ENGINEERING PHYSICS
SYLLABUS OF EXAMINATIONS
1998 EDITION

For textbook information please refer to the **Textbooks** section on page 3 of the document entitled **Information for Students and Examinations Candidates**.

GROUP A
COMPULSORY EXAMINATIONS (seven required)

98-Phys-Al   Classical Mechanics

Review of fundamental principles; Lagrangian Mechanics; non-conservative and non-holomonic systems; central force problem; motion of a rigid body; variational principles, and an introduction to Hamilton's equations.

98-Phys-A2   Statistical Physics

Kinetic theory of gases; Quantum states, temperature, entropy, chemical potential, Boltzmann factor, fermions and bosons. Fermi-Dirac distributions and electrons in metals. Bose-Einstein distributions and photons, Debye theory of phonons.

98-Phys-A3   Electromagnetics (98-Elec-A7)

Field concepts. Maxwell's equations. Free space and guided wave propagation, transmission lines. Radiation from current elements.

98-Phys-A4   Quantum Mechanics

Breakdown of classical mechanics. Schrodinger equation and elementary systems; one dimensional problems. Postulates and interpretation of quantum mechanics. Algebraic solution of the Schrodinger equation for the harmonic oscillator. Angular momentum and spin. Central force problems; the hydrogenic atom. Concepts and applications of tunneling. Perturbation theory.

98-Phys-A5   Semiconductor Devices and Circuits

Semiconductor physics; band theory, drift and diffusion. Semiconductor devices; diodes, bipolar and MOS devices. Time and Frequency responsed linear circuits. Small signal and operational amplifiers. Digital circuits and logic families; D/A and A/D conversion; instrumentation.

98-Phy-A6   Solid State Physics

Lattice structure and bonding. Lattice vibrations and phonons. Electrons in solids, band structure of metals, semiconductors and insulators, the Fermi surface. Semiconductors and junctions. Paramagnetism and diamagnetism. Introduction to lattice defects.

98-Phys-A7   Optics

Gaussian optics, optical instruments, matrix analysis of lens systems, aberrations, polarization: double and multiple-beam interference. Fraunhofer and Fresnel diffraction, fibre optics, contemporary optics design.

GROUP B
ELECTIVE EXAMINATIONS (three required)

98-Phys-B1   Radiation Physics

Atomic and nuclear structure, isotopes, radioactivity, X-rays, attenuation and absorption in matter, detection of radiation, radiation instrumentation, dosimetry, radiation protection, radiation safety and standards, non-ionizing radiation.

98-Phys-B2   Electro-Optical Engineering (98-Elec-B11)

Optical transmission: waveguide modes, fibre optic propagation characteristics. Optoelectronics: lasers, sources and detectors, couplers, modulators, guided wave devices. Applications.

98-Phys-B3   Digital Systems and Computers (98-Elec-A4)

Combinatorial and sequential switching circuits. Register level design of digital systems. Computer memories. Computer architecture, assembly language programming, interrupts, and interfacing.

98-Phys-B4   Communications (98-Elec-A3)

Amplitude and frequency modulation systems: signals, spectra, implementation. Sampling of continuous signals and the Nyquist sampling theorem. Fourier series and transforms, spectral concepts. Discrete signals and systems: the sampling theorem, time and frequency response, the Z-transform. PCM and simple baseband pulse code modulation systems.

98-Phys-B5   Control (98-Elec-A2)

Models, transfer functions, and system response. Root locus analysis and design. Feedback and stability: Bodes diagrams. Nyquist criterion, frequency domain design. State variable representation. Simple PID control systems.

98-Phys-B6   Applied Thermodynamics and Heat Transfer (98-Mec-Al)

Applied Thermodynamics: Review of fundamental laws and their applications to closed and open systems. Vapour cycles for power and refrigeration; cycle modifications including reheat, regeneration. Gas cycles; spark ignition and compression ignition cycles. Gas turbine cycles, including modifications such as regeneration and intercooling; effects of component efficiency on performance.

Heat Transfer: Conduction in one and two-dimensional systems; steady state and transient regimes. Natural- and forced-convection problems. Radiation heat exchange between black, gray, and real surfaces. Thermal design of heat exchangers.

98-Phys-B7   Structure of Materials (98-Met-A4)

Atomic and molecular structure. Metallic, ionic, covalent and Van der Walls's, Crystal structure, space lattices and Miller indices. Crystalline and non-crystalline (amorphous). Solidification (crystallisation) and associated microstructures of cast metals and phenomena of grain boundaries. Observations of material structure (X-ray techniques, metallography, optical and electron microscopy). Defects in solids, dislocation and slip, vacancies and diffusion. Basic mechanisms of deformation processes of materials. Phase diagrams (solid solution systems, eutectic and eutectoid systems, peritectic reaction, intermetallic compounds). Application of lever rule to phase proportions in common single- and binary-phase systems.

Revised April 2005