

DEPARTMENT OF PHYSIOLOGY
J.N. MEDICAL COLLEGE, AMU, ALIGARH

**Syllabus for admission Test for M.Phil./Ph.D. Physiology with
Research Methodologies.**

Physiology: Theory & Practical

- I. a. General & Cellular Physiology
 - b. Haematology
 - c. Renal Physiology & Fluid Balance II.
 - 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. Endocrine & Reproduction
- a. General & Cellular Physiology*
- Cell as the living unit of the body
 - Body fluid compartments
 - The internal environment

- Homeostasis
- Control systems
- Organization of a cell
- Physical structure of a cell membrane
- Transport across cell membranes
- Functional systems in the cells
- Genetic code , its expression, and regulation of gene expression
- Cell cycle and its regulation
- Physiology of growth & ageing

b. Haematology

- Erythrocytes
 - erythropoiesis
 - structure & function of RBCs
 - formation of haemoglobin
 - destruction & fate of RBCs
 - anaemias
 - 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
 - Hazards of transfusion

- Hemostasis
 - components of hemostasis
 - mechanisms of coagulation
 - coagulation tests
 - anticoagulants
 - Fibrinolytic system (plasmin system)
- Immunity
 - Innate immunity
 - Acquired immunity
 - Allergy, hypersensitivity and immunodeficiency
 - autoimmune disorders

c. Renal Physiology & Fluid Balance

- Water balance; regulation of fluid balance
- Urine formation
- Regulation of extra cellular sodium & osmolarity
- Renal mechanisms for the control of blood volume, blood pressure & ionic composition of ECF
- Regulation of acid –base balance
- Micturition
- Diuretics
- Renal failure

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 excitation & conduction

- Electrocardiogram
- Arrhythmias
- Principles of Haemodynamics
- Neurohormonal 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
- Principle of gas exchange
- Oxygen & carbon-dioxide transport
- Regulation of respiration
- Hypoxia
- Oxygen therapy and toxicity
- Artificial respiration
- Environmental Physiology

c. Physiology of hot environment

- Physiology of cold environment
- High altitude
- Aviation Physiology
- Space Physiology
- Deep sea diving & hyperbaric conditions

a. Nerve & Muscle Physiology

- Resting membrane potential
- Action potential
- Classification of nerve fibers
- Nerve conduction
- Degeneration & regeneration in nerves
- Functional anatomy of skeletal muscle
- Neuro-muscular transmission and blockers
- Excitation-contraction coupling
- Mechanism 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, touch vibrations & thermal sensations.
- Muscle spindle
- Organization of spinal cord for motor function
- Reflexes and reflex arc
- Brain stem and cortical control of motor function
- Cerebellum
- Basal ganglia
- Maintenance of posture and equilibrium & muscle tone.
- Motor cortex

c. Special Senses

- Optics of vision
- Receptors and neural function of retina
- Colour vision
- Perimetry
- Visual pathways
- Cortical vision 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
- Emotion & Behaviour
- Learning & memory

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 for GI function
- Mastication & swallowing
- Esophageal motility
- Salivary secretion
- Gastric mucosal barrier
- Pancreatic & biliary secretion
- Gastrointestinal motility
- Digestion & absorption
- Functions of colon
- Pathophysiology of peptic ulcer and diarrheal disease
- G.I. hormones
- Liver functions & LFT

c. Endocrines & Reproduction

- Classifications 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 hormones
- Spermatogenesis
- Hyper & Hypogonadism
- Menstrual cycle, ovarian cycle
- Female sex hormones
- Pregnancy & Lactation
- Functions of Placenta
- Parturition
- Lactation

Apart from the above topics in general and systemic physiology

1. Biophysics
2. Biochemistry
3. Biostatistics
4. Molecular Biology
5. Medical Education
6. History of Medicine
7. Recent advances in Physiology
8. Recent Physiological techniques.

RESEARCH METHODOLOGIES

1. Introduction to Health Research

- Definitions of Research
- Characteristics of Research
- Why to do Research? (Objectives)
- What are the types of Research?
- Major Areas of Health Systems Research
- Some of the problems encountered by the Researches.

2. Identification and Prioritization of Research

- Criteria for Prioritizing Topics for Research
- Nominal Group Technique (NGT)

3. Literature Search

- Sources of Information
- Conclusion

4 Formulation of Objective, Research Questions & Hypotheses

- Research Objectives
- Research Questions
- Hypotheses
- Characteristics of Good Hypothesis
- Types of Hypothesis

5 Planning the Measurements

- Measurement
- Scales of Measurement
- Strategies to Deal with Threats to Validity

6 Study Design Options in Medical and Health Research

- Decision Algorithm for study to be chosen
- Observational/Non-Experimental/Non Interventional Studies
- Schematic Diagram of Nested case-control study Design
- Measurements in various study Designs
- Experimental/Intervention Study Designs
- Randomized Controlled Trial (RCT)
- Types of Randomized Controlled trials
- Clinical Trials
- Principles for maximizing follow up and adherence to the Protocol
- Elements to Monitor Clinical Trials.

7. Research on Diagnostic Tests

- Lack of information on negative Tests.
- Lack of Objective standard for Disease
- Consequences of Imperfect standard
- Measures of Diagnostic Accuracy

8. Qualitative Research-Concepts and Methods

- Purposes of Qualitative Methods
- Research Methods and Philosophical Perspectives
- How to do Qualitative Research?
- Classification of Qualitative Research Procedures/Techniques
- Participatory Inquiry
- Procedures for focus Group Discussion
- Traits of a Good Focus Group Moderator
- Seven Advantages of Focus Group Discussion

9. Variables

- Operationalization of Variables by choosing Appropriate Indicators
- Identifying Indicators in Qualitative Studies

10. Determination of Sample Size

- Sample Size Determination
- Estimating Sample Size with Absolute Precision
- Absolute Size of Sample is Important, not the sampling fraction
- Two-Sample Situations
- Sample Size calculation for various Epidemiological Studies
- Sample Size calculations for measuring one variable

11. Sampling Methods

- Representativeness
- Sampling Methods
- Probability or Random Sampling Strategies to collect Quantitative Data
- Systematic Random Sampling
- Non-Probability or Non-Random Sampling
- Bias in Sampling
- Ethical Considerations.

12. Analysis of Quantitative Data

- Descriptive Statistics
- Properties of Frequency Distribution
- Range
- Quartile Deviation (Interquartile range)
- Mean Deviation (MD)
- Standard Deviation

Coefficient of Variation
Inferential Statistics
Large Sample Tests
Small Sample Test (T-Statistical) or Student's 't' Test
Tests of Significance for large and small Sample
Correlation and Regression

13. Analyses of Qualitative Data

Purposes of Qualitative Analysis

14. Data Collection Methods and Techniques

Experiencing (Through Observation and Field Notes)
Observational Methods
Enquiry
Examining
Bias in Data Collection
Ethical Considerations

15. Designing Research Instruments, Interview Guides and Skills

Interview Skills

16. Data Management, Processing and Analysis

Data Quality Control and Management
Data Screening
Constructing a Database
Data Processing-Quantitative Data
Quality Control Tables and Checklist for conducting Clinical Trials

17. Ethical Issues in Health Research

Informed Consent
Institutional Ethics Committee (IEC)/Institutional Review Board (IRB)
Elements of the Review
Selection of special Groups as Research Subjects: (Indian Council of Medical Research)

18. Writing a Research Proposal

Basic Outline of a Research Proposal/Project
Budget

19. Steps in Thesis Writing

Scientific Structure (Anatomy) of Dissertation
Tips to start Thesis/Dissertation Writing
Aims and Objectives
Review of Literature
Materials and Methods

20. How to Write an Article for Publication

Check List for writing an Original Paper
Types of Distraction while Writing a Paper

21. Critical Appraisal of Journal Article

Need for the Critical Review of Scientific Research Publication

Methods of Evaluation

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