

The Open University of Sri Lanka
B.Sc/B.Ed Degree Programme
Open Book Test (OBT) 2010/2011
Level 05 - Applied Mathematics
AMU 3185/AME 5185 – EM Theory & Special Relativity

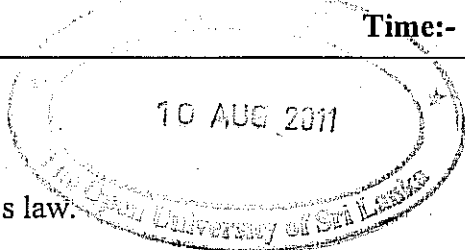


Duration :- One and half hours.

Date :- 09-03-2011/

Time:- 4.00 p.m. – 5.30 p.m.

Answer All Questions



01. State and prove the Coulomb's law.

Compute the vector electric field at the point(3,0,0) due to point charge $Q_1=10$ coulombs at point(0,0,3) and charge $Q_2=-5$ coulombs at point (0,3,0). Calculate also the magnitude of the field. All distances are in meters and the medium is air.

02. State Gauss's Theorem, in relation to an electric field.

Two charges of opposite sign and magnitude 10^{-9} coulomb each are located 6 meters apart. Calculate the resulting electric potential at a point which is midway between the two charges and 4 meters from the line joining the charges. What is the potential at the point of both the charges are positive?

03 A conducting sphere S of a radius has a charge Q . Verify, by direct evaluation of the integral $\phi = \frac{1}{4\pi\epsilon_0} \int \frac{\sigma}{r} ds$, that the potential is $\frac{Q}{4\pi\epsilon_0 r}$ at points outside the sphere and $\frac{Q}{4\pi\epsilon_0 a}$ at points inside S , r being the distance from the centre of the sphere.

Determine the electric field at any point and verify by performing the integral $W = \frac{\epsilon_0}{2} \int E^2 dW$, that the energy of the given conducting sphere $\frac{Q^2}{8\pi\epsilon_0 a}$.