

# **RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER**

## **SYLLABUS FOR SCREENING TEST FOR THE POST OF ASSISTANT PROFESSOR (Broad Speciality) BIO-PHYSICS MEDICAL EDUCATION DEPARTMENT**

### **Unit : I - Introduction and concept of Bio-physics**

Organization and structure of prokaryotes. Physical structure of cell. Cytoplasm and its organelles. Mitochondria. Structure, respiratory chain and ATP Synthesis, endoplasmic reticulum and ribosomes, Golgi apparatus, peroxisomes, lysosomes: their formation. structure and functions.

### **Unit : II - Nucleus**

Structure and function of nucleus and nucleolus. Nuclear membrane. Structure of DNA. Genetic code, gene and operon, plasmids, genomic libraries. DNA- micro arrays, DNA sequencing, cloning.

### **Unit : III**

Structure and properties of RNA: different forms of RNA and their significance, DNA and RNA, Polymerase reverse transcriptase, restriction endo nuclease. Apoptosis, cancer and molecular genetics, oncogenes, tumor suppressor genes, tumor metastasis.

### **Unit : IV**

Proteins: Primary, secondary, and tertiary structure of proteins: twenty amino acids: their structure and function, helical structure, quaternary structure of proteins. Synthesis of protein and peptides: transcription and translation process, central dogma of genetic code.

### **Unit : V - Microscopy**

Basic Principles of microscopy- phase contrast microscope. Interference microscope, fluorescence microscope, CIV- microscope, transmission and scanning electron microscope. Polarising microscope. Cryo-electron microscopy.

### **Unit : VI - Membrane biophysics**

Structure, composition and functions of cell membrane, fluidity of cell membranes. Transportation across the cell membrane. endocytosis, pinocytosis, phagocytosis, permeability, diffusion through cell membrane, Ion channels. Facilitated diffusion, factors affecting diffusion, osmotic pressure measurement, net diffusion of water. Active transport, primary and secondary active transport, co-transport and counter transport, active transport through cellular sheet.

### **Unit : VII - Membrane potentials**

Basic physics of membrane potential, measurement of action potential, resting membrane potential and its origin. Propagation of action potential, plateau in action potential. Refractory period and excitability. Recording of action potential, signal transmission, rhythmicity of excitable tissue, repetitive discharge. Role of voltage gated  $\text{Na}^+$  and  $\text{K}^+$  channels.

**Unit : VIII - Muscle and Nerve Biophysics**

Physiological anatomy of skeletal, smooth and cardiac muscles. Molecular mechanism of muscle contraction, characteristics of whole muscle contraction, excitation contraction coupling in muscular contraction. Neuromuscular Junction.

Regulation of neuromuscular transmission, myasthenia gravis, action potential in muscles, rhythmicity of cardiac muscle depolarization and repolarization of muscles, normal electrocardiogram, normal electromyogram. EEG. Structure of nerve fibers, neurones, membrane potential & propagation of action potential through nerve fibers, conduction of impulse. Saltatory conduction, degeneration & regeneration of nerve fibers, Electrical events during excitation and its causes, excitation of post synaptic membranes, electrical events during neuronal inhibition, spatial & temporal Summation.

**Unit : IX**

Hydrogen ion concentration & Solution: Definition and characterisation of true solution and colloidal solution. Principal of electrolyte dissociation, ionization, conductance and common ion effect. Ostwald's dilution law. Dielectric constant. Hydrogen ion concentration. PH value, acids, base and salts. Biological importance of acids base, and salts, buffers and buffering system. Henderson Hasselbalch equation, acid base balance.

**Unit : X**

Elementary particles, structure of atom, radioactivity, radioactive decay. Detection of nuclear radiation. Isotopes Biological effects of radiation, Diagnostic use of radionuclides. In vivo imaging and functional Studies of brain and thyroid heart, liver, kidney & other organs.

Radio immunoassays, antigen measurement. Clinical application, hormone assays, Radioiodination in Thyroid diseases Use of imaging, basic principles of radionuclide therapy in thyrotoxicosis & carcinoma.

**Unit : XI**

X-ray diffraction and elucidation of structure of DNA and other molecules Separation techniques, Basic principles and application of electrophoresis application of centrifugation, Sedimentation, basic principles and application of chromatography Capacity factor of the gel,  $k_{ds}$  values, alpha value.

**Unit : XII**

Spectroscopic techniques, Introduction, basic principles, instrumentation and application of uv-absorption, infrared, Raman Spectra, atomic absorption, fluorescence, laser Spectroscopy, NMR, electron Spin resonance.

**Unit : XIII**

Basic principles of modeling, modeling by energy minimization concept of rotation about bonds, Ramachandran plot, energy minimization in cartesian. Basic principles of molecular dynamics.

**Unit : XIV**

Principles of computers application in biology and medicine.

**Unit : XV**

Biophysics of sense of balance and rotation, vestibular apparatus, hearing, effect of barometric pressure, vibrations, microwaves and their effects on biological organs, Weightlessness. Radiation in aviation and space atmospheres and climate in space craft.

**Unit : XVI - Peptides-design, synthesis and applications**

Introduction to peptides, peptide design, synthesis of peptides (solution phase and solid phase), protection and deprotection of amino and carboxylic group, conformation of peptides, purification and crystallization of peptides.

**Unit : XVII - Mathematical methods and their applications in biological systems**

Ordinary differential equations of the first degree and first order (variable separable method, linear equation), linear differential equations of the second order with constant coefficients, the Laplace Transform, Inverse Laplace transform, application of Laplace transform to solutions of differential equations, Fourier series and their applications.

**Unit : XVIII - Quantum biology and chemistry**

Classical mechanics, Newton, Lagrange and Hamilton's equations, Schrodinger's equation and its complete solution for S.H.O, central force and angular momentum.

Atomic orbital models, the wave equation, molecular orbitals, the LCAO method, the overlap method, Coulomb and resonance integrals, the hydrogen molecule, charge distributions, approximate methods.

\* \* \* \* \*

Pattern of Question Papers:

1. Objective Type Paper
2. Maximum Marks : 180
3. Number of Questions : 180
4. Duration of Paper : Three Hours
5. All Questions carry equal marks
6. There will be Negative Marking

\* \* \* \* \*