Annexure X

(Enclosure to Notification No. 1479/SS/T9/KGBV/URS/2022, Dt:16.06.2023 of DSE & EO-SPD, TSS, Hyd.)

Syllabus of Written Test for Recruitment of PGCRTs in KGBVs
PGCRT - Physics

Part I - General Studies

1. Current Affairs - Regional, National & International.
2. Indian Constitution; Indian Political System: Governance and Public Policy.
3. Social Exclusion; Rights issues such as Gender, Caste, Tribe, Disability etc., and inclusive policies.
4. Society Culture, Civilization Heritage. Arts and Literature of India and Telangana
5. General Science; India's Achievements in Science and Technology
6. Environmental Issues; Disaster Management- Prevention and Mitigation Strategies and Sustainable Development.
7. Economic and Social Development of India and Telangana.
8. Socio-economic, Political and Cultural History of Telangana with special emphasis on Telangana Statehood Movement and formation of Telangana state.

Part II – Basic Proficiency in English

1. School Level English Grammar:

   Articles; Tenses; Noun & Pronouns; Adjectives; Adverbs; Verbs; Modals; Subject-verb Agreement; Non-finites; Reported Speech; Degrees of Comparison; Active and Passive Voice; Prepositions; Conjunctions; Conditionals.
2. Vocabulary:

   Synonyms and Antonyms; Phrasal Verbs; Related Pair of Words; Idioms and Phrases; Proverbs.
3. Words and Sentences:

   Use of Words; Choosing appropriate words and words often confused; Sentence Arrangement, Completion, Fillers and Improvement; Transformation of Sentences; Comprehension; Punctuation; Spelling Test; Spotting of Errors.

Part III - Perspectives in Education

1. **History of Education:** Pre-Vedic and Post-Vedic period, Medieval period Recommendations of various Committees during British period with special reference to Woods Despatch (1854), Hunter Commission (1882), Hartog Committee (1929), Sargent Committee (1944), Recommendations of various Committees in the post independent period with special reference to Mudaliar Commission (1952-53), Kothari Commission (1964-66), Ishwarbhai Patel Committee (1977), National Policy on Education, 1968, National Policy on Education, 1986, Programme of Action, 1992 and National Educational Policy, 2020.

   Aims, Objectives, Functions, Unipolar, Bipolar and Tripolar Processes of Education, Types of Education - Formal, Informal and Non-formal Education, their significance and interrelations, Philosophical, Sociological and Psychological Perspectives of Education.

2. **Teacher Education:** Concept, Teacher Preparation, NCFTE-2009, Pre-service and In service Teacher Education Programs, Teacher Motivation, Continuous Professional Development.

   Teacher Empowerment: Meaning, Interventions for Empowerment, Professional Code of Conduct for Teachers, Role of Teacher Organisations in Professional Development of Teachers, National and State Level Institutions for Teacher Education.

3. **Educational Concerns in Contemporary India:**

   Environmental Education: Meaning, Scope of Environmental Education, Concept of Sustainable Development, Role of Teacher, School and NGOs in Development and Protection of Environment; **Democracy and Education**: Equality, Equity, Equality of Educational Opportunities, Role of Education in promoting Democracy; **Economics of Education**: Meaning and Scope, Education as Human Capital, Education and Human Resource Development; **Population Education**: Significance of Population Education. Population situation, Approaches to Population Education and Themes of Population Education, Family Life Education, Sustainable development, Adolescence Education, Health Education, Gender Equality, Equity and Empowerment of Women, the Role of School and Teacher, Urbanization and Migration, Life Skills; **Inclusive Education**: Concept, Prevalence, Areas of Disabilities, Disadvantaged Groups, Gender etc., Myths & Facts, Importance of Early Identification and Assessment, Planning Inclusive

Education, Initiatives in Education, Method & Strategies of Classroom Management, Psycho-Social Management, Creation of Awareness – Students, Parents and Society & Sensitization Strategies, Evaluation, Documentation and Maintenance of Records; **Liberalization, Privatization and Globalization**; **Value Education; Initiatives in Education:** Sarva Siksha Abhiyan (SSA), National Programme for Education of Girls at Elementary Level (NPEGEL), Mid-day-Meal Programme, Rashtriya Madhyamika Siksha Abhiyan (RMSA), Samagra Shiksha and its interventions, KGBVS and Model Schools etc.

4. Constitutional Provisions relevant to Education: Acts/Rights**,** Right of Children to Free and Compulsory Education Act, 2009, Right to Information Act 2005, Child Rights, Human Rights, PWD Act, 2016 and other Provisions pertaining to Education.

5. National Curriculum Framework, 2005 and NCFSE, 2023.

Part IV - Content

1. Mathematical Methods of Physics

i. Physical World- What is Physics, Scope and excitement of Physics, Physics, technology and society, Fundamental forces in nature, nature of Physical laws.

ii. Units and Measurements - The International system of units, Measurement of length, Measurement of mass, Measurement of time, Accuracy, precision of instruments and errors in measurement, Significant figures, Dimensions of physical quantities, Dimensional formulae and dimensional equations, Dimensional analysis and its applications

2. Kinematics and Dynamics

i. Motion in a Straight line - Position, path length and displacement, Average velocity and average speed, Instantaneous velocity and speed, Acceleration, Kinematic equations for uniformly accelerated motion, Relative Velocity

ii. Motion in a Plane- Scalars and vectors, Multiplication of vectors by real numbers, Addition and subtraction of vectors graphical method, Resolution of vectors, Vector addition Analytical method, Motion in a plane, Motion in a plane with constant acceleration, Relative velocity in two dimensions, Projectile motion, Uniform circular motion

iii. Laws of Motion - Aristotle's facility, the law of inertia, Newton's first, second and third laws of motion, Conservation of momentum, Equilibrium of a particle, Common forces in mechanics, Circular motion, Solving problems in mechanics

iv. System of Particles and Rotational Motion - Centre of mass, Motion of Centre of mass, Centre of gravity, Linear momentum of a system of particles, Vector product of two vectors, Angular velocity and its relation with linear velocity, Torque and angular momentum, Equilibrium of a rigid body, Moment of inertia, Dynamics of rotational motion about a fixed axis, Angular momentum in case of rotations about a fixed axis, Rolling motion

v. Oscillations - Periodic and oscillatory motions, Simple Harmonic motions, Simple Harmonic motion and uniform circular motion, Velocity and acceleration in simple harmonic motion, Force law for simple harmonic motion, Energy in simple harmonic motion, some systems executing simple harmonic motion, damped simple harmonic motion, Forced oscillations and resonance

vi. Gravitation - Kepler's laws, Universal law of gravitation, The Gravitational constant, Acceleration due to gravity of Earth, Acceleration due to gravity below and above the surface of Earth, Gravitational Potential energy, Escape Speed, Earth Satellite, Energy of an orbiting satellite, Geo Stationary and Polar Satellites, Weightlessness

vii. Mechanical Properties of Solids - Elastic behaviour of solids, Stress and Strain, Hooke's Law, Stress-Strain curve, Elastic Moduli, applications of elastic behaviour of materials.

viii. Mechanical Properties of Fluids - Pressure, Streamline Flow, Bernoulli's Principle, Viscosity, Reynolds Number, Surface Tension

3. Natural Phenomena

i. Work, Energy and Power - Notions of work and kinetic energy: The work-energy theorem, Work, Kinetic Energy, Work done by a variable force, The work-energy theorem for a variable force. The concept of potential energy, The conservation of mechanical energy, The potential energy of a spring, Various forms of energy: the law of conservation of energy, Power Collisions

ii. Waves - Transverse and Longitudinal waves, Displacement relation in a progressive wave, Speed of a Travelling Wave, The principle of superposition of waves, Reflection of waves, Beats, Doppler Effect

iii. Ray Optics and Optical Instruments - Reflection of Light by Spherical Mirrors, Refraction, Total Internal Reflection, Refraction at Spherical Surfaces and by Lenses, Refraction through a Prism, Dispersion by a Prism, Some Natural Phenomena due to Sunlight, Optical Instruments

iv. Wave Optics - Huygens Principle, Refraction and reflection of plane waves using Huygens Principle, Coherent and Incoherent Addition of Waves, Interference of Light Waves and Young's Experiment, Diffraction, Polarisation

4. Electricity and Electromagnetism

i. Electric Charges and Fields - Electric Charges, Conductors and Insulators, Charging by Induction, Basic Properties of Electric Charge, Coulomb's Law, Forces between Multiple charges, Electric Field, Electric Field Lines, Electric Flux, Electric Dipole, Dipole in a uniform external field, Continuous Charge Distribution, Gauss's Law, Application of Gauss' Law

ii. Electrostatic Potential and Capacitance - Electrostatic Potential, Potential due to a point charge, Potential due to an Electric Dipole, Potential due to a System of Charges, Equipotential Surfaces Potential Energy of a System of Charges, Potential Energy in an External field, Electrostatics of Conductors, Dielectrics and Polarisation, Capacitors and Capacitance, The Parallel Plate Capacitor, Effect of Dielectric on Capacitance, Combination of Capacitors, Energy Stored in a Capacitor, Van de Graaff Generator .

iii. Current Electricity - Electric current, Electric current in conductors, Ohm's Law, Drift Electrons and Origin of Resistivity, Limitations of Ohm's Law, Resistivity of various Materials, Temperature Dependence of Resistivity, Electric Energy, Power, Combination of Resistors – Series and Parallel, Cells, emf, Internal Resistance, Cells in Series and in Parallel, Kirchhoff's Laws, Wheatstone Bridge, Meter Bridge, Potentiometer

iv. Moving Charges and Magnetism - Magnetic Force, Motion in a Magnetic field, Motion in combined Electric and Magnetic Fields, Magnetic Field due to a Current Element, Biot-Savart Law, Magnetic Field on the Axis of a Circular Current Loop, Ampere's Circuital Law, The Solenoid and the Toroid, Force between two Parallel Currents, The Ampere, Torque on Current Loop, Magnetic Dipole, The Moving Coil Galvanometer

v. Magnetism and Matter - The Bar Magnet, Magnetism and Gauss's Law, The Earth's Magnetism, Magnetisation and Magnetic Intensity, Magnetic Properties of Materials, Permanent Magnets and Electromagnets

vi. Electromagnetic Induction - The experiments of Faraday and Henry, Magnetic Flux, Faraday's Law of Induction, Faraday's Law of Induction, Lenz's Law and Conservation of Energy, Motional Electromotive Force, Energy consideration: A Quantitative Study, Eddy Currents, Inductance, AC Generator

vii. Alternating Current - Introduction, AC voltage applied to a Resistor, Representation of AC Current and Voltage by Rotating Vectors- Phasors, AC voltage

applied to an Inductor, AC voltage applied to a Capacitor, AC voltage applied to a Series LCR Circuit, Power in AC Circuit: The Power Factor, LC Oscillations, Transformers

viii. Electro Magnetic Waves - Displacement Current, Electro Magnetic Waves,4 Electromagnetic Spectrum

5. Thermodynamics and statistical Physics

i. Thermal Properties of Matter - Temperature and Heat, Measurement of Temperature, Ideal Gas Equation and Absolute Temperature, Thermal Expansion, Specific Heat Capacity, Calorimetry, Change of State, Newton's Law of Cooling

ii. Thermodynamics - Thermal equilibrium, Zeroth law of thermodynamics, Heat, Internal energy and work, First law of thermodynamics, Specific heat capacity, Thermodynamic state variables and equation of state, Thermodynamic Process, Heat Engines, Refrigerators and Heat pumps, Second law of thermodynamics, Reversible and irreversible processes, Carnot engine

iii. Kinetic Theory - Molecular nature of matter, Behaviour of gases, Kinetic theory of an ideal gas, Laws of equipartition of energy, Specific heat capacity, Mean free path

6. Electronics

i. Semiconductor Electronics: Materials, Devices and Simple Circuits – Classification of Metals, Conductors and Semiconductors Intrinsic Semiconductor, Extrinsic Semiconductor, p-n junction, Semiconductor diode, Application of Junction Diode as a Rectifier, Special Purpose p-n Junction Diodes, Junction Transistor, Digital Electronics and Logic Gates, Integrated Circuits

ii. Communication Systems - Elements of communication system, Basic Terminology used in Electronic Communication Systems, Bandwidth of Signals, Bandwidth of Transmission Medium, Propagation of Electromagnetic Waves, Modulation and its Necessity, Amplitude Modulation, Production of Amplitude Modulated Wave, Detection of Amplitude Modulated Wave

7. Atomic & Molecular Physics

i. Dual Nature of Radiation and Matter - Electron Emission, Photoelectric Effect, Experimental Study of Photoelectric Effect, Photoelectric Effect and Wave Theory of Light, Einstein's Photoelectric Equation: Energy Quantum of Radiation, Particle Nature of Light: The Photon, Wave Nature of Matter, Davisson and Germer Experiment

ii. Atoms - Alpha-particle Scattering and Rutherford's Nuclear model of Atom, Atomic Spectra, Bohr Model of the Hydrogen Atom, The Line Spectra of the Hydrogen Atom, De Broglie's Explanation of Bohr's Second Postulate of Quantisation

iii. Nuclei - Atomic Masses and Composition of Nucleus, Size of the Nucleus, Mass-Energy and Nuclear Binding Energy, Nuclear Force, Radioactivity, Nuclear Energy

Part V- Pedagogy

1. Nature of Physical Sciences

i. Science as a particular way of looking at nature, a rapidly expanding body of knowledge, an interdisciplinary area of learning, always tentative, an approach to investigation and as a Process of constructing knowledge.

ii. Scientific Method: Observation, inquiry, hypothesis, experimentation, data collection, generalization.

iii. How Science Works, how children learn science?

2. Science and Society – Historical Development

i. Physical science for environment, health, peace, equity (Gender & Science) and Inclusion.

ii. Need and Significance of History of science in teaching science – Historical development perspective of Science.

iii. Contributions of Scientists– Isaac Newton, John Dalton, J.C. Bose, Albert Einstein, Niels Bohr, C.V. Raman, Louis Victor de Broglie, Bimla Buti, Venkataraman Ramakrishnan, APJ Abdul Kalam, Marie Curie.

3. Aims of Learning Physical Science

i. Aims of Learning Science

ii. Knowledge and Understanding through Science

iii. Nurturing Process Skills of Science, Curiosity, Creativity and Aesthetic Sense

iv. Development of Scientific Attitude and Scientific Temper- Respect for evidence, Open-mindedness, Truthfulness in reporting observations, Critical thinking, Logical thinking, Skepticism, Objectivity, Perseverance – Notion of Popular Science – Its importance and involvement of science teacher.

v. Relating Physical Science Education to Natural and Social Environment, Technology, Society and Environment.

vi. Imbibing the Values Through Science Teaching – Feynman's Perspective of Science values

vii. Development of Problem Solving Skills

4. Learning objectives of physical science

i. Meaning of Learning Objectives

ii. Developing Learning Objectives, Features of well-developed learning objectives.

iii. Bloom's Taxonomy, Anderson and Krathwohl's Taxonomy

iv. Writing Learning Objectives, Remembering, Understanding, Applying, Analysing, Evaluating, Creating

v. Learning Objectives for Upper Primary, Secondary and Higher Secondary Stages

vi. Learning Objectives in the Constructivist Perspective

vii. Academic Standards in Physical Science

5. Pedagogical Shift in Physical Science

i. Pedagogical Shift:

a. Science as Fixed Body of Knowledge to the Process of Constructing Knowledge

b. Nature of Science

c. Learners learning and teacher

d. Physical Science curriculum, Diversity in class, Approaches

e. Planning Teaching-Learning Experiences

f. Assessment

g. Inclusion- Information and Communication Technology (ICT)

h. Professional development

ii. Democratising Science Learning: Critical Pedagogy- Critical pedagogy and role of Teachers.

iii. Content-cum-methodology: Meaning, Concept & Nature

iv. Steps to Content-cum-methodology

v. Steps to Pedagogical Analysis

vi. Content and Teaching Skills

6. School Curriculum in Physical Science

i. History of Development of Curriculum Framework

ii. Curriculum Framework, Curriculum and Syllabus

iii. Curriculum Development; From Subject-centred to Behaviourist to Constructivist Approach,

iv. Recommendations of NCF-2005 and APSCF-2011 on Science Curriculum-National Focus Group position paper on Science and State position paper (2011) on Science

v. Print Resources- Textbooks, Popular science books, Journals and magazines

vi. Dale's Cone of Experience- Using the Cone of Experience

vii. Teacher as Curriculum Developer – Localized curriculum, place for Artisans knowledge systems in curriculum, local Innovators and Innovative Practices of science.

7. Approaches and Strategies for Learning Physical Science

i. Approaches and Strategies for Learning Physical Science, Difference between approach and strategy.

ii. Different approaches and strategies of learning

   a. Scenario from 1950–1980
   b. Post 1980 Scenario
   c. Selecting appropriate approach and strategy

iii. Essential components of all approaches and strategies

iv. Constructivist Approach – Science teaching strategies – State developed model.

v. 5E Learning Model

vi. Collaborative Learning Approach (CLA)

   a. Steps of collaborative approach
   b. Ensuring meaningful learning through CLA
   c. Ways of applying collaborative learning approach
   d. Limitation of collaborative learning approach

vii. Problem Solving Approach (PSA)

   a. Steps in problem solving approach,
   b. Teacher's role in problem solving approach,
   c. Problem solving approach: an example

viii. Concept Mapping- Phases of the concept mapping, Uses of concept maps

ix. Experiential Learning- Abilities of an experiential learner

8. Learning Resources – Community, ICT and Laboratory

i. Using Community Resources- Bringing community to the class, Taking class to the community: Field visit

ii. Pooling of Learning Resources

a. Learning Resources from Immediate Environment (Natural pH indicators, Soaps and detergents, Baking soda, Washing soda, Common salt, Fruits, Fibre, Pulleys, Projectiles, Lenses and Mirrors, Inter-conversion of one form of energy to other, Propagation of waves in Solid, Liquid and Gas)

b. Improvisation of Apparatus

c. Inexpensive Sources of Chemicals

iii. Science Kits

iv. Laboratory as a Learning Resource- Approaches to laboratory work, Planning and organising laboratory work, Working in group in the laboratory

v. Handling Hurdles in Utilization of Resources – Addressing underutilization of resources.

vi. ICT resources – e-Text books, Journals, Websites, Magazines, Different forms of ICT and its applications in science education- Audio-aids, Video-aids, Audio-Video aids, educational T.V., Use of computer for simulations, internet and Open Educational Resources

9. Planning for Teaching-Learning of Physical Sciences

i. Planning - Annual Plan, Unit Plan and Period plan

ii. Identification and Organisation of Concepts for teaching -learning of science / Physics and Chemistry (Motion, Work and Energy, Matter and their Measurements, Carbon and its Compounds, Periodic Properties of Elements, Atomic Structure, Dual Nature of Matter and Radiation).

iii. Elements of a Physical Science Lesson- Learning objectives and key concepts, Pre-existing knowledge, Teaching-learning materials and involving learners in arranging them, Introduction, Presentation/ Development, Assessment: Acceptable evidences that show learners understand (i) Determining learning evidences (ii) Planning of the acceptable evidences of learning for assessment Extended learning/assignment.

iv. Making Groups-Why group learning? Facilitating formation of groups

v. Planning and Organising Activities in Physical Science

vi. Planning Laboratory Work – State commitments in organizing experiments Text-book orientation.

vii. Planning ICT Applications - Integrating ICT in teaching and learning process

10. Physical Science Teacher

i. Characteristics and role Science Teacher

ii. Professional Development

iii. Reflective Practices

iv. Science Teacher as a Researcher

11. Tools and Techniques of Assessment

i. Test, Examination, Measurement, Assessment and Evaluation.

ii. Continuous and Comprehensive Evaluation (CCE)- Educational assessment and educational evaluation, Performance-based assessment: A flexible way of school based assessment.

iii. Assessment Framework,

(a) Purpose of assessment

(b) Learning Indicators (LI);

- Types of indicators
- Illustrations of Learning Indicators,
  - Assessment of activity
  - Assessment of presentation
  - Assessment of group work
  - Assessment of collaborative learning

(c) Tools and Techniques of Assessment;

- Written test
- Project Work
- Field trips and field diary
- Laboratory work
- Interview/Oral test
- Journal writing.

(d) Recording and Reporting

- Measurement of students' achievements
- grading system
- Measurement of process skills
- Measurement of attitudes
- Portfolios

(e) Reflecting Process; Assessment as a reflecting process

iv. Assessment of Learning of Students with Special Needs.