

**JAWAHARLAL INSTITUTE OF POSTGRADUATE
MEDICAL EDUCATION & RESEARCH
(JIPMER)
PUDUCHERRY**



**MSc MEDICAL PHYSIOLOGY
CURRICULUM**

2021

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JIPMER

Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry (JIPMER) under Government of India since the year 1956, is one of the leading Medical Institutions of India. Spread over a sprawling 195-acre campus in an urban locale of Puducherry (formerly Pondicherry), JIPMER is 170 kms by road from Chennai.

JIPMER has been declared as an “Institution of National Importance” by an Act of Parliament, JIPMER, Puducherry, Act, 2008. A copy of the Act was Gazette notified on 14-7-2008 to enforce this Act. Prior to this, the Institute was functioning under the administrative control of Directorate General of Health Services, Ministry of Health and Family Welfare, New Delhi. The Institution is now empowered to award Medical Degrees under the clauses 23 & 24 of the said Act. Such Degrees shall be deemed to be included in the schedules to the respective Acts governing Medical Council of India/National Medical Commission, Indian Nursing Council, and Dental Council of India, entitling the holders to the same privileges as those attached to the equivalent awards from the recognized Universities of India.

JIPMER imparts Undergraduate (UG), Postgraduate (PG) and Super Specialty Medical Training through a large hospital complex (JIPMER Hospital) and a Nursing College. Some of the courses offered are MBBS., BSc., MSc., MD., MS, DM., and MCh. Courses. Full-time Ph.D. Programs are available in several disciplines.

DEPARTMENT OF PHYSIOLOGY

The Department of Physiology is one of the earliest departments of the institute. It provides medical education and training to undergraduate and postgraduate medical students, and also to the students of various allied health sciences courses. The department is involved in clinical investigations on electrophysiological diagnostic procedures, pulmonary functions tests and autonomic function tests for hospital patients. The electrophysiology laboratory has been providing hospital services in patient management for more than thirty years. Research activities are conducted vigorously in various laboratories of the department. Department has a state-of-the-art animal research laboratory.

Yoga research, therapy, and training are among the important routine functions of the department. The Advanced Center for Yoga Therapy, Training, Education and Research (ACYTER) of JIPMER is under the Department of Physiology. The Department of Physiology conducts many national conferences, CMEs and workshops in Physiology and Yoga.

2. Course details:

2.1 Nomenclature: MSc Medical Physiology

2.2 Introduction:

Medical Physiology is a platform for research, wherein the need of the society in health and disease can be chosen as a subject for research. By the end of three years, the students will develop a sound knowledge of concepts in Physiology along with practical skills in the field of hematology, human practical, clinical examinations, and laboratory investigations, wherein they can convey their knowledge to the learners in future. This will help to fill the gap in the field of teaching for different courses in the field of medical science.

Teaching programme scheduled during the three years of MSc Medical Physiology course will be a platform for the candidate qualifying the course to develop a good rapport with the students and understand the need of the students in teaching and learning. The students will be taught the new areas of recent advances in neuro, cardiac, urogenital, and gastrointestinal physiology in the recent advances every year. The collaboration with the other concerned departments and super-specialities will be done for better knowledge and training of the students.

2.3 Objectives:

At the end of three years of Medical Physiology course the student must be able to:

General Objectives:

1. To understand the basic concepts in Physiology with reasoning skills in the applied disciplines.
2. To understand the principles, techniques, and acquire practical skills and interpret and discuss the findings.
3. To learn to design a research protocol, develop research skill and art of publication.
4. To comprehend the recent advances in the field of Physiology
5. To plan and conduct academic programs in Physiology.
6. To teach Physiology to the undergraduate students.

Intermediate Objectives:

1. Demonstrate knowledge of the structure and function of the major organ systems, including the molecular basis and cellular mechanisms for maintaining homeostasis
2. Articulate the contents of Physiology with proper reasoning skills.

3. Reiterate the contents conveyed to the students
4. Carry out and assess the practical exercises performed by the students.
5. Find a novel topic for research, follow a proper research methodology, analyze the data, and interpret the findings in a scientific perspective.
6. Explain the principles of medical education and use various tools of teaching learning methods effectively.

3. Regulations:

3.1 Eligibility:

A candidate seeking admission should have qualified in BSc in Medical Lab Technology (MLT)/ BSc Allied Health Sciences (AHS)/ BSc Allied Medical Sciences (AMS)/ BSc Human Physiology/ Bachelor in Physiotherapy (BPT) and BDS courses.

3.2 Method of Selection

Candidates for the MSc (Medical Physiology) course will be selected on the basis of merit in the common All India Entrance Examination conducted by the Institute. The Entrance Examination will be a Computer Based Test (CBT) held online at centres across the country. The test is based on multiple choice questions from the subject of Human Physiology at the level of BSc

3.3 Candidates intake per year:

Five candidates will be admitted to the course every year. There is no provision for sponsored / nominated candidates.

3.4 Duration of the course

3 years (Three years). There are no stipendiary provisions during the study period.

3.5 Medium of instruction:

English

3.6 Vacation

As per institute guidelines, students will be eligible for 15 days' vacation in summer and 9 days in winter.

3.7 Subject details:

Year	Paper	Title of the paper
I year	I	Anatomy
	II	Physiology
	III	Biochemistry
II year	I	Principles of homeostasis, Physiology of the cell, Ion channels, Membrane transport mechanisms, Membrane potentials, Blood, Physiological basis of immunity.
	II	Renal physiology, Body fluids, Regulation of volume and osmolality of fluid compartments, Acid base homeostasis, GI system, Physiology of nutrition.
	III	Endocrine Physiology, Physiology of Reproduction, Physiology of Growth and Development
	IV	Physiology of Nerve & Muscle, Autonomic Nervous System, Research methodology & Biostatistics
III year	I	Cardiovascular system and Exercise physiology
	II	Respiratory system & Environmental physiology
	III	Central nervous system – Physiology of sensory system and Physiology of motor system
	IV	Central nervous system – Higher functions, Special senses, Integrative Physiology, Recent advances in Physiology

3.7 Training pattern: Theory, Practical and hands-on work in the Laboratory

The various teaching and learning experiences described as under shall put the student in an active situation for better learning experiences:

- Participation in undergraduate teaching activities.
- Participation in PG Seminars, Symposia, Case discussions Journal Clubs etc.
- Attendance of lectures
- Small group discussion/Tutorials

SYLLABUS:

I year: Paper 1 – Anatomy

The students at the end of learning Anatomy during the First year of their course should be able to:

- State the parts and describe the gross anatomy of the various systems of the human body.
- Recognize and state the histological features of the various tissues and organs of the human body.
- Continue to learn the anatomical aspects of the human body and apply the same in health care programs.

Theory:

General Anatomy:

Introduction – Anatomical terms, position, movements; epithelium – classification, structure & examples; connective tissue – classification and structure; skin – structure, thick and thin skins; cartilage – types, structure, hyaline, elastic, and white fibrocartilage; bones – classification, structure, growth; muscles - classification & structure; glands - classification & structure.

Musculoskeletal system:

Axial and appendicular skeleton – muscle groups and regions muscles with action.

Cardiovascular and lymphatic system:

Structure of pericardium, heart & major blood vessels – arteries, veins, and lymphatic system – classification and structure of lymphoid organs – thymus, spleen, lymph node, tonsil, and major lymphatic vessels.

Respiratory system:

Parts of respiratory system, structure of external nose, paranasal air sinuses, nasal cavity, nasopharynx, larynx, trachea, pleura, lungs & diaphragm.

Gastrointestinal system:

Parts of gastrointestinal system, salivary glands, oral cavity, pharynx, esophagus, stomach, small intestine, large intestine, liver, gallbladder, extrahepatic biliary apparatus, and pancreas.

Excretory system:

Parts of excretory system – structure of kidney, ureter, urinary bladder & urethra.

Male and female reproductive systems:

Structure & parts of male reproductive system, external genitalia, testis, epididymis, vasdeferens, seminal vesicle and prostate. Structure & parts of female reproductive system, uterus, ovary, fallopian tubes, and mammary gland

Endocrine system:

Location & structure of thyroid, parathyroid, pituitary, adrenal glands.

Special senses:

Structure of eyeball, external, middle & internal ear, olfactory mucosa, and papillae of tongue.

Nervous system:

Neuron, neuroglia, classification, autonomic nervous system, meninges, parts of brain, cerebrum, cerebellum, basal nuclei, limbic system, thalamus, hypothalamus, spinal cord, circulation of cerebrospinal fluid.

Practical:

- Dissection of the human cadaver to learn the anatomy of the organs of various systems listed above.
- Identification of the histological features of various tissues and organs using histology slides stained with hematoxylin and eosin.

Teaching/Learning activities:

1. Lectures: 2 hrs./week
2. Practical /Demonstration for gross anatomy: 4 hrs. /week
3. Histology practical: 2 hrs. /week

Assessment:**Internal assessment:**

A minimum of four periodic assessments (theory and practical) will be conducted. The average of all periodic assessment marks will be taken for calculation of final internal assessment marks.

Internal Assessment	Maximum marks
Theory	20
Practical	10
Record notebook	10
Total	40

Summative assessment:

Summative assessment will be held at the end of the year with the following components and distribution of marks

Summative Assessment	Maximum marks
Written examination (3-hour duration)	100
Practical examination	40
Viva-voce examination	20
Internal assessment	40
Total	200

Written Examination: One paper of 3 hours duration (100 marks). It consists of ten questions each carrying ten marks.

Practical examination: (40 marks):

The practical examination will have the following components:

Practical examination	Maximum marks
Gross anatomy spotters (10 × 2)	20
Histology slides spotters (10 × 2)	20
Total	40

Viva-voce examination: (20 marks):

Viva-voce examination	Maximum marks
Station – 1 Dissected parts and organs	10
Station – 2 Osteology	10
Total	20

Textbooks Recommended (Latest edition):

General anatomy:

Handbook of General Anatomy – B.D. Chaurasia - CBS Publishers

Systemic Anatomy:

Textbook of Anatomy – Vishram Singh – Elsevier

B.D. Chaurasia's Human Anatomy – CBS Publishers

Clinical Anatomy – R. Snell

Histology:

Di Fiore's Atlas of Histology – Eroschenko – Lippincott Williams & Wilkins

Dissection:

Cunningham's Manual of Practical Anatomy – Vol. I, II & III

Reference textbook:

Gray's Anatomy: The Anatomical Basis of Clinical Practice – Susan Standring - Elsevier

I year: Paper 2 – Physiology

The students at the end of learning Physiology during the First year of their course should be able to:

- state the functions of various organs and systems of the body
- describe in brief the mechanisms of function of various systems in the body
- apply basic principles of physiology to simple clinical conditions
- know and utilize the knowledge of physiology in organizing simple experiments for biochemical work
- continue to learn the physiological aspects of human body

Theory:

1. General Physiology

Structure of cell and cell membrane, composition of intracellular and extracellular fluid, transport of substances across cell membrane, resting membrane potential.

2. Body fluid and blood

Principle of homeostasis, body fluids, composition of blood, plasma proteins, bone marrow, erythrocytes, blood groups, white blood cell, immune mechanism, platelets, haemostasis.

3. Nerve and muscle

Nerve - Structure of neuron, action potential, conduction of nerve impulse, mechanism of neuromuscular transmission. Muscle - structure of skeletal muscle, mechanism of contraction of skeletal muscle and smooth muscle, properties of skeletal muscle and smooth muscle.

4. Renal Physiology

Structure of nephron, glomerular filtration, tubular reabsorption and secretion, clearance, water excretion, counter current mechanism, acid-base balance.

5. Endocrine and Reproductive Physiology

- a) Endocrine pancreas: Functional anatomy of islets, actions of insulin and insulin deficiency, regulation of insulin secretion.
- b) Physiology of bone: Vitamin D and Parathyroid, Calcium metabolism.
- c) Pituitary gland: Anterior pituitary and pituitary hormones, actions of growth hormone, effects of excess and deficiency of growth hormone, Prolactin, Post pituitary hormone - oxytocin and vasopressin.
- d) Adrenal Gland: Adrenal corticoids - actions, effects of excess and deficiency of cortisol, aldosterone. Adrenal medulla - catecholamines- actions, regulation of secretion.

e) Thyroid: Function of thyroid hormones, regulation of thyroid hormone secretion, thyroid dysfunction.

f) Reproductive Physiology: Puberty. Male reproductive system - spermatogenesis, testosterone- actions, regulation of testosterone secretion. Female reproductive system - menstrual cycle, ovarian hormones, control of ovarian functions, pregnancy, lactation - physiology of contraception.

6. Cardiovascular system

Functional anatomy of heart, genesis and spread of cardiac impulse, basic E.C.G., cardiac cycle, heart sound, cardiac output, blood pressure and regulation of blood pressure. Regional circulation - coronary, cerebral and skeletal muscle circulation.

7. Respiratory system

Functional anatomy, respiratory muscles, mechanics of respiration; lung volumes and capacities, transport of gasses - O₂ dissociation and CO₂ dissociation curves, control of breathing - neural and chemical, hypoxia.

8. Gastrointestinal system

i) Salivary secretion and its regulation.

ii) Regulation of gastric secretion and motility.

iii) Mechanism of secretion, function and regulation of bile and pancreatic secretion.

iv) Intestinal secretion and motility- regulation (including defecation)

9. Nervous system

Synaptic transmission in CNS, Sensory system: Receptors, afferent pathways, Theories of referred pain, mechanism of pain inhibition, Thalamus; Motor system: Muscle spindle and stretch reflex, Corticospinal tract; Cerebellum and basal ganglia; Functions of autonomic nervous system. Functions of hypothalamus and limbic system.

10. Special Senses

Basic physiology of vision, hearing taste and smell

Practical:

Practical shall comprise of

- a) Hematology: Hemoglobin estimation, RBC and WBC count, Differential leucocyte count, Blood group, Bleeding time and Clotting time.
- b) Human: Mosso's ergography, ECG, Stethography, Recording of BP and pulse, Demonstration of Spirometry and AFT.

Teaching/Learning activities:

The course in Physiology will be covered by:

- i) Lectures – 2 hours per week (60 hours approximately)
- ii) Group discussions/ Tutorials – 1 hour per week (30 hours approximately)
- iii) Demonstrations and Practical – 2 hours per week (60 hours approximately)

Textbooks and Reference books recommended (Latest edition):

Theory

1. Review of Medical Physiology. Ganong WF. McGraw-Hill Medical Publishers, UK.
2. Textbook of Medical Physiology, Pal GK, Ahuja-Elsevier
3. Textbook of Medical Physiology. Guyton A, Hal JE. Elsevier, India.

Practical

1. Textbook of Practical Physiology. Pal GK, Pal P, University Press, India.
2. Ghai's Textbook of Practical Physiology. Jaypee Brothers.

Assessment:

Internal assessment:

A minimum of four periodic assessments (theory and practical) will be conducted. The average of all periodic assessment marks will be taken for calculation of final internal assessment marks.

Internal Assessment	Maximum marks
Theory	20
Practical	10
Record notebook	10
Total	40

Summative assessment:

Summative assessment will be held at the end of the year with the following components and distribution of marks

Summative Assessment	Maximum marks
Written examination (3-hour duration)	100
Practical examination	40
Viva-voce examination	20
Internal assessment	40
Total	200

Written Examination: One paper of 3 hours duration (100 marks). It consists of ten questions each carrying ten marks.

Practical examination: (40 marks):

The practical examination will have the following components:

Practical examination	Maximum marks
Human practical - (Electrocardiogram, Stethography, Recording of blood pressure and pulse, Mosso's ergography)	20
Hematology Practical - (Hemoglobin estimation, RBC count, WBC count, Differential leucocyte count, Blood group, Bleeding time and Clotting time)	10
Cards – 2 problems	10
Total	40

Viva-voce examination: (20 marks)

I year: Paper 3 – Biochemistry

The following areas in the subject of Biochemistry shall be the course content in the year I Year. The general idea is that candidate is familiarized and sensitized to the basic concepts of biochemistry as applicable to the human body to enable him to undertake the study of biochemistry in the next two years of this course.

General Biochemistry:

- Chemistry of carbohydrates / lipids / proteins
- Enzyme kinetics, Inhibition and regulation of enzyme activity, Isoenzymes
- Electrophoresis / Chromatography
- Introduction to metabolism

Hematological system & Immunological system:

- Immunoglobulin structure and types, antigen-antibody complex Hemoglobin; Structure and function, Hemoglobinopathies.
- Heme: Synthesis and disorders
- Anemia: Vitamins: B12, folic acid, B6, Iron

Locomotor system & Autonomic nervous system:

- Biological oxidation and ATP synthesis
- Minerals: Calcium, Phosphorus, Magnesium
- Vitamins: Vitamin D and Rickets, Fanconi syndrome

Endocrine system:

- Carbohydrate metabolism, Regulation of blood glucose
- Thyroid function tests, Adrenocortical function tests

Respiratory system:

- General aspects of acid base balance, Respiratory regulation of blood pH and related disorders
- Interpretation of acid base disorders

Cardiovascular system:

- Collagen-structure, disorders of Lipid metabolism, prostaglandins,
- Sulphur containing amino acids,
- Homocysteine metabolism and disorders
- Free radicals and antioxidants

Gastrointestinal system and Nutrition:

- Digestion and absorption of carbohydrates, lipids, amino acids
- Metabolism of amino acids (Aromatic AA, glycine, branched chain, polyamine)

Micronutrients: Vitamins, Minerals

- BMR, SDA, Balanced diet, dietary fibers
- Metabolism of starvation

Hepatobiliary and Pancreatic function tests:

- Bilirubin metabolism, Types of jaundice and their biochemical alterations, LFT
- Xenobiotics
- Pancreatic function tests

Renal System:

- Excretory function: Formation of ammonia, Detoxification of ammonia, Urea cycle
- Regulatory function: Water and electrolyte balance (Na, K, Cl), Renal regulation of Ph
- Renal function test: Tests for glomerular and tubular functions

Reproductive system:

- Gonadal function test.
- Prenatal screening test

Molecular Biology, Cancer biology:

- Nucleotide chemistry and metabolism, Gout
- Replication, transcription, translation, regulation of gene expression
- Cancer biology
- CSF analysis

Advances in biochemistry:

- Radioactivity,
- Human genome project, Genetic engineering
- Biochemistry of AIDS

Research methodology:

1. Steps in designing a research protocol
2. Types of research designs (observational/ RCTs/ systematic reviews etc)
3. Sample size calculation
4. Ethics in biomedical research

Practical:

- Reactions of carbohydrates, lipids, proteins,
- Reactions and properties of hemoglobin.
- Qualitative analysis of normal and abnormal constituents of urine.
- Principles of colorimetry.
- Estimation of glucose, creatinine, and urea in blood.

Demonstrations:

- Electrophoretic and chromatographic techniques ABG analysis and electrolytes
- Oral glucose tolerance tests
- Renal function tests
- Hepatobiliary and pancreatic function tests
- Thyroid function tests

Teaching/Learning activities:

- Lectures – 5 hrs/week
- Practical/Demonstration - 2 hrs./week
- Small group discussion/Tutorials - 1 hr./week
- Individual assignments referral work in library - 3 hrs./week.

Assessment:**Internal assessment:**

A minimum of four periodic assessments (theory and practical) will be conducted. The average of all periodic assessment marks will be taken for calculation of final internal assessment marks.

Internal Assessment	Maximum marks
Theory	20
Practical	10
Record notebook	10
Total	40

Summative assessment:

Summative assessment will be held at the end of the year with the following components and distribution of marks

Summative Assessment	Maximum marks
Written examination (3-hour duration)	100
Practical examination	40
Viva-voce examination	20
Internal assessment	40
Total	200

Written Examination: One paper of 3 hours duration (100 marks). It consists of ten questions each carrying ten marks each.

Practical examination: (40 marks):

The practical examination will have the following components:

Practical examination	Maximum marks
Qualitative exercise	15
Quantitative exercise	15
Spotters	5
Interpretation of charts/graphs	5
Total	40

Viva-voce examination: (20 marks)

Second year

Papers I to IV

Theory:

- Principles of homeostasis
- Physiology of the cell,
- Ion channels,
- Membrane transport mechanisms,
- Membrane potentials,
- Physiology of genetics and apoptosis,
- Blood,
- Physiological basis of immunity,
- Renal physiology,
- Body fluids,
- Regulation of volume and osmolality of fluid compartments,
- Acid base homeostasis,
- GI system,
- Physiology of nutrition,
- Endocrine Physiology,
- Physiology of Reproduction,
- Physiology of Growth and Development,
- Physiology of Nerve & Muscle,
- Autonomic Nervous System,
- Research methodology & Biostatistics.

Practical:

1. Hematology practical:

Collection of blood samples, Estimation of Hb concentration, Determination of hematocrit, Microscopy, Hemocytometry, Total RBC count, Determination of red blood cell indices, Total leucocyte count, Differential leucocyte count, Arneeth count, Absolute eosinophil count, Determination of erythrocyte sedimentation rate, Determination of Blood group, Osmotic fragility of red cells, Determination of Bleeding time and Coagulation time, Platelet count, Reticulocyte count, Determination of specific gravity of blood.

2. Human practical:

Sensory Nerve conduction, Motor Nerve conduction, ELISA technique, Assessment of Body fat composition, Mosso's ergography, Clinical examination of Gastrointestinal system, Effect of drugs and ions on rabbit / rat intestine and uterus, Demonstration of Electromyography, Demonstration of Autonomic function tests.

Recommended Books (latest edition):

Theory

1. Review of Medical Physiology. Ganong WF. Editors: Barrett KE, Barman SM, Brooks HL, Yuan JX., McGraw-Hill Medical Publishers, UK.
2. Textbook of Medical Physiology, Pal GK, Elsevier Ahuja Publishers
3. Textbook of Medical Physiology. Guyton A, Hall JE. Adaptation Editors: Vaz M, Kurpad M, Raj T. Elsevier, India.
4. Medical Physiology – Principles for Clinical Medicine. Rhoades RA, Bell DR. Wolters Kluwer.
5. Best & Taylor's Physiological Basis of Medical Practice. Best C, Taylor NB. Editors: Tondon OP, Tripathy Y. Wolters Kluwer, India.
6. Understanding Medical Physiology: A Textbook for Medical Students by R. L. Bijlani, Jaypee, India

Practical

1. Textbook of Practical Physiology. Pal GK, Pal P, University Press, India.
2. Ghai's Textbook of Practical Physiology. Editors: Varshney VP, Bedi M. Jaypee Brothers, India.

Assessment:

Internal assessment, record/logbook, and journal club/seminar presentation:

A minimum of four notified internal assessment tests (Theory and practical) will be conducted in the second year.

	Maximum marks
Internal assessment (Theory- 100 + Practical - 100)	200
Practical records/logbook, and Journal club/seminar presentation	100

Second Year summative assessment – Distribution of marks

	Maximum marks
Theory examination	400
Practical examination	200
Viva-voce examination (Viva: 80 and Pedagogy: 20)	100
Internal assessment	200
Practical records/logbook, and Journal club/seminar presentation	100
Total marks	1000

Theory examination:

	Theory papers	Maximum marks
Paper I	Principles of Homeostasis, Physiology of the cell, Ion channels, Membrane transport mechanisms, Membrane potentials, Blood, Physiological basis of immunity	100
Paper II	Renal physiology, Body fluids, Regulation of volume and osmolality of fluid compartments, Acid base homeostasis, GI system, Physiology of nutrition.	100
Paper III	Endocrine Physiology, Physiology of Reproduction, Physiology of Growth and development.	100
Paper IV	Physiology of Nerve and Muscle, Autonomic nervous system, Research methodology and Biostatistics.	100
	Total marks	400

Practical and Viva-voce examinations: (Two days)

	Maximum marks
Hematology practical	50
Sensory nerve conduction, Motor nerve conduction	50
Effect of drugs and ions on rabbit / rat uterus, ELISA technique, Assessment of Body fat composition	50
Mosso's ergography, Clinical examination of Gastrointestinal system, Effect of drugs and ions on rabbit / rat intestine.	50
Total marks	200
Oral Examination/Viva Voce	100

Third year

Papers I to IV

Theory:

- Cardiovascular system,
- Exercise physiology,
- Respiratory system,
- Environmental physiology,
- Synaptic transmission in the CNS,
- Sensory system including Thalamus & Sensory cortex;
- EEG & consciousness,
- Hypothalamus,
- Motor system,
- Limbic system,
- Physiology of Learning & Memory,
- Physiology of Speech,
- Lobes of the brain & Association areas,
- Cerebral dominance,
- Special senses,
- Temperature regulation,
- Physiology of aging and Yoga

Practical:

Cardiovascular System:

1. Clinical examination of the cardiovascular system
2. Measurement of baroreceptor sensitivity (BRS)
3. Electrocardiogram (ECG)
4. Effect of posture on heart rate & blood pressure
5. Effect of exercise on heart rate & blood pressure
6. Conventional autonomic function tests
7. HRV analysis
8. Systolic time intervals
9. Tilt table testing for syncope assessment
10. Treadmill test

Respiratory System:

1. Clinical examination of the respiratory system
2. Stethography
3. Spirometry
4. Pulmonary function tests

Central Nervous System:

1. Clinical examination of sensory system, motor system & cranial nerves
2. Brainstem Auditory Evoked Responses
3. Evoked potentials - visual, somatosensory & motor
4. Electroencephalogram

Special Senses:

1. Visual Reaction Time & Auditory Reaction Time
2. Perimetry
3. Visual acuity & color vision
4. Hearing tests
5. Clinical examination of taste & smell

Recommended Books (latest edition):

Theory

1. Review of Medical Physiology. Ganong WF. Editors: Barrett KE, Barman SM, Brooks HL, Yuan JX., McGraw-Hill Medical Publishers, UK.
2. Textbook of Medical Physiology, Pal GK, Elsevier Ahuja Publishers.
3. Textbook of Medical Physiology. Guyton A, Hall JE. Adaptation Editors: Vaz M, Kurpad M, Raj T. Elsevier, India.
4. Medical Physiology – Principles for Clinical Medicine. Rhoades RA, Bell DR. Wolters Kluwer.
5. Best & Taylor's Physiological Basis of Medical Practice. Best C, Taylor NB. Editors: Tondon OP, Tripathy Y. Wolters Kluwer, India.
6. Understanding Medical Physiology: A Textbook for Medical Students by R. L. Bijlani, Jaypee, India

Practical

1. Textbook of Practical Physiology. Pal GK, Pal P, University Press, India.
2. Ghai's Textbook of Practical Physiology. Editors: Varshney VP, Bedi M. Jaypee Brothers, India.

Third Year summative assessment – Distribution of marks

Internal assessment, Project work and record/logbook marks:

A minimum of four notified internal assessment tests (Theory and practical) will be conducted in the third year.

	Maximum marks
Internal assessment (Theory- 100 + Practical - 100)	200
Practical records/logbook, and Journal club/seminar presentation	100

Summative assessment

	Maximum marks
Theory examination	400
Practical examination	200
Viva-voce examination	50
Internal assessment	200
Practical records/logbook, and Journal club/seminar presentation	100
Project work (25 marks for successful project submission, 25 marks for viva)	50
Total marks	1000

Theory examination:

	Theory papers	Maximum marks
Paper I	Cardiovascular system & Exercise physiology	100
Paper II	Respiratory system & Environmental Physiology	100
Paper III	Synaptic transmission in CNS, Sensory system including Thalamus & Sensory cortex; EEG & consciousness, Hypothalamus; Motor system	100
Paper IV	Central Nervous system (Limbic system, Physiology of Learning & Memory, Physiology of Speech, Lobes of the brain & Association areas, Cerebral dominance), Special senses, Integrative physiology (Temperature regulation, Physiology of aging and Yoga), Recent advances in Physiology	100
	Total marks	400

Practical and Viva-voce examinations: (Two days)

	Maximum marks
Cardiovascular system practical	50
Respiratory system practical	50
Central nervous system practical	50
Special senses practical	50
Total marks	200

Oral Examination/Viva Voce	100
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Regulations of MSc Medical Physiology course:

Attendance:

- Students are required to attend 75% or more of all theory classes held, and 75% or more of practical in each subject to be eligible to appear in the annual examination. Under no condition will a student with less than the prescribed attendance in any subject be allowed to appear in the annual examination of that subject.
- Students with less than 75% attendance in theory and/or practical at the end of any year must start afresh in those subjects by joining the junior batch of students. No extra classes will be arranged to make such students eligible for the annual examinations. The attendance accrued in the previous academic year in those subject(s) will not be transferred. Students will be required to secure 75% attendance afresh in theory and practical/clinical of subjects detained, after joining the junior batch to become eligible to appear in the annual examination.
- The 25% leverage in attendance includes all types of leaves (including leave on medical grounds). For absence because of illness or any medical condition, a duly approved medical leave from Dean (Academic) with medical and fitness certificate issued/verified by authorized JIPMER clinical faculty member is mandatory. Certificate must be submitted before or within 10 days after availing medical leave.
- Attendance cannot be improved upon by attending classes during the gap between the annual regular examination and supplementary examination held within 6 weeks of the former.
- Students who are detained in all the subjects of a year due to lack of attendance should join the classes with junior batch within 7 days of declaration of the eligibility/detention list or when classes commence, whichever is earlier.
- Students who are detained in one or more subject(s) because of lack of attendance but are eligible to appear for annual examination in at least one subject of the year should join classes with junior batch within 7 days of completion of the last final theory/practical examination or when classes start, whichever is earlier. Attendance accrued in the previous academic year will lapse and attendance will be calculated afresh from the date of joining the junior batch.
- A show-cause notice will be issued to students on continuous unauthorized absence without prior permission for two weeks or more. If such absence extends to a period more than one month for any reason, the student is liable for termination from the course. The decision of the competent authority is final.
- There is **no condonation permissible** for shortage of attendance.

Internal Assessment (IA):

A minimum of four notified internal assessments (including model examination) will be held for a subject paper periodically in each year before the final annual examination and the candidate will be examined in theory and practical. Each notified test and the model examination will carry equal weightage for calculation of final internal assessment marks. The internal assessment marks will form 20% of the summative assessment. There is no minimum cut-off percentage of internal assessment mandatory to appear in the annual examination.

Project:

1. Submission of project work is mandatory for the appearing in the final examination. The project work shall be carried out by the candidate under the guidance of a postgraduate teacher in the department. The topics for the project shall be selected within the first year of the course and the final project shall be submitted six months before the final examination. The project work is mainly to orient the candidate towards research methodology. Collaboration works with other departments are encouraged.
2. The project will be reviewed by external faculty and evaluated by the External/Internal Examiners at the time of viva voce examination of the candidate during the final summative exam. 50 marks will be allotted for the quality of work and defending of the project by the candidate.
3. The final project duly approved by the external/ Internal Examiners will be submitted to the Dean's office along with the result. The Dean's office will send the project to the library for record.

Examination rules and regulations:

1. A student needs to pass in all theory paper(s) and practical examination in the I year to progress to the II year.
2. A student who fails in any one or more theory subject(s) and/or practical examination in the first year will reappear in a supplementary examination (to be held within 6 weeks) in the theory and the practical examination of the corresponding subject(s) (2nd attempt). If he/she passes these subjects at this supplementary examination, he/she will continue with the regular batch.
3. In the I year, in case of fail result in any theory subject and/or practical in the 2nd attempt (supplementary examination), the student will study with the next junior year's batch and will have to reappear for I year examination (theory and practical) again the next year (3rd attempt). A student failing in any one or more theory subject(s) and/or practical examination in this attempt will reappear in a supplementary examination in the theory and the practical examination (to be held within 6 weeks) in the subjects (4th attempt).

4. In the II and III years, If the candidate fails to pass in the practical examination, he/she will be required to appear in all the theory papers and the complete practical examination in the supplementary examination. If the candidate passes in the practical examination but fails only in one or two theory papers, he/she will be permitted to appear only for that theory paper(s) in the supplementary exam, provided he/she has 50% or above aggregate in theory papers. If the candidate passes in the practical examination but fails in three or four theory papers or scores less than 50% aggregate in theory, then he/she will be required to appear in all the theory papers and the practical examination.
5. In case of fail result in any theory subject and/or practical in the 2nd attempt, the student will study with the next junior year's batch and will have to reappear for Year 2/Year 3 examination again the next year (3rd attempt). A student failing in any one or more theory subject(s) and/or practical examination in this attempt will reappear in a supplementary examination (to be held within 6 weeks) in the particular subjects (4th attempt).
6. If a student fails even in the 4th attempt, no further chances will be given, and his/her name will be struck off the rolls of JIPMER.
7. A student needs to complete the entire 3-year course within 6 years from the date of enrolment (twice the duration of the course), beyond which he/she will not be allowed to appear in any examination. Any exception for extenuating reasons (e.g. prolonged illness of the candidate, family problems, natural calamities, etc.) will be made only after approval of the Academic Advisory Committee and Head of the institution.
8. No grace marks will be awarded for either theory or practical examinations, under any circumstances.

Pass criteria:

First year

For a candidate to pass, he /she should attain the following-

1. A minimum of 40% in each of the theory papers.
2. A minimum of 50% in practical separately.
3. The candidates' overall marks for theory, practical, viva-voce and internal assessments put together should be 50% of the grand total.

Second and Third years

1. A minimum 40% in each of the theory papers and overall, in theory (all papers put together) should obtain a minimum of 50% marks.
2. A minimum of 50% in practical separately.
3. A minimum of 50% of the grand total (theory, practical and internal assessments).

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY FIRST YEAR EXAMINATION

Paper I– ANATOMY

Duration: Three Hours

Maximum Marks: 100

Answer ALL Questions. Each question carries TEN marks

Draw diagrams wherever necessary

1. Describe the external features of the heart. Add a note on venous drainage of the heart. (7+3)
2. Describe the stomach under- location, parts, relations, and blood supply. (1+2+4+3)
3. Enumerate the parts of male reproductive system. Describe in detail about gross features and blood supply of testis. (2+8)
4. Draw a neat, labeled diagram of the excretory system. Explain in detail the coverings, and relations of kidneys. (3+7)
5. Describe the parts of a long bone and its blood supply. Add a note on classification of bones. (6+4)
6. Describe in detail the parts, relations of pituitary gland. Add a note on its histological features. (5+5)
7. Describe in detail the tongue under- parts and features, muscles, nerve, and blood supply. (2+3+3+2)
8. Describe cerebellum under the following- location and parts, fissures and lobes, deep cerebellar nuclei. Add a note on its histological features. (10)
9. Enumerate and draw the ventricles of cerebrum. Describe in detail about the lateral ventricle. (3+7)
10. Describe spleen under the following- location, parts and relations, ligaments related and their content, blood supply. (1+5+2+2)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY FIRST YEAR EXAMINATION

Paper II– PHYSIOLOGY

Duration: Three Hours

Maximum Marks: 100

Answer ALL Questions. Each question carries TEN marks

Draw diagrams wherever necessary

1. With the help of a labeled schematic diagram, explain mechanism of action of $Na^{+}-K^{+}$ pump. List four functions of $Na^{+}-K^{+}$ pump. (6+4)
2. Draw a labeled diagram of neuromuscular junction. Describe the mechanism of neuromuscular transmission. (4+6)
3. List the steps of erythropoiesis. Describe the factors influencing erythropoiesis. (2+8)
4. Draw a schematic labeled diagram of lead II ECG. With the help of a suitable diagram, explain the genesis of various waveforms of ECG. (4+6)
5. Describe the neural regulation of respiration. (10)
6. With the help of a suitable diagram explain mechanism of gastric hydrochloric acid secretion. Add a note on gastric function tests. (6+4)
7. With the help of a suitable diagram, explain the counter-current mechanism for urine concentration. (10)
8. With the help of a suitable diagram, describe the mechanism of action of insulin. Describe the action of insulin on carbohydrate metabolism. (6+4)
9. List four indicators of ovulation. Describe the ovarian and uterine changes in menstrual cycle. (2+4+4)
10. With the help of a suitable diagram, depict the functional divisions of cerebellum and enumerate the functions of cerebellum. Give a short note on cerebellar function tests. (3+3+4)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY FIRST YEAR EXAMINATION

Paper III– BIOCHEMISTRY

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. Describe the food sources, daily requirements, biochemical function, and deficiency manifestations of Vitamin A. (2+2+3+3)
2. List the food sources for iron. Discuss factors affecting iron absorption from gut. Add a note on iron deficiency anemia. (2+4+4)
3. Briefly discuss the indications, procedure, and interpretations of OGTT. (2+3+5)
4. Enumerate the special products of glycine and tyrosine and specify their biological applications (10)
5. Write short notes on (5+5)
 - a. Features of codon
 - b. telomerase
6. Describe the steps of polymerase chain reaction with a suitable diagram and list its applications (6+4)
7. Enumerate various liver function tests. Add a note on the lab diagnosis of different types of jaundice. (10)
8. Write short notes on
 - a. HDL cycle and its importance
 - b. Phospholipids and its importance (5+5)
9. Discuss any four factors affecting enzyme activity. Mention two enzymes used in the diagnosis of pancreatic diseases. (8+2)
10. Briefly discuss the causes, clinical features, and treatment of gout. (4+4+2)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY SECOND YEAR EXAMINATION

Paper I – Principles of homeostasis, Physiology of the cell, Ion channels, Membrane transport mechanisms, Membrane potentials, Blood, Physiological basis of immunity

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. List the causes of hemolytic anemia. Explain the physiological basis of erythroblastosis fetalis, and its prevention. (2+5+3)
2. Define active transport. Describe various types of active transports across the cell membrane. (2+8)
3. Name the clotting factors. Explain the extrinsic clotting mechanism in brief. (10)
4. List the indications and complications of blood transfusion. Add a note on universal donor. (2+5+3)
5. Describe the cytoskeletal elements of the cell in brief. (10)
6. Describe the physiological basis of humoral immunity. (10)
7. Explain the role of Na⁺-K⁺ ATPase in the maintenance of cell membrane potential. (10)
8. List the various types of macrophages and describe their function in brief. (3+7)
9. Explain Gibbs-Donnan membrane equilibrium. Add a note on counter transporters. (5+5)
10. With suitable examples explain the positive feedback mechanism. (10)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY SECOND YEAR EXAMINATION

Paper II – Renal physiology, Body fluids, Regulation of volume and osmolality of fluid compartments, Acid base homeostasis, GI system, Physiology of nutrition

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. Describe the measurement and autoregulation of renal blood flow. (5+5)
2. Describe the micturition reflex & discuss the effect of denervation on urinary bladder function. (5+5)
3. Describe the role of Loop of Henle in renal counter-current mechanism. (10)
4. List the kidney function tests. Explain the renal clearance test to measure GFR. (5+5)
5. Describe the role of kidney in acid-base homeostasis. (10)
6. Define glomerular filtration rate (GFR), give its normal value, and describe the factors affecting it. (2+1+7)
7. Describe in detail the digestion and absorption of lipids. (10)
8. Describe the various movements of intestine and its function. (5+5)
9. Describe in detail the different stages of deglutition. (10)
10. Describe the source, daily requirements, & functions of Vitamin C. (2+1+7)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY SECOND YEAR EXAMINATION

Paper III – Endocrine Physiology, Physiology of Reproduction, Physiology of Growth and Development

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. Name the posterior pituitary hormones. Explain the physiological functions of posterior pituitary hormones. (2+8)
2. Name the hormones secreted by adrenal cortex and explain the role of cortisol in inflammation. (3+7)
3. Describe the function and formation of blood-testis barrier. Add a note on regulation of spermatogenesis. (2+2+6)
4. Describe various sex chromosome anomalies in brief. (10)
5. Describe the role of various hormones in the regulation of blood calcium level. (10)
6. Describe the contraceptive methods used by females. (10)
7. List the indicators of ovulation. Explain the uterine changes during the menstrual cycle. (4+6)
8. Describe the physical, neural growth and development in children. (5+5)
9. Describe the steps involved in thyroid hormone synthesis. Add a note on thyroid function tests. (6+4)
10. Describe the physiological functions of Insulin. Add a note on Insulin-Glucagon ratio. (7+3)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY SECOND YEAR EXAMINATION

Paper IV – Physiology of Nerve & Muscle, Autonomic Nervous System, Research methodology & Biostatistics

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. Describe the properties of nerve fibers. (10)
2. Describe the cardiovascular autonomic function tests. (10)
3. Describe the phases and ionic basis of nerve action potential. (5+5)
4. Describe the types and special properties of smooth muscle. (4+6)
5. Describe in detail the molecular mechanism of skeletal muscle contraction. (10)
6. Describe the Chi-square test in brief. (10)
7. Write the important steps involved in designing protocol. (10)
8. Describe the mechanism of transmission of impulse at neuromuscular junction. (10)
9. Describe sarco-tubular system. (10)
10. Describe degenerative and regenerative changes following nerve injury. Add a note on Neurotropins. (2+5+3)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY THIRD YEAR EXAMINATION

Paper I – Cardiovascular and Exercise Physiology

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. Explain the cardiovascular and tissue changes during moderate isotonic exercise. (10)
2. Describe the properties of cardiac muscle. (10)
3. Define and classify shock, explain the physiological basis of circulatory shock. (3+7)
4. Describe various methods of measurement of cardiac output. (10)
5. Explain the mechanisms of long-term regulation of blood pressure. (10)
6. Explain the effect of sympathetic and parasympathetic stimulation on pacemaker potential. (5+5)
7. Explain the physiological basis of sinus arrhythmia and add a note on ECG changes in hyperkalemia. (6+4)
8. List the sympathetic function tests. Explain principle and technique of two sympathetic function tests. (2+8)
9. Explain the physiological basis of orthostatic hypotension and how it is diagnosed. (6+4)
10. Describe the features and regulation of coronary blood flow. (5+5)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY THIRD YEAR EXAMINATION

Paper II – Respiratory system and Environmental Physiology

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. Describe the synthesis, composition, and functions of pulmonary surfactant. Add a note on Infant respiratory distress syndrome. (2+2+4+2)
2. Describe the sequence of events leading to inspiration and expiration. Add a note on intrapleural pressure. (6+4)
3. What is dead space? Describe the various methods of measurement of dead space. (3+7)
4. Describe the special features of pulmonary circulation. (10)
5. Draw and describe the oxygen-hemoglobin dissociation curve. List the factors that shift the curve to right and left. Add a note on Haldane effect. (4+4+2)
6. Describe the role of pontine and medullary respiratory centers in the regulation of respiration. Add a note on sleep apnea syndrome. (8+2)
7. Describe the respiratory and cardiovascular changes that occur during acclimatization at high altitude. Add a note on Monge's disease. (4+4+2)
8. Describe the different types of hypoxia. Add a note on hyperbaric oxygen therapy. (7+3)
9. Explain the physiological basis of various hazards of deep-sea diving. Add a note on SCUBA. (8+2)
10. Describe the various methods of artificial ventilation. List any four indications for cardiopulmonary resuscitation. (8+2)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY THIRD YEAR EXAMINATION

Paper III – Synaptic transmission in CNS, Sensory system including Thalamus & Sensory cortex; EEG & consciousness, Hypothalamus; Motor system

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. Describe the organization, connections & functions of cerebellum. (10)
2. Draw a labeled diagram of corticospinal tract. List three differences in the features of UMN & LMN paralysis. (7+3)
3. Describe the organization, connections & functions of thalamus. (10)
4. Discuss the properties of synaptic transmission. (10)
5. Discuss various waves of EEG. (10)
6. Discuss the endogenous analgesia system. (10)
7. Discuss the role of hypothalamus in feeding. (10)
8. Explain physiological basis and features of Parkinson's disease. (5+5)
9. Describe the stages of sleep. (10)
10. Discuss theories of referred pain. (10)

MODEL QUESTION PAPER

MSc MEDICAL PHYSIOLOGY THIRD YEAR EXAMINATION

Paper IV – Central Nervous system (Limbic system, Physiology of Learning & Memory, Physiology of Speech, Lobes of the brain & Association areas, Cerebral dominance), Special senses, Integrative physiology (Temperature regulation, Physiology of aging and Yoga), Recent advances in Physiology

Duration: Three Hours

Maximum Marks: 100

Answer ALL questions.

Draw diagrams wherever necessary

1. Define and classify memory. Add a note on dementia. (2+3+5)
2. Describe the formation, composition, and functions of cerebrospinal fluid. (2+3+5)
3. Explain the theories of color vision. Add a note on color blindness. (6+4)
4. Draw a schematic diagram of auditory pathway. Add a note on the tests of hearing. (4+6)
5. Describe the role of yoga in the prevention of non-communicable diseases. (10)
6. Explain the mechanism of phototransduction. Add a note on presbyopia. (7+3)
7. Discuss the theories of aging. (10)
8. Describe the anatomical organization of Limbic system and the role of it in the control of emotions. (10)
9. Describe the different types of aphasias. (10)
10. Explain the role of hair cells in hearing. (10)
