## POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOL

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	Reg. No.:
	Question Paper Code: 30143
	B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.
	Fourth Semester
	Electronics and Communication Engineering
	EC 3452 — ELECTROMAGNETIC FIELDS
	(Common to : Electronics and Telecommunication Engineering)
	(Regulations 2021)
Tim	e: Three hours Maximum: 100 marks
	Answer ALL questions.
	PART A — $(10 \times 2 = 20 \text{ marks})$
1.	What is divergance of a vector field?
2.	Calculate the curl of gradient of the scalar field, $V = 3xy - yz$ .
3.	Define Gauss's Law.
4.	What is the significance of Laplacian Operator?
5.	Define Ampere's Law.
6.	What is the significance of magnetic vector potential?
7.	What is the displacement current?
8. 9.	What is the significance of Continuity Equation?  Define skin depth
<ol> <li>10.</li> </ol>	"X-rays can penetrate the human body, but light cannot". Justify.
(8)	PART B — $(5 \times 13 = 65 \text{ marks})$
11.	(a) Explain different type of coordinate systems along with examples of their use.
	Or  (b) Explain Gradient, Divergence and Curl in detail along with examples.
	(3+5+5=13)

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7:	
12. (a	Determine the net electric flux leaving through closed surface defined by: $\rho = 4, 0 \le z \le 1$ , if electric flux density is given by:
	$D = \rho^2 \cos^2 \varphi  \alpha_{\rho} + z \sin \varphi  \alpha_{\varphi} C / m^2  .$
	Or
(b	Derive the expression for Electric Field Intensity, $E$ at a distance, $r$ due to a volume charge as sphere of radius, $R$ carrying charge density, $\rho_v C/m^3$ . Consider
	(i) $r < R$ (6.5)
	(ii) $r > R$ . (6.5)
13. (a	centre of the circular loop carries a current of $I$ Amperes in the clockwise direction at $z=0$ plane. Assume the diameter of the circular loop is $2a$ .
	Or Control State of S
(b	For a current distribution in free space, magnetic vector potential is given by : $A = (2x^2z + yz)a_x + (xy^2 - xz^3)a_y - (6xyz - 2x^2y^2)a_zWb/m$ .
	Calculate:
	(i) magnetic flux density, $B$ and (5)
	(ii) the flux crossing through the surface described by $x = 1, 0 < y < 2$ ,
	0 < z < 2. (8)
14. (a	Explain in detail Maxwell's equations in integral and differential form for time varying fields.  Or
(b	C TRAC
15. (a	
	$E(y,t) = 25\sin(10^8t - y)\alpha_z V / m.$
	Calculate:
	(i) nature of the medium, (2)
	(ii) attenuation constant $(\alpha)$ , (2)
	(iii) phase constant $(\beta)$ , (2)
	(iv) phase velocity $(v_p)$ and (2)
	(v) derive the expression for magnetic field intensity, H. (5)
	Or
tiadi (t	where its amplitude decays to 1/e times of its initial value. If the phase shift for the same period is 60°, then Calculate the propagation constant of the medium.
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16.	(b) A c c c c c c c c c c c c c c c c c c	Three infinite sheets with $24 \text{ nC/m}^2$ are located at $x$ electric field intensity at (8, 0, 6) and (ii) $(-2, -7, 1)$ .  An EM wave travels from itelectric constant $(\varepsilon_r) = 4$ she electric field of incident $E_i = E_0 \cos(\omega t - \beta z) a_y V / m$ , when, calculate the value of (i) reflection coefficient (Fig. 1) transmission coefficient (Fig. 2) iii) the fraction of power transmission of power	Or a free space to a dielected in the contract of the contrac	prectively. Find the (7.5) (7.5) (7.5) ctric medium with on the interface. If a by: $=10\pi.$ (3) (3) (3) ric medium and, (3)	
16.	(b) A c c c c c c c c c c c c c c c c c c	24 nC/m² are located at $x$ : lectric field intensity at (8, 0, 6) and (1) (-2, -7, 1).  An EM wave travels from ielectric constant $(\varepsilon_r) = 4$ at the electric field of incident $E_i = E_0 \cos(\omega t - \beta z) a_y V / m$ ,  Then, calculate the value of it reflection coefficient ( $\Gamma$ (ii) transmission coefficient iii) the fraction of power transmission of power transmission coefficient ( $\Gamma$	Or  a free space to a dielected distribution of the space is given where $\omega = 3 \times 10^9 \pi$ and $\beta$ .  by the space is given as the space is given where $\omega = 3 \times 10^9 \pi$ and $\beta$ .	prectively. Find the $(7.5)$ $(7.5)$ ctric medium with on the interface. If a by: $=10\pi.$ $(3)$ $(3)$ ric medium and, $(3)$ smitted wave $(E_T)$ .	
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		iii) the fraction of power tr	ansmitted into the dielect	(3) smitted wave $(E_T)$ .	
				(3) smitted wave $(E_T)$ .	
		iv) derive the expression for	or electric field of the trans		
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