

Code No: 153AR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, March - 2022

ELECTROMAGNETIC FIELDS

(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

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- 1.a) Derive the expression for electric field intensity due to an electric dipole.  
b) Determine the field strength at a point situated 6 cm away from two equal charge of  $Q_1 = +109C$  and other charge of  $Q_2 = 109C$ , if the distance between them is 9m. [8+7]
- 2.a) Consider an infinite line charge along z-axis. Show that the work done is zero if a point charge  $Q$  is moving in a circular path of radius  $\rho$ , centered at the line charge.  
b) A scalar potential is given by  $V = 7y + 12x$  volts, find  $\vec{E}$  at the origin. [8+7]
- 3.a) List out the properties of dielectric materials.  
b) Deduce the relation of tangential and normal components of electric field in the boundary condition of two perfect dielectric materials. [6+9]
- 4.a) Explain and derive Laplace's equation.  
b) Derive the expression for the capacitance of a two wire line. [7+8]
- 5.a) Derive an expression for the force on a differential current element.  
b) The field  $\vec{B} = -2a_x + 3a_y + 4a_z$  mT is present in free space. Find the vector force exerted on a straight wire carrying 12A in the  $a_{AB}$  direction, given A(1,1,1) and B(3,5,6). [8+7]
- 6.a) State and explain Biot-Savart's law.  
b) A solenoid has an inductance of 20 mH. If the length of the solenoid is increased by two times and the radius is decreased to half of its original value, find the new inductance. [8+7]
7. Derive the Maxwell's equations both in integral form and differential form for Time varying fields. [15]
- 8.a) State and prove the Poynting theorem.  
b) What is plane wave? Derive the equation for plane waves in free space. [8+7]

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