

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018**

**Course Code: EE 302**

**Course Name: ELECTROMAGNETICS (EE)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 5 marks.*

Marks

- |   |   |     |
|---|---|-----|
| 1 | Obtain gradient of the functions:   | (5) |
|   | a) $F = 5\rho^4 z^3 \sin \varphi$   |     |
|   | b) $V = 10r^4 \sin \theta \cos \varphi$ .   |     |
| 2 | Obtain the expression of electric field due to different charge bodies.   | (5) |
| 3 | Find the magnetic flux crossing the portion of the conductor in the plane $\theta = \pi/4$ defined by $0.01 \leq \theta \leq 0.05 \text{ m}$ and $0 \leq z \leq 2 \text{ m}$ for a current of 2 A | (5) |
| 4 | Explain about energy densities in electric and magnetic fields.   | (5) |
| 5 | Explain about Poynting theorem.   | (5) |
| 6 | Derive and Explain Uniform plane wave equation.   | (5) |
| 7 | Define a) intrinsic impedance b) characteristic impedance.  | (5) |
| 8 | Write down the expression of transmission line parameters.  | (5) |

**PART B**

*Answer any two full questions, each carries 10 marks.*

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|----|---|-----|
| 9  | a) Explain about the cylindrical coordinate system.   | (3) |
|    | b) Find the gradient of scalar function $V = \rho^2 \sin 2\theta$ in cylindrical coordinates and the directional derivative of the function in the direction of the vector $\vec{A} = \vec{a}_\rho + \vec{a}_\theta$ at the point $(2, \pi/4, 0)$ . | (7) |
| 10 | a) Explain about the physical significance of divergence of vector quantity.  | (4) |
|    | b) Derive the expression of electric field intensity due to sheet charge having surface charge density $\sigma_s \text{ C/m}^2$   | (6) |
| 11 | a) Explain about the conservative field.  | (2) |
|    | b) Determine the divergence of vector field   | (8) |
|    | 1) $P = x^2 yz \vec{a}_x + xy \vec{a}_z$ 2) $Q = 1/r^2 \cos \theta \vec{a}_r + r \cos \theta \sin \theta \vec{a}_\theta$  |     |

**PART C**

*Answer any two full questions, each carries 10 marks.*

- 12 a) State and explain Ampere's circuit law. (3)  
b) A current filament carries a current of 10 A in the  $a_z$  direction on the z axis. (7)  
Find  $\vec{H}$  in rectangular system at point P(1,2,3) due to this filament if it extends from a)  $z = -\infty$  to  $+\infty$  b) 5 to  $\infty$ .
- 13 a) Derive the expression of inductance of solenoid having N turns. (6)  
b) Explain the electric boundary conditions of two dielectric media. (4)
- 14 a) Formulate the Maxwell's equation in differential form and point form in phasor form. (7)  
b) Explain the continuity equation. (3)

**PART D**

*Answer any two full questions, each carries 10 marks.*

- 15 a) What is skin depth? (3)  
b) Show that the power flow along a concentric cable is the product of voltage and current using Poynting Theorem. (7)
- 16 a) Explain group velocity and phase velocity. (5)  
b) Derive the attenuation constant and phase shift constant for a perfect conductor. (5)
- 17 a) Explain about electromagnetic interference. (4)  
b) A 9375 MHz uniform plane wave is propagating in polystyrene. If the amplitude of the electric field intensity is 20 V/m and the material is assumed to be loss less find  $\alpha$ ,  $\beta$ ,  $\lambda$ , intrinsic impedance, propagation constant and amplitude of H. (6)

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