(Please write your Exam Roll No.)

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END TERM EXAMINATION

SECOND SEMESTER [B.TECH] MAY-JUNE 2016

Paper Code: ETPH 104 **Subject: Applied Physics-II (Batch 2013 Onwards)**

Time : 3 Hours **Maximum Marks :75**

Note: Attempt any five questions including Question NO. 1which is compulsory. Select one question from each units. Symbols have their usual meaning. Scientific calculator is allowed.

Q1. Attempt all the parts.

a) Find the gradient of a vector
$A = (x^2 - xy + z)\hat{i} + (x^3 - xz + x)\hat{j} + (y^2 - y + z)\hat{k}$
at point(2,1,1). (2)

b) Write the expression of gradient in spherical coordinates. (2)

c) Give the expression of Gauss's law for magnetic field in both differential and integral form. (2)

d) How will the equation for Poynting theorem change for static fields? (2)

e) Write the expression for general wave equation. Show how it changes in case of a dielectric medium. (2)

f) Calculate the value of wave impedance in vacuum. (2)

g) State the significance of normalization of a wave function. (2)

h) Are energy levels of a particle in a box equally- spaced? Show with appropriate equation. (2)

i) What thermodynamic statistics do electron follow, Bose-Einstein, or Fermi Dirac? (2)

j) Draw the plane in a unit cube represented by the miller indices (110). (2)

k) A p-type semiconductor has a Hall coefficient equal to 0.0125m3/C. Find the density of charge carrier in it. (3)

l) State *Bloch Theorem.* (2)

Unit-I

Q2. a) Show that the trajectory of motion of a charged particle in crossed electric and magnetic fields (constant) is a cycloid. (6)

b) What is skin depth in electromagnetic? Does it depend upon the frequency of the electromagnetic radiation? (2.5)

c) Write the Maxwell equations in differential form and state their significance. (4)

Q3. a) An electric field in a region is given by $\mathbf{E} = -3\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$. Calculate the electric flux through the surface $\mathbf{S} = 2.0 \times 10^{-5} m^2$. (2.5)

b) Discuss continuity equation. Distinguish between *conduction current and displacement current.* (4)

c) If the earth receives 20 cal/min/sq cm solar energy, what are the amplitudes of electric and magnetic fields of radiation? (4)

d) A 2kW laser beam is concentrated by a lens into cross-sectional area about 10^{-6} cm^2. Find the *Poynting vector.* (2)

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Unit-II

Q4. a) Using the uncertainty principle show that an electron does not exist inside a nucleus. (4)

b) Describe Davission-Germer experiment. Find the lowest energy in eV, for an electron in one dimensional box of length a =0.2nm. (6)

c) The eigenfunction of an operator $\frac{d^2}{dx^2}\psi(x) = e^{ax}$. Find the corresponding eigen value. (2.5)

Q5. a) What type of statistics shall be application for a gas of photon? Justify your answer. (2.5)

b) Compare the qualitative features of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics on the basis of their functions. (6)

c) Show that Bose Einstein, Fermi Dirac statistics reduces to Maxwell Boltzamann statistics at high temperature. (4)

Unit-III

Q6. a) Chromium has structure. It has atomic radius is 0.125nm. Calculate the free volume/unit cell. (4)

b) Describe with a proper diagram the following terms: (a) Unit Cell, (b) Packing factor, (c) Coordination Number (d) fcc. (4)

c) Deduce the Miller indices of a plane which cuts off intercepts in the ratio 1a: 3b: -2c along the three axes. (2)

d) What is the difference between (111) and <111> for miller indices. (2.5)

Q7. a) Define the following (a) Unit Cell (b) Primitive Cell (c) Primitive Lattice (d) Bravis Lattice. (4)

b) Germanium crystallizes in diamond form structure with 8 atoms per unit cell. If lattice constant is 5.62 Angstrom, calculate the density of Germanium. (2.5)

c) Write short notes on (a) Point Defect (b) Frenkel Defect (c) Schottky Deffect. (6)

Unit-IV

Q8. a) Describe Kronig-Penney Model. (4)

b) Define law of *mass action* for a semiconductor. (2.5)

c) How does the location of Fermi level change with doping of a semiconductor? (6)

Q9. a) Derive the expression for *Hall coefficient*. (4)

b) What are *Brillouin zones*? (2.5)

c) Show that the Fermi energy lies midway between the conduction band and valance band for an intrinsic semiconductor. (6)

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