classes regularly (for one batch of students). During the second year of the course postings may be made to attend other clinical and paraclinical subjects in co-ordination with concerned departments, only in the forenoon sessions as follows:

1. Cardiology dept. – 15 days
Learn to operate ECG apparatus, Echo, Doppler, Cardiac monitor, Learn the methodology of cardiac catheterisation. Resuscitation technique, interpretation of ECG & other records.
2. Neurology – 15 days
Observe and understand Neuro – Physiological Techniques (clinical Physiology).
 - Clinical Examination of patient.
 - Use of EEG, EMG and Interpretation of EEG, EMG & other investigation data.
3. Medical Gastroenterology – 15 days.
Clinical examination of patients.
To observe Endoscopic techniques.
4. Clinical Biochemistry – 15 days.
To understand the principles of clinical biochemical tests and interpretation of data.
 - Liver function tests.
 - Renal function tests.
5. Haematology Department – 15 days
To learn investigations
6. Blood Bank – 15 days
To learn Blood grouping and cross matching, collection, storage and transfusion of blood.

7. Department of Anatomy – 15 days.
(Histology Laboratory) Staining techniques, moulding of specimens, slide identification characteristics.
8. **Biostatics and Research Methodology** – To attend workshop on research methodology - 3 days
9. Postings in Institute of Aerospace Medicine, Bangalore for Applied Physiology – 1 week

Training would include :

- a. Applied Cardio-Respiratory Physiology
- b. Thermal Physiology
- c. Space Physiology
- d. High altitude physiology and Hyperbaric medicine
- e. Acceleration Physiology

The above topics would include hands-on training in spirometry, orthostatic stress test and evaluation of heat stress and heat strain. The students would be evaluated by means of presentation/symposium at the end of posting.

10. Obstetrics and Gynecology postings – 15 days.
 - i. Methods to determine ovulation time
 - Basal Body Temperature chart.
 - Cervical smear.
 - Vaginal smear.
 - ii. Clinical examination during pregnancy including antenatal checkup and investigations
11. Chest Medicine – 15 days
To learn in laboratory – Lung function tests and interpretation of results.
12. General Medicine – 1 month.
 - Clinical examination of patients
 - Investigation procedures
 - Drawing of blood and storage.
 - Lumbar puncture.

- Interpretation of : X – Ray, ECG, Biopsy report , Biochemical results.
- Endocrinology Postings : Clinical Examination of patient, Radio Immuno Assay techniques.
- Ophthalmology for fundoscopy and measurement of Intraocular pressure, Refractometry & Perimetry.

Total six months of clinical postings. At the end of these postings, a certificate has to be obtained from the concerned Heads of the Department about satisfactory learning or otherwise.

V. Seminars & Journal reviews.

The post graduate students should actively participate in departmental seminars and journal clubs. A record showing the involvement of the student shall be maintained. A diary should be maintained. Seminars and journal clubs are suggested to be conducted alternately once in every 15 days. See chapter for model check lists.

During three years of the course, Postgraduate students shall participate in teaching undergraduate students in practicals, tutorials and group discussions.

VI. Dissertation Work

During the course of study every candidate has to prepare a dissertation individually on a selected topic under the direct guidance and supervision of a recognised post graduate teacher as per MCI and RGUHS regulations.

The suggested time schedule for dissertation work is:

Identification and selection of topic for dissertation – in first 4 weeks. Preparatory work of dissertation /synopsis including pilot study if necessary and submission of the synopsis to the University within first 6 months from the beginning of course or as per the dates notified by the University. Data collection for dissertation. Writing the dissertation in the following 1½ years. Submission of the dissertation six months prior to the final examination or as per the dates notified by the University.

Registration of dissertation topic

Every candidate shall submit a synopsis in the prescribed proforma of the University for registration of dissertation topic subject of dissertation after it is scrutinised by the P.G. Training cum Research Committee of the concerned institution. The synopsis shall be sent within first 6 months from the commencement of course as notified in the University calendar of events, to the Registrar (Academic).

Submission of dissertation

The dissertation shall be submitted to the Registrar (Evaluation) of the University six months before final examination or as per the dates notified by the University. Approval of the dissertation by the panel of examiners is a pre-requisite for a candidate to appear in the University examination.

VII. Maintenance of Record of Work Done, Periodical assessment and progress report.

1. A diary showing each day's work has to be maintained by the candidate, which shall be scrutinised by the Head of the Department once in every three months.
2. A practical record has to be maintained by the candidate and duly scrutinised and certified by the HOD and to be submitted to the external examiner during the final examination.
3. A list of the Seminars and Journal reviews that have been attended and participated by the student has to be maintained which should be scrutinised by the Head of the Department.
4. A practical record has to be maintained by every candidate and duly scrutinised and certified by the head of the department and to be submitted to the external examiner during the final examination.

IX. Scheme of Examination

University Examination

A. Theory: The written examination consists of four papers of 100 marks each. Each paper will be of three hours duration. Questions on recent advances may be asked in any or all papers*.

- Paper – I : General Physiology, Biopotential, Transport across membrane, Biophysical Principles, Comparative physiology, History of Medicine with special reference to physiology.
- Paper – II : Systemic Physiology including applied aspects of Blood, Respiratory Physiology, Cardiovascular, Digestive, Excretory systems, Exercise & Sports Physiology & Environmental physiology.
- Paper – III : Systemic physiology including applied aspects of Central Nervous System, Muscle & Nerve Physiology, Endocrines.
- Paper – IV : Reproductive Physiology, Special Senses, Clinical Physiology, Chrono-Physiology, Behavioural Physiology with Yoga & Meditation.

**The topics assigned to the different papers are given as general guidelines. A strict division of subjects may not be possible. Some overlapping of topics is inevitable. Students should be prepared to answer the overlapping topics.*

Each theory paper will consist of: Long Essay type questions - 2 X 20 marks = 40
 Short Essay type questions - 6 X 10 marks = 60

B. Practical 200 marks

i) Laboratory Procedures

- a. Human Normal subjects ... 50 marks
- b. Rabbit /Rat/guinea pigs ... 25 marks
- c. Haematology ... 30 marks
- d. Histology ... 20 marks

ii) Clinical Physiology:

Clinical examination of a given subject, discussion on investigations, interpretation of laboratory findings and physiological principles in diagnosis - 25 marks

Discussion on investigations, interpretation of laboratory findings and Physiological principles in diagnosis 50 marks

iii) Clinical Bio-chemistry - 25 marks

C. Viva Voce 100 marks

The Viva-Voce would be on all components of syllabus including discussion on dissertation 80 marks

2) Pedagogy 20 marks

D. Maximum marks for	Theory	Practicals	Viva-voce	Total
M.D.Physiology Examination	400	200	100	700

X. Recommended Text, Reference books and Journals

1. J B West, Best & Taylor, Physiological basis of Medical Practice. Williams & Wilkins
2. Guyton, Text Book of Medical Physiology,. Elseveir.

3. Ganong, Review of Medical Physiology, Mc Graw hill
4. Campbell, Clinical Physiology ., ELBS & Blackwell
5. John Bullock, Joseph Boyle, III Michael B. Wang, NMS, **Physiology 3rd Edn** , B. I. Waverly.
6. Sir. John V Dacie S M Lewis, Practical Hematology , Churchill Livingstone
7. Donald Emslie-Smith, Colin R Paterson, Thomas Ccatcherd, Nicholas W.Read, Textbook of Physiology, **ELBS/** Churchill Livingstone
8. Vernon B Mount Castle, Medical Physiology, vol. 1 & vol. 2 , CV Mosby Company
9. Robert M. Berne & Mathew N. Levy, Physiology , Mosby Year book
10. .Carl J Wiggers, Physiology in health and disease , Lea Febiger
11. Williams, Text book of Endocrinology, W.B. Saunders
12. Peters dort, Adams, Braunwald, Issel Bacher, Matir, Wilson, Harrison's Principles of Internal Medicine ,16 th edition., Mc Graw hill
13. Harper, Biochemistry , McGraw-Hill
14. John Field, H W Magou , Vol 1,2,3. Hand Book of Neurophysiology, Williams & Wilkins
15. Wallance O Fem, Hand Book of respiratory Physiology, vol 1,. Williams & Wilkins
16. Wintrobe, **Clinical Hematology**, Lea Febiger
17. **Kathryn L Mc. Cance** Sue E Huether, **Text Book of Pathophysiology**, Mosby
18. Gyrla Keele & Eric Neil, Samson wright's Applied Physiology, ELBS, Oxford University Press.

Journals :

1. Journal of Applied Physiology, By American Physiological Society
2. Physiological Reviews, By American Physiological Society
3. Annual Review of Physiology, By American Physiological Society
4. Advances in Physiology Education, By American Physiological Society
5. Recent advances in Physiology, By American Physiological Society
6. Journal of Physiology, British Publication
7. Indian Journal of Physiology and Pharmacology.
8. Indian Journal of Medical Research

9. News in Physiological Sciences
10. New England Journal Medicine
11. British Medical Journal
13. Nature
14. Lancet

ADDITIONAL READING

1. Compendium of recommendations of various committees on Health and Development (1943-1975). DGHS, 1985 Central Bureau of Health Intelligence, Directorate General of Health Services, min. of Health and Family Welfare, Govt. of India, Nirman Bhawan, New Delhi. P - 335.
2. National Health Policy, Min. of Health & Family Welfare, Nirman Bhawan, New Delhi, 1983
3. Santosh Kumar, The elements of Research, writing and editing 1994, Dept. of Urology, JIPMER, Pondicherry
4. Srinivasa D K et al, Medical Education Principles and Practice, 1995. National Teacher Training Centre, JIPMER, Pondicherry
5. Indian Council of Medical Research, "Policy Statement of Ethical considerations involved in Research on Human Subjects", 1982, I.C.M.R, New Delhi.
6. Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956. Medical Council of India, Kotla Road, New Delhi.
7. Francis C M, Medical Ethics, J P Publications, Bangalore, 1 edn., 2004
8. Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, New Delhi, 1994.
9. International Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical journals, N Engl J Med 1991; 424-8
10. Kirkwood B R, Essentials of Medical Statistics , 1st Ed., Oxford: Blackwell Scientific Publications 1988.
11. Mahajan B K, Methods in Bio statistics for medical students, 5th Ed. New Delhi, Jaypee Brothers Medical Publishers, 1989.
12. Raveendran, B Gitanjali, A Practical approach to PG dissertation, New Delhi, J P Publications, 1998.