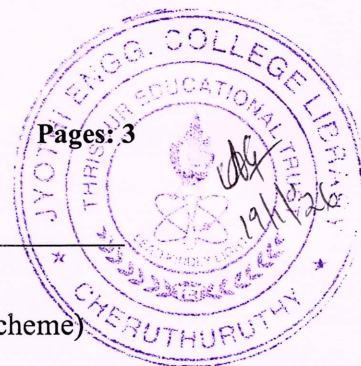


Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) (FT/WP) Examination January 2026 (2019 Scheme)



Course Code: EET204

Course Name: ELECTROMAGNETIC THEORY

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks)

- |    |   | Marks |
|----|---|-------|
| 1  | Define the curl of a vector field and explain its physical significance.  | (3)   |
| 2  | Express the point (-2,6,3) in spherical coordinate system.  | (3)   |
| 3  | Explain the conservative nature of electrostatic field.   | (3)   |
| 4  | Capacitance of a parallel plate capacitor having plate area 100 cm <sup>2</sup> and separated by 2mm is $2 \times 10^{-4} \mu\text{F}$ . Find the electric flux and potential gradient in kV/cm when 20kV is applied across the plates. | (3)   |
| 5  | State Ampere's circuital law and express it in point form.  | (3)   |
| 6  | Find the frequency at which conduction current density and displacement current density are equal in a medium with $\sigma = 2 \times 10^{-4} \text{ mho/m}$ and $\epsilon_r = 81$ .  | (3)   |
| 7  | Define Poynting theorem with mathematical representation.   | (3)   |
| 8  | A uniform plane wave is travelling through a lossless dielectric medium with $\epsilon_r = 4$ and $\mu_r = 1$ . Find the intrinsic impedance of the medium.   | (3)   |
| 9  | Define Standing wave ratio and how it is related to reflection coefficient.   | (3)   |
| 10 | What is electromagnetic interference? List any two methods to reduce electromagnetic interference.  | (3)   |

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

- |    |  |      |
|----|--|------|
| 11 | a) Verify Stokes' theorem for a vector field $\mathbf{F} = \rho^2 \cos \varphi \mathbf{a}_\rho + z \sin \varphi \mathbf{a}_z$ around a path L defined by $0 \leq \rho \leq 3$ , $0 \leq \varphi \leq 45^\circ$ and $z = 0$ . | (10) |
|    | b) Define gradient of a scalar field and mention its physical significance   | (4)  |
| 12 | a) Explain the transformation of a vector from spherical coordinate system to Cartesian coordinate system.   | (7)  |
|    | b) State and prove Gauss divergence theorem.   | (7)  |

Module -2

- 13 a) State and prove Gauss's law. Using Gauss's law, find the electric field intensity due to an infinite line charge distribution. (7)
- b) A charge of 1C is placed at point (2,0,0) and another charge Q is placed at point (-2,0,0). Find the value of Q which will make y component of total electric field intensity zero at the point (1,2,2). (7)
- 14 a) Derive the expression of capacitance of a coaxial cable. (7)
- b) What is the potential at the centre of a square with side 2m length, when the charges  $2\mu\text{C}$ ,  $-4\mu\text{C}$ ,  $6\mu\text{C}$  and  $2\mu\text{C}$  are located at its four corners. (7)

### Module -3

- 15 a) State and explain Biot Savart's Law. Find the expression for magnetic field intensity at a point on the axis of a circular current carrying loop. (10)
- b) A flat perfectly conducting surface in xy plane is situated in a magnetic field of  $\mathbf{H} = 3\cos x \mathbf{a}_x + z\cos x \mathbf{a}_y$  A/m. Find the current density on the conducting surface. (4)
- 16 a) Derive the boundary conditions for electric field at the interface between two dielectric media. (6)
- b) Obtain maxwell's equations in differential form for time varying field from Ampere's circuital law and Faradays law. (8)

### Module -4

- 17 a) Derive wave equation in phasor form, obtain expression for propagation constant, attenuation constant and phase constant. (14)
- 18 a) A lossy dielectric is characterised by  $\epsilon_r = 2.5$  and  $\mu_r = 4$  and  $\sigma = 10^{-3}$  mho/m at a frequency of 10 MHz. Find i) Attenuation constant ii) Phase constant iii) velocity of propagation iv) wave length and v) intrinsic impedance (10)
- b) Explain skin effect and skin depth. (4)

### Module -5

- 19 a) What are transmission line parameters? Explain the significance of each parameter. (8)
- b) A low-loss coaxial transmission line with a characteristic impedance of  $75 \Omega$  is terminated with a resistive load of  $25 \Omega$ . Calculate the voltage standing wave ratio on the line. Also find the minimum voltage if the maximum voltage on the standing wave pattern is 20 V. (6)
- 20 a) A transmission line has following parameters per unit length.  $R = 2\Omega$ ,  $L = 0.2\mu\text{H}$ ,  $C = 200\text{pF}$  and  $G = 0.005\text{mho}$ . Calculate the propagation constant and characteristic (8)



impedance of the line at 1 GHz.

- b) What is impedance matching? Describe any two impedance matching methods (6)

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