ALL INDIA INSTITUTE OF MEDICAL SCIENCES, NAGPUR

Curriculum for MSc Medical Physiology

Curriculum for MSc Medical Physiology AIIMS Nagpur v2021.1

1. Introduction:

The All-India Institute of Medical Sciences [AIIMS] was designed to serve as a nucleus for nurturing excellence in all aspects of health and wellness throughout India. AIIMS are a group of autonomous public medical institutes that have been declared by an Act of Parliament 1956 as "Institute of National Importance".

Department of Physiology AIIMS Nagpur offers full-time postgraduation courses MSc in Medical Physiology. The course and its curriculum are tailored to provide opportunities for training teachers for medical colleges in the country in an atmosphere of research and enquiry keeping in mind that education is the holistic development of one's personality & includes development of one's knowledge, attitude & skills.

In addition, the institute aims to develop world-class facilities to achieve excellence in the field of medical research and is actively engaged in developing infrastructure for carrying out meaningful research. The educational principles and practices being adopted are those which are best suited to the needs of the nation.

2. Duration:

MSc Medical physiology is **TWO** years course where the students will be trained in various branches of medical physiology. They will be given theoretical, practical training as well as thesis work to be able to pursue career as a teacher or/and researcher in Medical Physiology and its subspecialities. Seventy-five percent attendance will be mandatory both in theory as well as Practicals.

3. Eligibility

- BSc graduates of biological Sciences.
- B.Sc. Zoology/Microbiology/Physiology

4. Course Aims

4.1 To expose the students to broad range of topics within the field of Physiology

4.2 Formal training in theory as well as practical aspects of Physiology

4.3 Training to write a Thesis Project, while understanding the scientific background in the field of Physiology

4.4 Training and offering research projects in the field at various Laboratories set up in the department and the institute

5. LEARNING OBJECTIVES

The student qualifying for the award of MSc Medical Physiology should have thorough knowledge in following domains related to Medical Physiology.

5.1 Cognitive domain

At the end of this course students should be able to explain

a. Historical, Embryological and Comparative aspects of Medical Physiology
b. Structure, function & relationship from cell, tissue, organ to systems level.
c. Understanding the homeostatic regulating mechanisms operating in the body
d. Understanding the pathophysiological mechanism operating in disease states
e. Concepts in clinical and applied medical physiology
f. Critically evaluate the impact of recent advances in the field of medical physiology

5.2 Psychomotor Domain

Students should be able

a. To perform basic microscopy and all hematological experiments
b. To perform basic human experiments like ECG, Spirometry, EMG, Nerve conduction Study, EEG, Autonomic and vascular Functions, Sperm function tests including Semen Analysis, Evoked Potentials, Event Related Potentials, Sleep Analysis, Exercise testing, Physical fitness, Cognitive Testing
c. Learn basic principles of experimental animal handling and techniques in experiments using laboratory animals.
d. To acquire basic level history taking and clinical examination skills.

5.3 Affective domain:

Students should be able

a. to develop appropriate communication skills to interact with students, colleagues, superiors and other staff members.
b. to work as a member of a team to carry out teaching as well as research activities
c. to have right attitude in accordance to ethics toward teaching profession and patients attending diagnostic facilities

6.COURSE OUTCOMES

The M.Sc. in Physiology program has the following outcomes:

1. **Student will develop a knowledge and understanding of physiology as well as that of the applied disciplines**
    a. structure, function and development of the various systems in the human body
    b. elementary understanding of the clinical applications of physiology
    c. recapitulate the information imparted to the undergraduate students in physiology
    d. perform and critically evaluate the practical exercises done by undergraduate students

2. **Student will develop a knowledge and understanding of the current developments in medical sciences as related to physiology**
    a. Search and evaluate literature pertinent to recent advances in the field of medical physiology
    b. critically evaluate the impact of the recent information on the genesis of current concepts related to various topics of physiology

3. **Students will develop the art of teaching in physiology**
    a. Plan educational programs in physiology utilizing traditional and modern methods of teaching
    b. demonstrate familiarity with the principles of medical education including definitions of objectives, curriculum construction, merits and demerits of various tools used in the teaching-learning process
    c. give lucid, interactive lectures, presenting the information in a logical, simple and comprehensive manner; generate interest and curiosity amongst the students during lectures; give practical demonstrations
    d. share learning experiences with the undergraduate and postgraduate students using appropriate pedagogical skills and methods
    e. Learn to implement evaluation tools and techniques and develop if needed

4. **Students will gain knowledge to plan and conduct research**
    a. identify a research problem which could be basic, fundamental or applied in nature
    b. define the objectives of the problem and give a fair assessment as to what is expected to be achieved at the completion of the project
    c. design and carry out research methods required for the study
    d. methods for analyzing the data
    e. record accurately and systematically the observations and analyze them objectively
    f. effectively use statistical methods
    g. learn to critically appraise the results and build up a conclusion.
    h. write a scientific paper
    i. fabricate and use indigenous gadgets for experimental purposes

5. **Students will learn to set up, organize and equip physiology laboratories.**
    a. organize the laboratories for various practical exercises, substitute and fabricate some of the simple requipment for teaching purposes
    b. handle and order for stores, draw up lists of equipment required to equip physiology laboratories

7.TEACHING PROGRAMME

To achieve the above objectives in two years, we have the following structured program.

7.1 Timeline

Semester 1 (First 6th month)

1. Orientation to the department
2. Choosing the subject of thesis and guide
3. Writing the protocol
4. Recapitulation of undergraduate physiology through attending UG lectures

Semester 2 (7th – 12th month)

1. Physiology: theory & practical
2. Thesis work
3. Recapitulation of undergraduate physiology through attending UG lectures

Semester 3 (13th – 18th month)

1. Physiology: theory & practical
2. Thesis work

Semester 4 (19th – 24th month)

1. Physiology: theory & practical
2. Submission of thesis

7.2 PHYSIOLOGY: THEORY & PRACTICAL

The theory and practical syllabus are completed in four semesters. The department conducts the semester-wise program in a cyclic fashion so that no matter at what point a student joins the program, he/she completes the course in two years. The semester wise program will start from 1 st Semester and will continue till 4th semester. The semester-wise program is as follows:

I. (a) General & Cellular Physiology
   (b) Hematology
   (c) Renal Physiology & Fluid Balance

II. (a) Cardio-vascular Physiology

(b) Respiration
(c) Environmental Physiology

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

IV. (a) Nutrition & Metabolism
(b) Gastro-intestinal System
(c) Endocrines & Reproduction

7.3 Syllabus

Semester I

(a) General & Cellular Physiology

- Cell as the living unit of the body
- The internal environment
- Homeostasis
- Control systems
- Organization of a cell
- Physical structure 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

(b) Hematology

- Erythrocytes
- Erythropoiesis
- structure & function of RBC
- formation of hemoglobin
- destruction & fate of RBCs
- anemias
- polycythemias

Leucocytes

- general characteristics
- genesis & life span of WBCs
- classification & functions of each type of WBC
- leukopenia
- leukemias

Blood groups

- classification
- antigenicity
- agglutination

- blood typing
- principles of transfusion medicine

Hemostasis

- components of hemostasis
- mechanisms of coagulation
- coagulation tests
- anticoagulants

Immunity

- Innate immunity
- Acquired immunity
- Allergy, hypersensitivity and immunodeficiency
- Psychoneuroimmunology

(c) Renal Physiology & Fluid Balance

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

Semester II

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

(b) Respiration
• Functional anatomy of respiratory system
• Pulmonary ventilation
• Alveolar ventilation
• Mechanics of respiration
• Pulmonary circulation
• Pleural fluid
• Lung edema
• Principles of gas exchange
• Oxygen & carbon-dioxide transport
• Regulation of respiration
• Hypoxia
• Oxygen therapy & toxicity
• Artificial respiration

(c) Environmental Physiology
• Physiology of hot environment
• Physiology of cold environment
• High altitude
• Aviation physiology
• Space physiology
• Deep Sea diving & hyperbaric conditions

Semester III

(a) Nerve & Muscle Physiology

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

(b) General, Sensory & Motor Physiology

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

(c) Special Senses
• Optics of vision
• Receptors & 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 & hearing aids
• Primary taste sensations
• Taste buds
• Transduction & transmission of taste signals
• Perception of taste
• Peripheral olfactory mechanisms
• Olfactory pathways
• Olfactory perception

(d) Limbic System and Higher Nervous System
• Autonomic nervous system
• Limbic system and hypothalamus
• EEG
• Sleep
• Emotions & Behaviour
• Learning & Memory
• Yoga

Semester IV

(a) Nutrition & Metabolism
• Carbohydrates
• Fats
• Proteins
• Minerals
• Vitamins
• Dietary fiber
• Recommended Dietary Allowances
• Balanced diet
• Diet for infants, children, pregnant & lactating mothers, and the elderly
• Energy metabolism
• Obesity & Starvation

(b) Gastro-intestinal System
• General principles of G-I function
• Mastication & swallowing
• Esophageal motility
• Salivary secretion
• Gastric mucosal barrier
• Pancreatic & billiary secretion
• Gastrointestinal motility

• Digestion & absorption
• Functions of Colon
• Pathophysiology of peptic ulcer and diarrheal disease
• Liver functions

(c) Endocrines & Reproduction
• Classification of Hormones
• Mechanism of Hormone action
• Measurement of hormones in Blood
• Endocrine functions of the hypothalamus
• Pituitary
• Thyroid
• Adrenals
• The endocrine pancreas
• Pathophysiology of diabetes
• Parathyroid, calcitonin, Vit D & calcium metabolism
• Pineal gland
• Testosterone & male sex hromones
• Spermatogenesis
• Hyper & hypogonadism
• Menstrual cycle
• Female sex hormones
• Pregnancy & Lactation
• Functions of Placenta
• Parturition
• Lactation

Apart from the above topics in general and systemic physiology, the students are introduced to:

1. Biophysics
2. Biochemistry
3. Biostatistics
4. Molecular Biology
5. Medical Education
6. History of Medicine

7.4 Schedule of Teaching Programme

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

a) Seminars every Saturday

The seminars are on a topic belonging to a system scheduled for the semester. The topic is presented in depth appropriate for postgraduates by one of the M.Sc or M.D. students and moderated by a faculty member.
The seminars represent only a small and somewhat arbitrary selection of topics. They are not intended to cover an entire system. Their aims are to:
(a) introduce the system
(b) tune the students to the system
(c) cover recent advances
(d) give students practice in the art of oral presentation

b) Journal clubs and Faculty presentations, every Tuesday

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

The aims of journal clubs are to:

(a) highlight recent advances
(b) discuss classical papers
(c) inculcate the faculty of critical appreciation of a research article
(d) give students and senior demonstrators practice in the art of oral presentation
(e) Faculty presentations are usually on:
(f) medical education
(g) research methodology
(h) an area of research in which the faculty member is involved

c) Practicals

About 8-10 practical exercises are conducted every semester exclusively for M.Sc. (and M.D.) students on systems scheduled for the semester. The results obtained in these exercises are presented in teaching meetings (see below).

Besides specially designed P.G. practicals, M.Sc. students perform all undergraduate practicals and also teach a few of these practicals to the undergraduates.

d) Teaching meetings, every Saturday

Since M.Sc. students might opt for a teaching career, they are occasionally involved in teaching undergraduates. In the teaching meetings, the forthcoming practical exercises are discussed, and feedback on recently held exercises is obtained. These discussions are designed to tune the M.Sc. students to teaching and related administrative responsibilities. In addition, teaching meetings are also utilized for discussion of P.G. practicals, research protocols of new P.G. students, presentation of thesis work by P.G. students prior to submission of the thesis, and any other items of interest to the teaching and research staff of the department.

8. Dissertation Submission: -

8.1 Every candidate shall carry out work on an assigned research protocol under the guidance of a recognized Postgraduate teacher; the protocol shall be written and submitted in the form of a Dissertation.

8.2 Every candidate shall submit Dissertation plan in form of synopsis to the Academic section within the given time frame.

Process to be completed within six months of admission to MSc program:

Activity	Month
Admission to the course	July
Allotment of PG guide and Selection of topic in consultation with PG Guide	September / October
Approval by Department PG Committee	November / December
Institute Scientific Committee approval	
Institute Ethics Committee approval	
Final approval letter by Academics Section	31st December

8.3 Dissertation shall be submitted to the Academic section three months before the commencement of theory examination.

8.4 The student will (i) identify a relevant research question; (ii) conduct a critical review of literature; (iii) formulate a hypothesis; (iv) determine the most suitable study design; (v) state the objectives of the study; (vi) prepare a study protocol; (vii) undertake a study according to the protocol; (viii) analyze and interpret research data, and draw conclusions; (ix) write a research paper for Presentation / Publication.

9. ASSESSMENT

In the first three semesters, an end-semester theory, practical and oral examination is conducted by the department on the systems scheduled for the semester, and a record of the internal assessment maintained. In the last (4th) semester, the students take the final M.Sc. examination conducted by the examination section.

9.1 Exam regulations

The Examination Regulations relating to this course are available at aiimsnagpur.edu.in, academics and at the department. In case of any queries, the student shall contact the course coordinators. The policies and regulations that apply to the students are available at aiimsnagpur.edu.in, academics and at the department

9.2 Eligibility for exam

Sr no.	Parameter	Criteria
1	Research Methodology Examination conducted at end of Induction Programme	Pass
2	Internal Assessment marks	>50% marks separately in theory and practicals
3	Dissertation	Accepted
4	MSc Programme attendance	>80% in each year
5	Poster and Paper presentation in Conference	1 poster and/or 1 paper presentation
6	Peer reviewed Indexed Publication	One (Accepted /published/ Sent for publication)
7	Six Monthly Progress Report	At least 3 out of 4 satisfactory Progress Reports

9.3 Examination Scheme for post graduate course M.SC

a. The weightage of internal assessment will be equal to 20% of total marks in both theory and practical component of final examination. Department will decide modalities of internal assessment for both components i.e., Theory and practical.

b. M.SC. student will be assessed every six months. Marks will be awarded for both theory and Practical component. Marks awarded to the candidates shall be submitted to the Examination Section at least once in a year.

c. Total score in various internal assessment for both theory and practical components will be used to give weightage equal to 20 % of total marks of final examination in both theory as well as practical.

d. Final result will be prepared after adding scores of internal assessment and final examination in both components by Examination Cell.

9.4 Marking System

a) Theory – Total Marks -500
   Paper -I Marks -100
   Paper -II Marks -100
   Paper -III Marks -100
   Paper -IV Marks -100
   Internal Assessment – 100 Marks

b) Practical – Total marks – 500
   Final exam 400 marks (modalities to be developed by the Department)
   Internal Assessment 100 Marks

9.5 Passing criteria: 50% marks in theory and practical separately.

10 **Timeline**

Course work	**1st semester**	**2nd semester**	**3rd semester**	**4th semester**	**5th semester**	**6th semester**
Attending UG classes						
Seminars, JournalClubs, & Faculty Presentations						
PG Practicals						
Teaching Meetings						
Dissertation Work	Protocol Submission	Dissertation Work	Dissertation Work	Dissertation Work	Dissertation Work	Dissertation writing and submission
Assessment*		1st internal exam	2nd internal exam	3rd internal exam	Preprofessional exam	Professional exam
Time Line	**0-6 months**	**06-12 months**	**12-18 months**	**18-24 months**	**24-30 months**	**30-36 months**

*Assessment exam will be conducted in the last month of each session