Shirpur Education Society's

R. C. PATEL INSTITUTE OF TECHNOLOGY, SHIRPUR

An Autonomous Institute

[Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere]

आर. सी. पटेल इन्स्टिट्यूट ऑफ टेक्नॉलॉजी, शिरपूर

(स्वायत्त महाविद्यालय)

Academic Year (2022-23)

Year: 3 Semester: V

Program: B. Tech. (ELECTRICAL ENGG.) **Max. Marks: 75**

Subject: Electromagnetic Engineering (PCEE5030T) **Time: 10:30 am to 1:30 pm**

Date:05/01/2023 **Duration: 3 Hours**

END SEM EXAMINATION –ODD SEM-V (Regular)

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

(1) This question paper contains 02 pages.

(2) All Questions are Compulsory.

(3) All questions carry equal marks.

(4) Answer to each new question is to be started on a fresh page.

(5) Figures in the brackets on the right indicate full marks.

(6) Assume suitable data wherever required, but justify it.

(7) Draw the neat labelled diagrams, wherever necessary.

Question No.		Max. Marks
Q1 (a)	Consider $E = 3a_y + 4a_z$ and $F = 4a_x - 10a_y + 5a_z$ a) Find the component of E along F b) Determine a unit vector perpendicular to both E and F	[05]
	OR	
	Show that points P_1 (5,2,-4), P_2(1,1,2), and P_3(-3, 0, 8) all lie on a straight line. Determine the shortest distance between the line and points P_4(3,-1,0)	[05]
Q1 (b)	Given point P(-2,6,3) and vector $A = ya_x + (x+z)a_y$, express P and A in cylindrical and spherical coordinates. Evaluate A at P in the Cartesian, cylindrical, and spherical systems.	[10]
Q2 (a)	i. Obtain the absolute potential of A (2,2,3) if a point charge of 0.4 nC is located at a) Origin b) (2,3,3) c) If point B is at (-2, 3, 3) obtain the potential difference between the points A and B	[06]
	ii. Write a note on spherical capacitor.	[04]
	OR	
	i. Write a note on Co-axial capacitor.	[04]
	ii. Explain the relationship between E and V (Maxwell's equation)	[06]
Q2 (b)	State and explain the Coulomb's law and electric field intensity in detail	[05]
Q3 (a)	Explain Poison's and Laplace equations in detail.	[05]
	OR	
	Explain Uniqueness theorem in detail.	[05]

Q3 (b)	In a one-dimensional device, the charge density is given by, $\rho_v = \rho_0 x/a$. If E=0 at x=0 and v=0 at x=a, find V and E. **OR** Write a detail note on different boundary conditions: dielectric-dielectric, conductor-dielectric, conductor-free space.	[10] [10]
Q4 (a)	Explain Biot-Savart's law in detail. **OR** A circular loop located on $x^2 + y^2 = 9$, z=0 carries a direct current of 10 A along a_ϕ. Determine H at (0.0,-4).	[08] [08]
Q4 (b)	Explain magnetic scalar and vector potentials in detail with the help of equations.	[07]
Q5 (a)	**Solve any two.** i. Write a note on Faraday's law. ii. A parallel plate capacitor with plate area of 5 cm^2 and plate separation of 3 mm has a voltage 50 sin 10^3 t V applied to its plates. Calculate the displacement current assuming $\varepsilon = 2\varepsilon_0$ iii. Write a note on time-varying potentials. iv. State and explain Pointing theorem in detail	 [05] [05] [05] [05]
Q5 (b)	A uniform plane wave propagating in a medium has $E=2e^{-\alpha z} \sin(10^8 t - \beta z)\, a_y$ V/m. If the medium is characterized by $\varepsilon_r = 1$, $\mu_r = 20$, and $\sigma = 3$ mhos/m, find α, β and H.	[05]