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# BMS College of Engineering, Bangalore-560019

(Autonomous Institute, Affiliated to VTU, Belgaum)

## January 2017 Semester End Make Up Examinations

Course: FIELDS AND WAVES  
Course Code: 15ES3GCFW

Duration: 3 hrs  
Max Marks: 100

Date: 17.01.2017

**Instructions:** Answer 5 full questions.

### UNIT 1

- 1
  - a State & prove Gauss Law, also Define Divergence Theorem. 8
  - b Discuss the Boundary conditions between two different dielectrics. 8
  - c Given  $D = \hat{a}_x(2x^2yz) + \hat{a}_y(2xy^2z) + \hat{a}_z(2xyz^2) \mu\text{C/m}^2$ . Find the value of the charge Q for  $-1 < x < 2$ ,  $2 < y < 4$  and  $1 < z < 3$ . 4

### OR

- 2
  - a Derive expressions of energy stored & energy density in electrostatic field. 8
  - b By using Coulomb's concept, derive expressions of E & V at any point on the axis of a circular coil of radius "r" m carrying uniform line charge density  $\lambda$  c/m. 7
  - c Given  $V = 10r\theta\Phi$  volt. Find V, E & unit vector at  $(3, 20^\circ, 45^\circ)$  5

### UNIT 2

- 3
  - a Obtain the differential form of Ampere's work law in a steady magnetic field & hence obtain Stokes theorem. 8
  - b Derive an expression of magnetic force acting on a current element. 8
  - c A conductor of length 2m is carrying current of 4 ampere in the  $-\hat{a}_z$  direction. Determine the uniform magnetic flux density components when a force of 20mN is exerting on a conductor in a direction of  $(\hat{a}_x + \hat{a}_y (2)/1.414)$ . 4

### UNIT 3

- 4
  - a Obtain the differential & integral form of Faraday's law of electromagnetic induction. 7
  - b List all Maxwell's equations in (i) steady magnetic field & (ii) Time varying field. 8
  - c In a Time varying field circuit having capacitor, prove that the conduction current is equal to the displacement current. 5

### UNIT 4

- 5
  - a State & prove Poynting theorem. 8
  - b Discuss the wave propagation in a general conducting medium. Also derive equations of attenuation & phase factors. 8
  - c Find the skin Depth  $\delta$  @ a frequency of 1.6MHz in aluminium,  $\sigma=38.2\text{Ms/m}$  &  $\mu_r=1$ . Also find  $\gamma$  and wave velocity V. 4

UNIT 5		
6	a Discuss the Reflection of uniform plane waves at normal incidence.	10
	b Discuss the wave propagation in dispersive media.	10

7	<p>a Discuss the plane wave reflection at oblique incidence angles. <span style="float: right;"><b>10</b></span></p> <p>b A glass surface is to be coated with an appropriate dielectric layer to provide total transmission from air to the glass at a free space wave length of 570 nm. The glass has refractive index <math>n_3 = 1.445</math>. Determine the required index for the coating &amp; its minimum thickness. <span style="float: right;"><b>10</b></span></p>
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