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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST 1 EXAMINATION - September 2017

B.Tech V Semester

COURSE CODE: 11B11EC513 MAX. MARKS: 15

COURSE NAME: Electromagnetic Engineering

COURSE CREDITS: 3 MAX. TIME: 1HR

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Assume any missing data. Marks are indicated in parenthesis.*

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1. Let $\boldsymbol{D} = 20\rho^2 a_\rho + \cos\varphi\, a_\varphi + z a_z\ C/m^2$. Use both sides of the Gauss's divergence theorem to find the total amount of charge lying within the closed surface bounded by $0 < \rho < 1$, $0 < \varphi < \pi$ and $0 < z < 2$. (5m)

2. An infinite line charge density of $10\ nC/m$ lies along the x-axis in the free space. What is the electric field intensity at the point $P(1,2,3)$. Use the formula directly. (2m)

3. A point charge is at the point $(0,-10,0)$, a line charge density of $20\ nC/m$ exists along the y-axis from $-1 < y < 1$ and a surface charge density exists for $-1 < x < 1$ and $-1 < y < 1$ on $z = 0$ plane. Write the expression (do not solve the expression) for electric field intensity at the point (10,0,0). (3m)

4. If $\boldsymbol{E} = \frac{2r}{(r^2+a^2)^2} a_r V/m$ (a is a constant), find the amount of work done in moving the point charge of $25nC$ from $P(r = 10, \theta = \frac{\pi}{2}, \varphi = \frac{\pi}{2})$ to $Q(r = 5, \theta = \frac{\pi}{4}, \varphi = \frac{\pi}{4})$. Show the path that you have considered. (3m)

5. The current density in a certain region is given by $\boldsymbol{J} = \frac{0.1}{r} e^{-10^6 t} a_r\ A/m^2$. At $t = 1\mu s$, how much of the current is crossing the spherical surface $r = 5$. (2m)