

Reg. No. :

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**D 4150**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Fourth Semester

(Regulation 2004)

Electronics and Communication Engineering

EC 1253 — ELECTROMAGNETIC FIELDS

(Common to B.E. (Part-Time) Third Semester Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

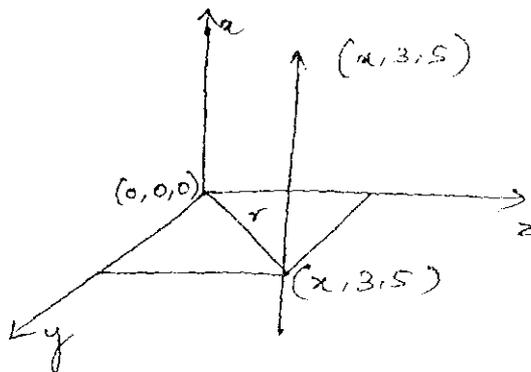
1. Why Gauss's law cannot be applied to determine the electric field due to finite line charge?
2. A uniform surface charge of  $\sigma = 2 \mu\text{C}/\text{m}^2$  is situated at  $z = 2$  plane. What is the value of flux density at P (1, 1, 1) m?
3. State Lorentz's law.
4. What is solenoid?
5. Write the continuity equation.
6. Classify the magnetic materials.
7. Write the Maxwell's equations in differential form.
8. State Poynting Theorem.
9. What is Brewster angle?
10. State one-dimensional wave equation.

PART B — (5 × 16 = 80 marks)

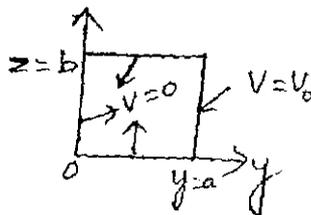
11. (a) State and explain
- Divergence theorem
  - Stoke's theorem
  - The electric flux density is given as  $D = \frac{r}{4} \hat{r}$ , nc/m<sup>2</sup> in free space. Calculate :
    - the electric field intensity at  $r = 0.25$  m
    - the total charge within a sphere of  $r = 0.25$  m and
    - the total flux leaving the sphere of  $r = 0.35$  m.

Or

- (b) An infinitely long uniform line charge is located at  $y=3, z=5$ . If  $\rho_l = 30$  nc/m, find field intensity  $E$  at : (i) origin (ii) P (0, 6, 1) and (iii) P (5, 6, 1).



12. (a) Derive the expression for  $\text{curl } H = J$ .
- Or
- (b) Explain the concepts of (i) scalar magnetic potential (ii) magnetic vector potential.
13. (a) A rectangular Loop is shown in fig. The voltages at different parts are shown. There exists insulation between  $V = 0$  and  $V = V_0$  parts. Solve Laplace's equation to find the potential function for the region inside the Loop.



Or

- (b) Derive the boundary relations at the boundary between a conductor and a dielectric.

14. (a) Derive the differential and integral forms of Maxwell's equations.

Or

- (b) Discuss Poynting vector and Poynting theorem.
15. (a) A uniform plane wave in a medium having  $\sigma = 10^{-3} \text{ s/m}$ ,  $\epsilon = 80 \epsilon_0$  and  $\mu = \mu_0$  is having a frequency of 10 KHz. Calculate the different parameters of the wave.

Or

- (b) A normally incident electric field has amplitude  $E = 1 \text{ V/m}$  in free space just outside the sea water in which  $\epsilon_r = 80$ ;  $\mu_r = 1$ ,  $\sigma = 2.5 \text{ s/m}$ . For a frequency of 30 MHz at what depth the amplitude of E be 1 mV/m.