Engineering physics syllabi

Engineering physics examinations

Group A - Compulsory examinations (seven required)

17-Phys-A1 Classical Mechanics

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

Textbooks (most recent edition is recommended):

Primary Text:

Secondary Text:

17-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, Black-body radiation, Debye theory of phonons.

Textbooks (most recent edition is recommended):

Primary Text:
- Charles Kittel and Herbert Kroemer, Thermal Physics, W H Freeman & Co (Sd); 2nd ed. edition (Dec 17 2012)

Secondary Text:

17-Phys-A3 Electromagnetics (16-Elec-A7)


Textbooks (most recent edition is recommended):

- Demarest, Engineering Electromagnetics, Prentice-Hall.

17-Phys-A4 Quantum Mechanics


Textbooks (most recent edition is recommended):
17-Phys-A5-A Electronic Materials and Devices

Semiconductor physics; band theory, drift and diffusion. Semiconductor devices; diodes, bipolar and MOS devices, sensors and transducers. Other electronics related materials; dielectrics, piezoelectrics, and magnetic materials and their application to modern sensors and transducers.

Textbooks (most recent edition is recommended):

Primary Text:

Secondary Text:

17-Phys-A5-B Analog and Digital Electronic Circuits


Textbooks (most recent edition is recommended):

17-Phys-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. The effects of reduced size/dimensionality, i.e., nanostructures. Semiconductors and junctions. Paramagnetism and diamagnetism. Introduction to lattice defects.

Textbooks (most recent edition is recommended):

Primary Text:

Secondary Text:

17-Phys-A7 Optics

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

Textbooks (most recent edition is recommended):

Group B - Optional examinations (three required)

17-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.

**Textbooks (most recent edition is recommended):**


**17-Phys-B2 Electro-Optical Engineering (16-Elec-B10)**


**Textbooks (most recent edition is recommended):**


**17-Phys-B3 Digital Systems and Computers (16-Elec-A4)**


**Textbooks (most recent edition is recommended):**


**17-Phys-B4 Signals and Communications (16-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. Digital modulation techniques, e.g., ASK, PSK, QAM.

**Textbooks (most recent edition is recommended):**


Or


**17-Phys-B5 Systems and Control (16-Elec-A2)**


**Textbooks (most recent edition is recommended):**


**17-Phys-B6 Applied Thermodynamics and Heat Transfer (16-Mec-A1)**

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.

Textbooks (most recent edition is recommended):


17-Phys-B7 Structure of Materials (10-Met-A4)


Textbooks (most recent edition is recommended):

Primary Text:

Secondary Text: