GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (OLD) - EXAMINATION – WINTER 2017

Subject Code: 151002
Subject Name: Engineering Electromagnetics
Date: 08-11-2017
Time: 10:30 am to 01:00 pm
Total Marks: 70

Instructions:
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 (a) Compare Cartesian, Spherical and Cylindrical coordinate systems.
(b) Given \( A = 2a_x + 4a_y \) and \( B = 6a_y - 4a_z \), find the smaller angle between them using (i) the cross product (ii) the dot product.

Q.2 (a) Develop the expression Electric field of an infinite uniform line charge.
(b) Find the force on a point charge of 50 \( \mu \)C at (0,0,5) m due to a charge of 500\( \pi \) \( \mu \)C that is uniformly distributed over the circular disk \( r \leq 5 \) m, \( z = 0 \) m.

OR
(b) Develop the expression Electric field of an infinite uniform plane charge.

Q.3 (a) Explain Gauss’s law with suitable examples.
(b) Determine the flux crossing a 1 mm by 1 mm area on the surface of a cylindrical shell at \( r = 10 \) m, \( z = 2 \) m, \( \varphi = 53.2^\circ \) if \( D = 2x a_x + 2(1-y)a_y + 4z a_z \) (C/m\(^2\)).

OR
(a) Derive the expression of energy in the static electric point charges.
(b) Given that \( A = 30e^{-r}a_r - 2z a_z \), evaluate both sides of the divergence theorem for the volume enclosed by \( r = 2 \), \( z = 0 \) and \( z = 5 \).

Q.4 (a) Discuss the boundary conditions for electric field at the boundary of two dielectrics.
(b) Explain continuity of current equation with suitable example.

OR
(a) Explain Ampere’s circuital law with at least two suitable examples.
(b) Write a short note on (i) Uniqueness theorem (ii) Laplace’s Equation.

Q.5 (a) Explain Maxwell’s equations in the point and the integral form.
(b) Given \( E = 30\pi e^{j(w t + \beta z)} a_x \) V/m, \( H = Hm e^{j(w t + \beta z)} a_y \) A/m in free space, Find \( H_m \) and \( \beta \) (\( \beta > 0 \)).

OR
(a) Compare scalar and vector magnetic potential.
(b) Derive the expression of the Poynting vector.

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