Joint Entrance Screening Test

PHYSICAL SCIENCES

Syllabus

Mathematical Methods

Vector algebra and vector calculus, tensors, curvilinear coordinate systems, linear algebra; Linear differential equations, elements of Sturm–Liouville theory; Special functions; Complex analysis; Fourier series and Fourier transforms, Laplace transforms; Elementary properties of discrete groups; Elements of probability theory, error analysis.

Classical Mechanics

Newton's laws, conservation of energy and momentum, collisions; generalized coordinates, principle of least action, Lagrangian and Hamiltonian formulations of mechanics; Symmetry and conservation laws; central force problem, Kepler problem; Small oscillations and normal modes; special relativity in classical mechanics.

Electromagnetism & Optics

Electrostatics and magnetostatics, boundary value problems, multipole expansion;

Fields in conducting, dielectric, diamagnetic and paramagnetic media; Faraday's law and time varying fields; displacement current; Maxwell's equations; energy and momentum of electromagnetic fields; Propagation of plane electromagnetic waves, reflection, refraction; Electromagnetic waves in dispersive and conducting media; diffraction, interference, polarization.

Quantum Mechanics

Uncertainty principle; Schrodinger equation; central potentials, hydrogen atom; Orbital and spin angular momenta, addition of angular momenta; Matrix formulation of quantum theory, unitary transformations, Hermitian operators; Variational principle, time independent perturbation theory, time dependent perturbation theory.

Thermodynamics & Statistical Physics

Laws of thermodynamics, work and heat, thermodynamic potentials; Elements of kinetic theory; Maxwell's relations; Statistical ensembles; partition function; classical ideal gas, harmonic oscillators; Classical and quantum statistics; Fermi and Bose gases; black body radiation; statistics of paramagnetism

Electronics

Basics of semiconductor; p-n junctions, diodes, transistors; LCR circuits, rectifiers, amplifiers, active filters and oscillators; basics of OPAMPs and their applications; basics of digital electronics.

Applicants seeking admission for a Ph.D / Integrated Ph.D Programme in Physics or Theoretical Computer Science or Neuroscience or Computational Biology in one of the Participating Institutes may appear for the Joint Entrance Screening Test (JEST).

The Science & Engineering Research Board (SERB) (statutory body established through an Act of Parliament) recognizes **JEST** as a **National Eligibility Test (NET)**. Fellows working in **SERB programmes** and qualified in **NET** are eligible to get enhanced fellowship.

Participating Institutes have their own eligibility criteria. Applicants who are expected to complete their final examinations by August of each year are also eligible to appear for the JEST exam of that year.

JEST Schedule

JEST is conducted **once in a year**, i.e., in the months of **February**. The notifications announcing the **JEST** published in the months of October in the weekly journal of nation-wide circulation (Employment News).

Eligibility

Ph.D. Programme Physics

M.Sc in Physics, Applied Physics, Optics and Photonics Instrumentation, Electronics, Astronomy, Applied Mathematics, Engineering Physics, Chemistry, Applied Mathematics, Biophysics or Biochemistry.

B.E./ B.Tech. / M.E. / M.Tech./MCA in all discipline.

Integrated M.Sc. / M.Tech - Ph.D Programme (Physics)

B.Sc. (Physics / Mathematics) / B.E. / B.Tech. in Electrical / Instrumentation / Engineering Physics / Electronics and Communications / Computer Science and Engineering / Optics and Photonics.

Scheme of JEST Test

Part A contains 15 questions, and carry 3 (three) marks each for correct answer, and -1 (negative one) mark for incorrect answer.

Part B contains 10 questions and each carries 3 (three marks). These questions must be answered by integers of 4 digits each. Answer these questions on the OMR by filling in bubbles in the OMR sheet. There are NO NEGATIVE MARKS for these questions.

Part C contains 25 questions, and each carries 1 (one) mark for the correct answer, and -1/3 (negative one third) mark for incorrect answer. Multiple choice questions have only one correct answer.

Participating Institutes

Visit the individual institute pages to view the programmes and subject areas being offered.

ARIES	Aryabhatta Research Institute of Observational Sciences, Nainital: Astronomy and Astrophysics, and Atmospheric Physics.
Bose Institute	Bose Institute, Kolkata: Atmospheric sciences, Biophysics, Complex systems and networks, Condensed matter physics and materials science, High energy physics and astroparticle physics, Quantum physics and quantum information, Nuclear and radiation physics
HBNI	Homi Bhabha National Institute, Mumbai
HRI	Harish-Chandra Research Institute, Allahabad:Theoretical Physics, Astrophysics
ICTS	International centre for theoretical sciences (TIFR), Bangalore:Astrophysical Relativity, Data Assimilation and Dynamical Systems, Statistical Physics and Turbulence, and String theory and Quantum Gravity.
IGCAR	Indira Gandhi Centre for Atomic Research, Kalpakkam:Solid State Phase transformations, Superconductivity, Structure and dynamics of soft condensed matter, Band structure studies, Accelerators based Irradiation induced phenomena, Low-dimensional systems, Physics of interfaces, Nano-materials, Thin films technology and Theoretical physics

IIA	Indian Institute of Astrophysics, Bangalore: Astronomy and Astrophysics, Astronomical Instrumentation, Optics, and Atomic Physics.
IISc	Indian Institute of Science, Bangalore: Condensed Matter Physics (Experiments and Theory), Astronomy and Astrophysics (Theoretical), Atomic and Optical Physics (Experimental), Biocrystallography and Bio-informatics, and High Energy Physics (Theoretical).
IISER BHOPAL	Indian Institute of Science Education and Research Bhopal: Condensed Matter Physics (Theory and Experiment), Soft Matter Physics (Theory), Biophysics, Laser Plasma Interactions, Ultrafast Physics (Experiment), Astrophysics and Cosmology, High Energy Physics (Theory, Phenomenology and Experiment), Non-linear Optics
IISER KOLKATA	Indian Institute of Science Education and Research Kolkata: Condensed Matter Physics, Field Theory, Classical & Quantum Gravity, Cosmology, Solar Science, High Energy Physics, Non-linear dynamics, Statistical Physics, Soft Matter, Optics & Spectroscopy, Atomic physics, Biophotonics, Spintronics, Nanoscience, NMR, Quantum Information
IISER MOHALI	Indian Institute of Science Education and Research, Mohali: Quantum Theory, Quantum Information Processing, NMR-Methodology, Optics, Statistical Mechanics, Quantum Thermodynamics, Non-linear Dynamics, String Theory, Ultrafast Physics, and Low Temperature Mesoscopic Physics.
IISER PUNE	Indian Institute of Science Education and Research, Pune: Field Theory, Theoretical Particle Physics, Condensed Matter Physics, Non-linear Dynamics, Complex Systems and Networks, Nuclear Magnetic Resonance Spectroscopy, Quantum Information Processing, Radio Astrophysics, Atomic Physics and Quantum Optics, Energy Studies, Solar and Plasma Physics, Nanosciences, Scanning Probe Techniques, and Semiconductor Physics and Devices.
IISER THIRUVANANTHAPURAM	Indian Institute of Science Education and Research, Thiruvananthapuram: Experimental Condensed Matter: Magnetic and Superconducting materials, Nanoscience and Energy materials, Photonics, Soft Condensed Matter, Semiconductor Physics and Devices, Surface Sciences and Nano-scale Plasmonics, Terahertz and Ultrafast Spectroscopy; Theory:

	Cosmology, Classical and Quantum Gravity, Gravitational Wave Physics, Quantum Information Theory, Quantum Field Theory, and Statistical Physics.
IIST	Indian Institute of Space Science and Technology, Thiruvananthapuram: Astronomy and Astrophysics, Atmospheric Sciences, Applied and Adaptive Optics, Atomic and Molecular Physics, Condensed Matter Physics, Nanotechnology, Nonlinear Dynamics, Photonics, Quantum Information and Statistical Physics
IMSc	The Institute of Mathematical Sciences, Chennai:Theoretical Physics, Theoretical Computer Science, and Computational Biology
IOP	Institute of Physics, Bhubaneswar: Physics (Condensed Matter, Nuclear and High Energy Physics) and Accelerator-based Research.
IPR	Institute for Plasma Research, Gandhinagar: Physics (Experimental and Theoretical).
IUCAA	Inter-University Centre for Astronomy and Astrophysics, Pune: Physics, Astronomy and Astrophysics.
JNCASR	Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore: Experimental and Theoretical Condensed Matter Physics, Statistical Mechanics, and Materials Science.
NBRC	National Brain Research Centre, Manesar:Molecular, Computaional and Systems Neuroscience. Sensory & motor systems, learning & memory, language & speech processing, functional neuroimaging: EEG, MEG, fMRI, MRS, stem cells, developmental neurobiology, neurogenetics, neurodegenerative and neurodevelopmental disorders, cancer signaling & glial tumor biology.
NCRA-TIFR	National Centre for Radio Astrophysics, TIFR, Pune:Astronomy and Astrophysics.
NISER	National Institute of Science Education and Research, Bhubaneswar: Theoretical High Energy Physics and Lattice QCD, Experimental High Energy Physics, Condensed Matter Physics (Theory and Experiment), Optics and Metamaterials.
PRL	Physical Research Laboratory, Ahmedabad: Theoretical Physics, Astronomy

	and Astrophysics, Solar Physics, Space and Atmospheric Sciences, Planetary Science and Geo-Sciences.
RRCAT	Raja Ramanna Centre for Advanced Technology, Indore:Lasers and their Applications, Laser Plasma Interaction, Cold Atom Physics, Condensed Matter Physics (Superconductivity and Magnetism, Crystals and Thin Films), Nanomaterials and Applications, Non-linear and Ultrafast Optical Studies, Beam Physics, and Free Electron Laser.
RRI	Raman Research Institute, Bangalore: Astronomy and Astrophysics, Light and Matter Physics, Soft Condensed Matter Physics (Liquid Crystals, Physics in Biology), and Theoretical Physics.
SINP	Saha Institute of Nuclear Physics, Kolkata: Condensed Matter Physics (Theory and Experiments), Nuclear Physics (Theory and Experiments), High Energy Physics (Theory and Experiments), Astroparticle Physics, Quantum Gravity, String Theory, Mathematical Physics, and Materials Science (Surface Science and Plasma Physics).
SNBNCBS	Satyendra Nath Bose National Centre for Basic Sciences, Kolkata: Astrophysics and Cosmology, Chemical and Biological Physics, Condensed Matter Physics and Material Science, High Energy Physics and Quantum Field Theory, Mathematical Physics, Nanosciences, Quantum Optics and Quantum Information, Statistical Physics, and Complex Systems.
TIFR-TCIS	TIFR Centre for Interdisciplinary Sciences, Hyderabad: Condensed Matter Physics & Materials Science of Nonequilibrium, Soft & Living matter, Fluid Dynamics, Intense Laser-matter interactions, Computational Physics, Statistical physics, NMR of Biophysical & other systems
TIFR	Tata Institute of Fundamental Research, Mumbai: Astronomy and Astrophysics, Condensed Matter Physics and Material Science, High Energy Physics, Nuclear and Atomic Physics, Theoretical Physics
UGC-DAE CSR	UGC-DAE Consortium for Scientific Research, Indore:Surfaces, Interfaces, Thin Films and Nanomaterials, Physics at Low Temperatures and High Magnetic Fields, X-ray, Optical and Electron Spectroscopic Studies Using Synchrotron

	and Laboratory Sources; Electrical, Magnetic and Thermal Properties of Condensed Matter; Condensed Matter studies using Magnetic Neutron Diffraction, Nuclear Technique Based Condensed Matter Physics-Positron Annihilation Spectroscopy, Mossbauer Spectroscopy, Experimental Nuclear Physics, Gamma Ray Spectroscopy of Nuclear High Spin States, and Nuclear Reactions.
VECC	Variable Energy Cyclotron Centre, Kolkata: Accelerator Physics, Condensed Matter Physics and Materials Science, Nuclear Physics (Experiments and Theory), Relativistic Heavy Ion Collisions (Experiments, Theory, QCD and QGP), and Physics of Neutrinos (Experiments).