

# Central University of Rajasthan

## Ph.D. Admission – Written Test Syllabus

The question paper consists of 100 MCQs. The exam shall be for duration of TWO hours. The question paper shall be divided in two parts; Part–I: Research methodology (50 MCQs) and Part –II: concerned subject (50 MCQs). There is no negative for wrong answer.

### **Part - I:**

#### **A. Research Methodology (50 Marks)**

(For Ph.D. Architecture, Atmospheric Science, Biochemistry, Biotechnology, Chemistry, Computer Science, Computer Science and Engineering, Electronics and Communication Engineering, Environmental Science, Mathematics, Microbiology, Pharmacy, Physics, Sports Biosciences, Statistics)

1.	<b>Research and Type of Research:</b> Meaning of Research, Types (primary, secondary, qualitative, quantitative, basic, applied, fundamental, empirical), Identification of research problem, Objectives of Research, Motivation in Research, Research methods vs. Methodology. Criteria of good research.	About 15 Questions
2.	<b>Data Collection and Interpretation:</b> Data, Types of Data, Methods of Data Collection, Samples and sampling techniques, Sampling errors, Types of statistical errors, Statistical methods/Tools – Measures of Central Tendency and Variation, Test of Hypothesis – z test, t test, F test, ANNOVA, Chi square, correlation and regression analysis, Error Estimation.	About 10 Questions
3.	<b>Scientific Writing:</b> Structure and Components of Scientific Reports – Types of Report – Technical Reports and Thesis, Components of Research Reports, Significance, Graphic representation of data, Referencing Styles, Impact factor, h-index, i-10 index and other research related parameters.	About 10 Questions
4.	<b>Research Ethics:</b> Plagiarism, its types. Ethics in research and introduction to ethical misconducts like self-plagiarism, ghost-writing, salami publications and undue benefits. An understanding of the publishing ethics in sciences.	About 10 Questions
5.	<b>Intellectual Property Rights:</b> Introduction to patents, trademarks, copyrights, industrial designs, geographical indications and traditional knowledge.	About 5 Questions

## **B. Research Methodology (50 Marks)**

(For Ph.D. Commerce, Education, Linguistics, Management, Public Policy, Law and Governance, Social Work, Sports Psychology)

1.	<b>Research and Type of Research:</b> Social Research, Types (Historical, Descriptive and Experimental; Basic, Applied and Action Research- Longitudinal and Cross-sectional Research - Quantitative and Qualitative Research, Mixed Method), literature review, Variables – Concept, Construct, Indicators and Variables, Research Designs.	About 15 Questions
2.	<b>Data collection for research:</b> Data, Types of Data, Methods of Data Collection- Interview, Observation, Questionnaire, Focused Group Discussions. Telephonic Interviews, Surveys, Web based surveys, Tools of Data Collection- Unstructured, Semi-Structured, Structured Need and Importance of data, different types of data, sources of data, population, universe, Samples and sampling techniques, Hypothesis.	About 10 Questions
3.	<b>Data interpretation:</b> Probability - Theory, Principles of Probability Distribution, Sampling & Normal Distribution; Statistics and Data Processing - meaning and significance of statistics; Data processing, Data management, analysis and presentation- Classification and Tabulation of data, Graphic representation of data, Frequency Distribution; Basic Statistics- Measures of central tendency, Measures of dispersion. Meaning, uses, and computation of mean, median mode, range, quartile deviation, standard deviation etc. and hypothesis testing- z test, t test, F test, ANNOVA, Chi square, correlation and regression analysis	About 15 Questions
4.	<b>Scientific Writing:</b> Structure and Components of Scientific Reports – Types of Report – Technical Reports and Thesis, Components of Research Reports, Referencing Styles, Impact factor, h-index, i-10 index and other research related parameters. Intellectual property rights and patent, trademarks.	About 5 Questions
5.	<b>Research Ethics:</b> Ethics in research – Informed consent, confidentiality, Plagiarism, its types. Ethics misconducts like self-plagiarism. An understanding of the publishing ethics in social sciences.	About 5 Questions

## **Part - II: Concerned Subjects (50 Marks)**

<b>Sl. No.</b>	<b>Name of Programme</b>	<b>Syllabus: Subject</b>
1.	Ph.D. Architecture	GATE: Architecture & Planning
2.	Ph.D. Atmospheric Science	CSIR-NET: Earth, Atmospheric, Ocean and Planetary Sciences
3.	Ph.D. Biochemistry	CSIR-NET: Life Sciences
4.	Ph.D. Biotechnology	CSIR-NET: Life Sciences
5.	Ph.D. Chemistry	CSIR-NET: Chemical Sciences
6.	Ph.D. Commerce	UGC-NET: Commerce
7.	Ph.D. Computer Science	UGC-NET: Computer Science
8.	Ph.D. Computer Science and Engineering	GATE: Computer Science and Information Technology
9.	Ph.D. Electronics and Communication Engineering	GATE: Electronics and Communication Engineering
10.	Ph.D. Education	UGC-NET: Education
11.	Ph.D. Environmental Science	UGC-NET: Environmental Sciences
12.	Ph.D. Linguistics	UGC-NET: Linguistics
13.	Ph.D. Management	CSIR-NET: Management
14.	Ph.D. Mathematics	CSIR-NET: Mathematics
15.	Ph.D. Microbiology	CSIR-NET: Life Sciences
16.	Ph.D. Pharmacy	Graduate Pharmacy Aptitude Test (GPAT)
17.	Ph.D. Physics	CSIR-NET: Physics
18.	Ph.D. Public Policy, Laws and Governance	UGC-NET: Political Science
19.	Ph.D. Social Work	UGC-NET: Social Work
20.	Ph.D. Sports Biosciences	<b>Please see Annexure-1</b>
21.	Ph.D. Sports Psychology	UGC-NET: Psychology
22.	Ph.D. Statistics	UGC-NET: Statistics

*Note: Written test for the Part-II will be based on NET/GATE/GPAT syllabus of the respective subjects. For the subjects where NET examination is not conducted, the paper would be based on syllabus at post-graduation level in the concerned subject.*

## **Part-II: Syllabus for Ph.D. Sports Biosciences**

### **1. Human Anatomy and Exercise Physiology**

Basis of cell biology; Anatomy and Physiology of Cardiovascular System Lymphatic System, Respiratory System and acute effects of exercise on cardiovascular, lymphatic and respiratory systems.

Anatomy and Physiology of: Nervous System, Special Senses, Endocrine System, Musculoskeletal system and acute effects of exercise on Nervous, Endocrine, and Musculoskeletal systems.

Anatomy and Physiology of: Digestive System, Immune System, Urinary System, Reproductive System, and Integumentary System and acute effects of exercise on Digestive, Immune and Urinary systems.

Anatomy and Physiology of: Reproductive System, and Integumentary System and acute effects of exercise on Reproductive System, and Integumentary System.

Control of the Internal Environment Homeostasis: Dynamic Constancy Control Systems of the Body - Nature of the Control Systems - Negative Feedback - Positive Feedback - Gain of a Control System - Duration and Intensity - Short-Term, Intense Exercise - Prolonged Exercise - Incremental Exercise - Examples of Homeostatic Control - Regulation of Body Temperature - Factors Governing Fuel Selection - Exercise Intensity and Fuel Selection - Exercise Duration and Fuel Selection - Interaction of Fat/Carbohydrate Metabolism - Body Fuel Sources - Biological Energy Transformation, Skeletal Muscle: Structure and Function - Structure of Skeletal Muscle - Neuromuscular Junction - Muscular Contraction - Overview of the Sliding Filament Model - Energy for Contraction -Regulation of Excitation- Contraction Coupling - Fiber Types - Biochemical and Contractile Characteristics of Skeletal Muscle - Characteristics of Individual Fiber Types - Fiber Types and Performance - Alterations in Skeletal Muscle Due to Exercise, Inactivity, and Aging - Exercise-Induced Changes in Skeletal Muscles

The Nervous System: Structure and Control of Movement - General Nervous System Functions Organisation of the Nervous System - Structure of the Neuron - Electrical Activity in Neurons - Sensory Information and Reflexes - Joint Proprioceptors - Muscle Proprioceptors - Muscle Chemoreceptors - Reflexes - Somatic Motor Function - Vestibular Apparatus and Equilibrium - Motor Control Functions of the Brain and Brainstem

Hormones: Regulation and Action - Hypothalamus and the Pituitary Gland - Thyroid Gland - Parathyroid Gland - Adrenal Gland - Pancreas - Testes and Ovaries -Hormonal Control of Substrate Mobilisation During Exercise - Muscle-Glycogen Utilisation - Blood Glucose Homeostasis During Exercise - Hormone-Substrate Interaction - Temperature Regulation - Overview of Heat Balance During Exercise - Temperature Measurement - During Exercise - Overview of Heat Production/Heat Loss - Heat Production - Heat Loss - Heat Storage in the

Body During Exercise - Body's Thermostat-Hypothalamus - Shift in the Hypothalamic Thermostat Set Point - Due to Fever - Thermal Events During Exercise  
Circulatory Responses to Exercise - Organization of the Circulatory System - Structure of the Heart - Pulmonary and Systemic Circuits - Heart: Myocardium and Cardiac Cycle - Myocardium - Cardiac Cycle - Arterial Blood Pressure - Factors That Influence Arterial Blood Pressure - Electrical Activity of the Heart - Cardiac Output - Regulation of Heart Rate - Regulation of Stroke Volume - Hemodynamics - Physical Characteristics of Blood - Relationships Among Pressure, Resistance, and Flow - Sources of Vascular Resistance  
Control of Ventilation - Ventilatory Regulation at Rest - Respiratory Control Center - Ventilatory Control During Submaximal Exercise - Ventilatory Control During Heavy Exercise - Lungs Adaptation to Exercise Training - Pulmonary System Limiting Maximal Exercise Performance - Acid-Base Balance During Exercise - Acids, Bases, and pH - Hydrogen Ion Production During Exercise - Importance of Acid-Base Regulation  
The Physiology of Training: Effect on V<sub>O2</sub> Max. Performance, Homeostasis and Strength - Principles of Training - Overload - Specificity - Research Designs to Study Training - Endurance Training and V<sub>O2</sub> Max - Training Programs and Changes In V<sub>O2</sub> Max - V<sub>O2</sub> Max: Cardiac Output and the Arteriovenous O<sub>2</sub> Difference - Stroke Volume - Arteriovenous O<sub>2</sub> Difference - Detraining and V<sub>O2</sub> Max - Endurance Training: Effects on Performance and Homeostasis - Biochemical Adaptations and the Oxygen Deficit - Biochemical Adaptations and the Plasma Glucose Concentration - Biochemical Adaptations and Blood pH - Biochemical Adaptations and Lactate Removal - Endurance Training: Links Between Muscle and Systemic Physiology - Peripheral Feedback - Central Command - Physiological Effects of Strength Training - Physiological Mechanisms Causing Increased Strength - Neural Factors - Muscular Enlargement - Concurrent Strength and Endurance Training

## **2. Food and Nutrition in Sports**

Nutrients and nutritional Role of macro and micro nutrients: Water Requirements and Fluid Balance, Nutrition Supplements. Gastric Emptying, Digestion, and Absorption.

Nutrients: Functions and Recommended Intakes, Healthy Eating and Balanced Diet, Fuel Sources for Muscle and Exercise Metabolism, Energy: Food Energy and Expenditure

Nutrition and Immune Function in Athletes, Body Composition and Weight Management, Eating Disorders in Athletes.

Personalized Nutrition, Menu Planning (Meal Timing and Spacing); Principles of diet planning, Food data table and Usage of software, validity and reliability of dietary assessment tools, translating the dietary intake into analysis and determining nutritional information.

## **3. Kinesiology & Biomechanics**

Exercise and sports biomechanics basic concepts of kinematics and kinetics – vectors, motion, degrees of freedom, force, moment of force, equilibrium. Biomechanical considerations in reducing sporting injury rates.

Posture static and dynamic posture, postural diversity within individuals, posture and its relationship to somatotype posture assessment, desirable postures for high level sport performance, modifying posture and technique to improve performance.

Movement patterns – the essence of sports biomechanics, Qualitative analysis of sports movements, Structure of Motor Action: Definition of motor action, Classification: types of Movements i.e., acyclic, cyclic and movement combination Phases of movement and their importance, Structure of acyclic, cyclic and movement combination with examples and function of various phases.

Image analysis in sports performance errors in motion analysis, planar Video analysis, 3d motion analysis, data filtering.

Definition of Kinesiology, Its importance in the field of Sports Reference System for Movement Analysis: Concept of reference system and its significance Various references, centre of gravity, Mechanical Axis, Anatomical and Standard standing position, Types of Planes and Axes.

Fundamental and Auxiliary Movements: Definition and explanation of various fundamental and Auxiliary movements: flexion, extension, hyper extension, abduction, adduction, hyper adduction, lateral flexion, rotation, pronation, supination, planter flexion, dorsiflexion, inversion, eversion, and circumduction.

#### 4. **Sports Biochemistry**

Foundation of Biochemistry: Introduction to Biomolecules; Properties of water: Structure and properties of water, importance of water in biological systems, Ionic product of water; Chemical bonding: Properties of covalent bond, non-covalent bonds and their importance in biological systems; Types of biochemical reactions: oxidation, reduction, condensation, rearrangement, cleavage, group transfer, Resonance bond, electrophilic and nucleophilic.

Carbohydrates: Classification, characteristics, structure and functions of monosaccharides, disaccharides, trisaccharides and polysaccharides; amino sugars, proteoglycans and glycoproteins.; Lipids: Classification, structure and function of major lipid subclasses Triacylglycerols, Phospholipids, Sphingolipids, glycolipids, Lipoproteins, chylomicrons, LDL, HDL and VLDL, steroids, prostaglandins and bile acids, rancidity.

Protein: Amino acids: Structure, Classification, and physico-chemical properties of amino acids, role of non-protein amino acids, peptides, peptides of physiological significance, peptide bond.; Proteins: Structural features of proteins and their biological Functions- Primary Structure, Secondary structure, Tertiary Structure and Quaternary structure.

Nucleic acids: Structure and properties of nucleotides, nucleosides, purine (Adenine, Guanine) and pyrimidine (Cytosine, Thiamine, Uracil) bases. Structural features of nucleic acids (DNA & RNA) and their biological functions; Vitamins: Structure and Classification, water soluble and fat soluble vitamins.

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