KAKATIYA UNIVERSITY, WARANGAL, TELANAGANA STATE
Ph. D. Entrance Test – 2016

PHYSICS
SYLLABUS

Unit -I

Mathematical Physics: Solution of second order differential equations (Hermite, Legendre, Laguerre). Beta and gamma functions (evaluations and transformation). Mypergeometric functions and their representation and transformation. Fourier and Laplace transforms and their properties.

Classical Mechanics; Generalised coordinates-Hamilton's variational principle - Lagrange eqations from D' Alemberts principle - Hamilton's canonical equations - modified variational principle -canonical transformations - Poissons brackets - Hamilton-Jacobi equation - action angle variables. Rigid body dynamics: Kinetic energy of rigid body - Euler's equations-symmetrical top.

Unit - II

Quantum mechanics: Principle of superposition - Dirac's bra and ket notation - eigen values and eigen vectors of Hermitian operators - complete set of states and commuting operators - orthonormality - position and momentum representation - Schrodinger, Heisenberg and interaction pictures - exactly solvable problems (harmonic oscillator, Hydrogen atom) - angular momentum operators - eigen values of P and J_Z - addition of angular momenta and Clebsh-Gordon coefficients - time independent (degenerate and non-degenerate) and dependent perturbation theory and applications - variation method - relativistic quantum mechanics (Klein Gordon and Dirac's equations).

Statistical mechanics: Micro and macro states - phase space - ensemble and ensemble average -Liouville's theorem - Microcanonical, canonical and grand canonical ensembles and partition functions - Fermi-Dirac and Bose-Einstein distribution functions from grand partition function - equation of state for quantum gases - Planck's distribution law - Bose-Einstein condensation-Liquid He - superfluidity - Boltzman transport equation - electrical and thermal conductivity -Weidermann-Frenz law.

Unit - III

Electromagnetic theory: Gauss law and its applications - Laplace and Poisson equations - electrostatic boundary conditions - magnetic vector potential - magnetic boundary conditions -scalar and vector potentials - Coulomb and Lorentz gauge - retarded potentials - Jefimenko's equations - Lienard-Wiechart potentials. Maxwell's equations and magnetic charge - continuity equation - Poynting theorem - Newton's third law of electrodynamics. Energy and momentum of electromagnetic waves in vacuum and non-conducting media - propagation through linear media -reflection and transmission at normal and oblique incidence - reflection and transmission at a conducting surface.

Nuclear Physics : Basic nuclear properties(size, shape, charge distribution, spin and parity) - binding energy - semi-empirical mass formula - liquid drop model - fission and fusion - nature of nuclear forces - form of nucleon-nucleon potential - charge independence and charge symmetry of nuclear forces - isospin - deuteron problem - elementary ideas of alpha, beta and gamma decay - classification of fundamental forces - elementary particles (quarks, baryons, mesons; leptons)-spin and parity assignments-strangeness - C, P and T invariance and application of symmetry arguments to particle reaction - parity non-conservation in weak interaction.

Unit - IV

Solid state physics; X-ray diffraction-Lane equations - Ewald sphere. Elastic vibrations: group velocity and phase velocity - vibrations of mono-atomic and diatomic lattices - concept of phonons - infrared absorption of ionic crystals - thermal expansion and thermal conductivity. Kronig Penny model - Brillouin zones. Langevin's theory of diamagnetism -quantum theory of paramagnetism -

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Weiss molecular field theory of ferromagnctism -ferromagnetic domains - concept of magnons. Superconductivity: type-I and type-II superconductors - Josephson junctions - lattice defects and dislocations - ionic conductivity and diffusion. Nano-particles - metal clusters and semiconductor nano-particles - carban nanotubes and quantum nano-structures.

Spectroscopy: Nucler magnetic resonance - resonance condition, classical theory and Bloch equations - relaxation processes - spin-lattice and spin-spin relaxations - chemical shift. Electron spin resonance - condition for resonance - spin hamiltonian - hyperfme structure -ESR spectra of free radicals - ESR-instrumentation.

Electronics: Semiconductor and opto-electronic devices(diode, BJT, FET, LED, Solar cell) and their characteristics - regulated power supply - RC coupled amplifier and its frequency response - transformer coupled push pull power amplifiers - RC phase shift oscillator - Colpitts oscillator -astable multivibrator - digital techniques and applications(flip flops, registers and counters) -operational amplifier characteristics - inverting and non-inverting amplifiers -addition, subtraction, differentiation and integration - active filters(low pass, high pass and band pass).

05.3.16

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continue the same syllabus for the Ph.D entrance test, no modifications required.

20/05/2022

Model Paper

Entrance Test for Ph.D admission in Physics

Time: 2Hrs] **[Max. Marks: 100**

Choose the correct answer for the following questions.

1. Which of the following is known as Schroedinger equation
   A) $E = h\nu$ B) $E\psi = H\psi$ C) $\lambda = h/p$ D) $E = mc^2$

2. Proton has the charge
   A) 1637 times of an electron B) 1737 times of an electron
   C) 1837 times of an electron D) 1937 times of an electron

3. In diamond, the coordination number of carbon is ---
   A) 4 and its unit cell has 8 carbon atoms.
   B) 4 and its unit cell has 6 carbon atoms
   C) 6 with 4 carbon atoms in unit cell
   D) 4 with 4 carbon atoms in unit cell

4. Which of the following wavelength ranges is associated with UV spectroscopy?
   A) 0.8 – 500 μm B) 400 – 100 nm C) 380 – 750 nm D) 0.01 – 10 nm

5. A 10 KΩ resistor in parallel with another 10KΩ resistor produces a resultant resistance equal to ---
   A) 10 KΩ B) 100 KΩ C) 20 KΩ D) 5 KΩ

6.

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Model Approved
20/5/2022