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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION - May 2019

B.Tech 4<sup>th</sup> Semester

COURSE CODE: 10B11EC513

MAX. MARKS: 35

COURSE NAME: Electromagnetic Engineering

COURSE CREDITS: 4

MAX. TIME: 3 Hrs.

*Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

1. Determine the flux of  $\mathbf{D} = \rho^2 \cos^2 \phi \mathbf{a}_\rho + z \sin \phi \mathbf{a}_\phi$  over the closed surface of the cylinder  $0 \leq z \leq 1, \rho = 4$ . Confirm the results using the divergence theorem. [CO-1; 5 Marks]
2. Derive the expressions of electric and magnetic fields components for TE modes in rectangular waveguide. Does TEM mode exist in rectangular waveguide? [CO-3, 4; 5 Marks]
3. Show the top view and side view of the behaviour of electric and magnetic fields within a rectangular waveguide for dominant mode. [CO-3,4; 3 Marks]
4. Calculate the ratio of Circular waveguide cross sectional area to Rectangular waveguide cross sectional area. Assuming that both these waveguides have equal cut-off frequencies for TE modes. [CO-4; 3 Marks]
5. Derive the expression of Brewster angle at pure dielectric interface for perpendicular and parallel polarized incident waves. [CO-4; 5 Marks]
6. If  $\mu_1 = 2\mu_0$  for medium 1 ( $0 < \phi < \pi$ ) and  $\mu_2 = 5\mu_0$  for region 2 ( $\pi < \phi < 2\pi$ ) and  $\mathbf{B}_2 = 10\mathbf{a}_\rho + 15\mathbf{a}_\phi - 20\mathbf{a}_z$  mWb/m<sup>2</sup>. Calculate:  
(a)  $\mathbf{B}_1$   
(b) The energy density in two media. [CO-2,3; 3 Marks]
7. The cross-section of rectangular waveguide is 20 cm × 5cm. Find six lowest order modes which will propagate in the waveguide and their cut-off frequencies. [CO-4; 3 Marks]
8. Obtain the solution of Helmholtz equation in cylindrical co-ordinate system highlighting its importance in circular waveguides. [CO-4; 5 Marks]

9. Calculate the total no. of modes of propagation for frequencies below 20 GHz with guide radius of 1 cm. [CO-4; 3 Marks]

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