SYLLABUS OF WRITTEN TEST FOR RECRUITMENT TO THE POST OF SCIENTIST/ENGINEER 'SC'
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DOMAIN: APPLIED OPTICS / OPTICAL ENGINEERING / OPTICS & PHOTONICS / OPTICS & OPTO ELECTRONICS
Post Code – 10

General Optics

Electromagnetic Spectrum, Light Wave Propagation, Reflection and Refraction, Interference, Diffraction and Polarization, Photoelectric Effect, Image Formation, Cardinal Points of an optical system, Paraxial consideration, Thin Lens approximation, Aberration Polynomial and Seidal Aberrations, Chromatic Aberrations, Wave Front Aberrations, Strehl Ratio, Prisms, Minimum Deviation, Total Internal Reflection, Penta Prisms, Beam Splitters, Plane and Curved Mirrors, Stops, Pupils and Apertures, Spectral Elements: Prism, Grating, Grism, Optical Instruments: Telescopes, Microscopes, Binoculars, Autocollimators etc.

Optical Sources and Photometry

Types of optical sources and materials, Inverse Square Law, Radiance and Lambert's Law, Radiance into a Hemisphere, Irradiance from a diffused source, Radiometry, Black Body Radiation, Photometry.

Optical System Design

Merit Function, Optimization, Local Minima, Test Plate Fits, Melt Fits, Lens design Prescription, Design consideration for Singlet, Doublet, Null Corrector, Vignetting and its uses, Balancing aberrations, Telescopic Objectives, Eyepieces and Magnifiers, Telephoto Lenses, Wide angle Lenses, Zoom Lenses, Tele-centric Lenses, Microscope Objectives, Mirror and Catadioptric Systems, Infrared Optics

Optical Fabrication and Metrology

Optical Materials, Grinding, Polishing, Surface Quality, Single Point Diamond Turning (SPDT), Geometric Testing, Interferometric Testing, Non-contact Profilometry, Coordinate Measuring Machine (CMM), Surface Roughness, Optical Coatings and Thin Films, Lens Fabrication.

Advanced Electromagnetic Theory

Maxwell's equations; Boundary Conditions at dielectric and metallic interfaces, Poynting's Theorem, Energy density in dispersive media, Radiation Pressure, Scalar and Vector Potentials, Hertz Potentials, Coulomb and Lorentz gauges, Wave Propagation in Homogeneous Media, Reflection and Transmission at normal and oblique incidences, Complex Refractive Index, Skin Effect, Polarization of EM Waves, Jones Vectors and Matrices, Stokes Parameter, Birefringent Media, Dispersion: Group velocity and Phase velocity, pulse broadening, Fresnel's equation, Critical and Brewster's angle, Evanescent Waves, Scattering Theory, Rayleigh and Mie scattering, Dielectric Waveguides, Planar Waveguides, Coupled Mode Theory, Anisotropic Media: Crystal optics, Index ellipsoid, electro-optic effect, Photonic Crystals, Meta materials and Surface Plasmons.

Quantum Mechanics and Applications in Optics

Wave-particle duality, Heisenberg uncertainty principle, Schrödinger equation (time-dependent and time-independent), Eigenstates, Potential Wells, Dirac notation for state vectors, Motion in a central potential: orbital angular momentum, spin, Hydrogen atom model, Perturbation theory: Stark and Zeeman Effect, Fermi's golden rule, Quantum Statistics: Bosons and Fermions, Identical particles, Pauli exclusion principle, Distribution Laws, Band Theory of Solids, Quantum Optical Applications; Quantum Wells, Quantum Information; Photon Entanglement and Quantum Key Distribution (QKD).

Laser and Applications

Interaction of Light with matter, Absorption, Spontaneous and Stimulated Emission, Einstein Relation, Population Inversion, Pumping and Metastable State, Optical Resonant Cavity, Modes of Laser, Solid State Laser, He- Ne Laser, Semiconductor Laser, Q Switching, Laser Applications.

Non Linear Optics

Optical Nonlinearity, Second Harmonics, Frequency Mixing, Phase Matching, Optical Kerr effect, Self-Focusing, Raman Scattering and Spectroscopy.

Optical Fiber Communication

Opto-electronic Devices, Light Emitting Diodes, Laser Diodes, Photodetectors, Optical Modulators, Optical Fibers, Single mode and multimode fibers, Fiber Bragg Grating, Fiber Amplifiers.

Fourier Optics

Fourier Transform, Linear Shift Invariant System, Impulse Response, Transfer function, Spatial Frequency, Point Spread Function, Lens as a Fourier transformer, Coherent and Incoherent Imaging, Spatial Filtering, Image Enhancement and Restoration

Adaptive Optics

Atmospheric Turbulence and Light Propagation, Wavefront Sensing Techniques, Wavefront Correctors and Actuators, Reconstruction Algorithms.

Hindi version shall follow.