DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Summer Examination – 2023

Course: B. Tech. **Branch: Electronics Engineering** **Semester: V**

Subject Code & Name: Electromagnetic Field Theory (BTEXPE504A)

Max Marks: 60 **Date: 17/08/2023** **Duration: 3 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		**12**
A)	Given point P (-2, 6, 3) and vector $A = y\,\overline{ax} + (x+z)\overline{ay}$, Express P and A in Cylindrical and spherical coordinates. Evaluate A at P in Cartesian, cylindrical, and spherical systems.	**Understand**	**6**
B)	Given $\overline{A} = 25\,\overline{a\rho} + 12\,\overline{a\emptyset} - 20\,\overline{az}$ at $(8,120^0,5)$ find the vector component of $\overline{A}$ (i) Perpendicular to cylinder $\rho = 8$ (ii) tangent to the cylinder $\rho = 8$ (iii) tangent to the plane $\emptyset = 120^0$ (iv) a unit vector perpendicular to $\overline{A}$ and also tangent to $\rho = 8$	**Understand**	**6**
C)	State and Verify Divergence Theorem		**6**
Q.2	**Solve Any Two of the following.**		**12**
A)	Derive an Expression for Electric Field Intensity at any point due to infinite Line charge with charge density ρl C/m	**Remember**	**6**
B)	A Line charge density $\rho l = 15nC/m$ is located in free space on the line y = 3, x =4, and point charge Q = 2 X 10^{-12} C located at origin. Find $\overline{E}$ due to a) Line charge at P_2 (8, 9, 10) b) Point charge at P_2 (8, 9, 10)	**Understand**	**6**
C)	What are the Applications and Types of Transmission Line?	**Remember**	**6**
Q. 3	**Solve Any Two of the following.**		**12**
A)	Given the following values for P_1,P_2,I_1dl_1 Calculate dH_2 a) $P_1(4,0,0)$, $P_2(0,3,0)$, $2\pi\,\overline{az}$ μAm	**Understand**	**6**

b) $P_1(4,-2,3)$, $P_2(1,3,2)$, $2\pi(0.6\,\overline{ax} - 0.8\,\overline{ay})$ µAm

B) Show that Magnetic Field Intensity at any point due to finite conductor carrying current I placed along Z axis is **Understand** **6**

$$\overline{H} = \frac{I}{4\rho\pi}(\sin\alpha 2 - \sin\alpha 1)\,\overline{a}\varphi$$

Where $\alpha 2, \alpha 1$ are the Inclination of Upper end and Lower end of current carrying conductor.

C) A current at 0.4Amp is in $\overline{az}$ direction in the free spacein filament parallel to z axis and passing through point (2, -4, 0). Find magnitude of H at (0, 1, 0) if filament lies in the interval $-\infty < z < \infty$. **Understand** **6**

Q.4 Solve Any Two of the following. **12**

A) In the region where σ = 0, $\epsilon r = 2.5$, μr = 10. Determine whether following pairs of field satisfy Maxwell's equation, $\overline{E} = 2y\,\overline{ay}, \overline{H} = 5x\overline{ax}$ **Understand** **6**

B) Define: Propagation constant, characteristic impedance, reflection coefficient and VSWR **Understand** **6**

C) If an electric vector A is incident at a boundary between two different dielectric medium with permittivity $\epsilon r1$and $\epsilon r2$.at an angle of incidence $\theta 1$and Let vactor B refracted at an angle of refraction $\theta 2$. Then prove that $\frac{\tan\theta 1}{\tan\theta 2} = \frac{\epsilon r1}{\epsilon r2}$. **Understand** **6**

Q. 5 Solve Any Two of the following. **12**

A) For Poor conductor , prove that **Understand** **6**

$$\alpha = \frac{\sigma}{2}\sqrt{\frac{\mu}{\epsilon}} \quad \text{and} \quad \beta = \omega\sqrt{\epsilon\mu}\left[1 + \frac{1}{8}\left(\frac{\sigma}{\omega\epsilon}\right)^2\right]$$

B) A 10 GHz plane wave travelling in free space has amplitude of 15 V/m. Find Velocity of propagation, Wavelength, characteristic impedance of medium, amplitude of H, propagation constant. **Understand** **6**

C) Explain In short **Remember** **6**

(i) Biot savart's law

(ii) Maxwell's Equation in final forms

***** End *****