Student Exam No:-_____

GANPAT UNIVERSITY
B.TECH SEM-IV ELECTRICAL ENGINEERING
REGULAR EXAMINATION MAY-JUNE-2013
2EE405:-ELECTROMAGNETICS

Time: 3 Hours **Total Marks:-70**

Instructions: - 1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

SECTION-I

Q:1 **(A)** Write a short note on Gauss's Law and significance of electric flux. **(6)**

(B) (i) A Vector is defined by A= $x\,y^2\,a_x + y\,z^2\,a_y + x\,z^2 a_z$. Find $\nabla \times \nabla \times A$. **(6)**
(ii) Given a vector function F=$2\,x^{1/2}y a_x + xy^2\,a_y + (1/z)a_z$. Find divergrnce and curl of F at P(0.5,0.8,0.2)

OR

Q:1 **(A)** State and explain the Ohm's law for conductors. What is analogous relation in the static electric field? **(6)**

(B) Given the potential V= $\frac{10}{r^2}\sin\theta\cos\varphi$, **(6)**
(a)find the electric flux density D at $(2,\pi/2,0)$
(b)calculate the work done in moving a 10 μC charge from point A$(1,30°,120°)$ to B(4, 90°, 60°)

Q:2 **(A)** An electric dipole of 100 a_z pC-m is located at the origin. Find V and E at points **(5)**
(i) (0,0,10) (ii) $(1,\pi/3,\pi/2)$.

(B) Derive the Laplace's equation in three coordinate system. And also find the Laplacian for the function f= $\rho\cos\varphi + \rho^2\sin\varphi$ **(6)**

OR

Q:2 **(A)** To verify that E= $zy\,a_x + xz\,a_y + xy\,a_z$ V/m is truly an electic field,show that **(5)**
(a) $\nabla \times E = 0$
(b)$\oint E.dl$=0,where L is the edge of the square defined by $0 < x, y < 2, z = 1$.

(B) A wire of diameter 1 mm and conductivity 5×10^7 S/m has 10^{29} free electrons per cubic meter when an electric field of 10 mV/m is applied. Determine **(6)**
(a) The charge density of free electrons
(b) The current density
(c) The current in wire
(d) The drift velocity of the electrons.

Q:3 **Attempt any two:** **(12)**

(A) (i) Show that P=$(\varepsilon - \varepsilon_o)$E and D= $\frac{\varepsilon_r}{\varepsilon_r - 1}P$.
(ii)Given that Xe= 2.4 and D= 300 $\mu C/m^2$, Find ε_r ,E and P.

(B) Three field quantities are given by P= $2\,a_x - a_z$,Q= $2a_x - a_y + 2a_z$,R= $2a_x - 3a_y + a_z$.Determine(i)(P+Q)×(P-Q)(ii)Q.R× P(iii)P.Q×R(iv)sin θ_{QR} (v)P× (Q × R)(VI)A unit vector perpendicular to both Q and R. (vii)The component of P along Q.

(C) $V=x^2Y(Z+3)$Volts. Find (i) E at (3, 4,-6) (ii) the charge within the cube 0<x, y, z<1.

SECTION-II

Q:4 (A) Derive the continuity equation & and from that define the term "relaxation time". (6)

(B) The area of each plate of a parallel-plate capacitor with air as dielectrics 0.8 m^2.the distance between the plates is 5 mm. (a) find the energy stored in the capacitor if it is connected to a DC source of 500 V.(b) find the energy stored if the space between the plates is filled with a dielectric of relative permittivity 4.5 after disconnecting the capacitor from the source. (6)

OR

Q:4 (A) A current element I dl=0.01 a_z A-m is oriented along z direction of cylindrical coordinates with its mid point at origin. Find the magnetic field intensity at $(3.6m, 56°, 5m)$ (6)

(B) Define the current density vector J. using Ampere's circuital law derive the relationship between B and J. (6)

Q:5 (A) A certain liner, homogeneous, isotropic, dielectic material has a relative permittivity of 1.8. if V= -4000 y V in the material ,find (a)E (b) D (c)P (d) ρ_v. (5)

(B) Explain why Uniqueness theorem is important in solutions of Laplace's and Poisson's equation. (6)

OR

Q:5 (A) What do you mean by the hall effect? Name and explain at least two applications of hall effect? (5)

(B) If the unit of charge density ρ_v is C/ m^3 then from equation $\nabla . D = \rho_v$ show that the unit of D is C/ m^2.also write the unit of $\nabla . D$? (6)

Q:6 **Attempt any two:**

(A) Let $V=2(x+1)^2(y+2)^2(z+3)^2$ in free space. At P(2,1,4).Find(a)V (b)E (c)$|E|$ (d)D (e) $|D|$ (f) ρ_v (12)

(B) Explain the concept of Polarization density P and also explain how it is related to the electric field.

(C) State and explain the properties of the gradient of a scalar function.

END OF PAPER

Best of Luck