A.P.P.S.C. Government Polytechnic College Lecturer Posts

Electronics & Communication Engineering Syllabus

Paper I: General Studies and Mental Ability

- Major Current Events and Issues of International, National, and State of Andhra Pradesh.
- General Science and its applications to the day to day life Contemporary developments in Science & Technology and Information Technology.
- History of India – emphasis will be on a broad general understanding of the subject in its social, economic, cultural, and political aspects with a focus on AP and the Indian National Movement.
- Geography of India with a focus on Andhra Pradesh.
- Indian polity and Governance: constitutional issues, public policy, reforms and eGovernance initiatives.
- Indian Economy and Planning
- Sustainable Development and Environmental Protection
- **Disaster management:** vulnerability profile, prevention, and mitigation strategies, Application of Remote Sensing and GIS in the Assessment of Disaster
- Logical reasoning, analytical ability, and logical interpretation.
- **Data Analysis:** Tabulation of data Visual representation of data Basic data analysis (Summary Statistics such as mean, median, mode, and variance) and Interpretation.

Paper II: Physics

I. Mathematical Methods of Physics:

Dimensional analysis, Vector algebra and vector calculus, Linear algebra, matrices, Caley-Hamilton theorem, Eigenvalue and eigenvectors, Linear ordinary differential equations of first and second order, Special functions (Hermite, Bessel, Laguerre and Legendre). Fourier series, Fourier and Laplace transform. Elements of complex analysis, analytic functions: Taylor and Laurent series; poles, residues and evaluation of integrals. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem. Data interpretation and analysis, Precision and accuracy. Error analysis, propagation of errors. Least square fitting, linear and nonlinear curve fitting and Chi-square test. Introductory group theory; SU(2), 0(3).

II. Classical Mechanics:

Newton's laws, Phase space dynamics, stability analysis, Central force motion. Two body collisions, scattering in laboratory and center-of-mass frames, Rigid body dynamics, moment of inertia tensor, Non-inertial frames and pseudoforces. Variational principle, Generalized

coordinates, Lagrangian and Hamiltonian formalism and equations of motion. Poisson brackets and canonical transformations, Symmetry, invariance and Conservation laws, cyclic coordinates. Periodic motion, small oscillations, normal modes. Special theory of relativity, Loretz transformations, relativistic kinematics and mass-energy equivalence.

III. Electromagnetic Theory:

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems; Magnetostatics: Biot -Savart law, Ampere's theorem, electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces; Scalar and Vector Potentials, Gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors. Reflection, Refraction and Polarization, Fresnel's law, interference, coherence and diffraction. Lorentz invariance of Maxwell's equations, Dynamics of charged particles in static and uniform electromagnetic fields. Radiation from moving charges, dipoles and retarded potentials.

IV. Quantum Mechanics:

Wave particle duality, Schrodinger equation: time dependent and time independent. Wave functions in coordinate and momentum representations, Eigenvalue problems: particle in a box, harmonic oscillator etc.; Tunneling through a barrier. Wave function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Matrix representation, Dirac notation and state vectors. Motion in central potential: orbital angular momentum, angular momentum algebra, Spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Time independent perturbation theory and applications. Variational method. Time dependent perturbation theory and Fermi's golden rule, selection rules, semi -classical theory of radiation; Elementary theory of scattering, phase shift, partial waves, Born approximation, Identical particles, Pauli exclusion principle, Spin-statistics connection. Relativistic quantum mechanics: Klein Gordon and Dirac Equations.

V. Thermodynamics and Statistical Physics:

Laws of thermodynamics and their consequences. Thermodynamic potential, Maxwell relations, Chemical potential, phase equilibria. Phase space, micro and macro states, Micro-canonical, Canonical and Grand canonical ensembles and Partition functions. Free energy and its connection with thermodynamic quantities. First and second order phase transitions, Classical and quantum statistics. Ideal Bose and Fermi Gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law; Bose Einstein condensation.

VI. Electronics:

Semiconductor devices (diodes, junctions, traosistors, field effect devices, homo- and hetero-junction devices), device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs). Operational amplifiers and their applications. Digital techniques and applications (logic circuits, registers, counters and comparators). A/D and D/A convertors, Microprocessor microcontroller basics. Fundamentals of communication electronics, modulation techniques.

VII. Atomic & Molecular Physics:

Quantum state of an electron in an atom. Electron spin, Spectrum of Hydrogen, helium and alkali atoms. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS and JJ couplings. Zeeman , Paschen-Bach and Stark effects. Electron spin resonance, Nuclear magnetic resonance, Electronic, rotational, vibrational and Raman spectra of diatomic molecules, Frank - Condon principle and selection rules. Spontaneous and stimulated emission, Einstein A&B coefficients; Lasers, Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

VIII. Condensed Matter Physics:

Bravais lattices. Reciprocal lattice. Diffraction and structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors.

Superconductivity: type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasicrystals.

IX. Nuclear and Particle Physics:

Basic nuclear properties; size, shape and charge distribution, spin and parity. Binding energy, semi-empirical mass formula, Liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge independence and charge asymmetry of nuclear forces. Isospin; Deuteron problem. Evidence of shell structure, single particle shell model, its validity and limitations. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion, nuclear reactions, reaction mechanism, compound nuclei and direct reactions. Classification of fundamental forces; Elementary particles (quarks, baryons, mesons, leptons); C, P and T invariance and applications of symmetry arguments to particle reactions, parity nonconservation in weak interaction; Relativistic kinematics.