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ET-105(A)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

BTCLEVI/BTMEVI/BTELVI/BTECVI/BTCSVI

Term-End Examination

December, 2011

01432

ET-105(A) : PHYSICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **all** questions. Internal choices are provided. Assume missing data suitably, if any.*

1. (a) State Gauss law and obtain it in differential form. **6**

OR

Define capacitance of a capacitor. Derive an expression for the energy stored in a parallel plate capacitor.

(b) Two positive charges 0.2 μC and 0.01 μC are placed 10 cm apart. Calculate work done in reducing their distance to 5 cm. **4**

(c) (i) A thin spherical shell of metal has a radius of 0.25 m and carries a charge of 0.2 μC. Calculate the electric intensity at a point : **4**

(A) Inside the shell, and

(B) Just outside the shell.

OR

(ii) The plates of a parallel plate capacitor have an area of 90 cm^2 each and are separated by 2.5 mm. The capacitor is charged to 400 V. How much electrostatic energy is stored in it ?

2. (a) Distinguish between unpolarized and plane polarized light. Can light be polarized by reflection ? Explain. 6

OR

State Brewster's Law. Discuss polarization of light by scattering.

(b) A body executes S.H.M. such that its velocity at the mean position is 1 m/s and acceleration at one of the extremity is 1.57 m/s^2. Calculate time period of vibration. 4

(c) (i) A plano - convex lens of radius 3 m is placed on an optically flat glass plate and is illuminated by monochromatic light. The diameter of the 8^{th} bright ring in the reflected system is 0.72×10^{-2} m. Calculate the wavelength of light used. 4

OR

(ii) A thin film has a refractive index of 1.45. Determine the minimum thickness of the film if it appears black on reflection, when the light of 600 nm wavelength is used.

3. (a) State Ampere's circuital law. Find the magnetic field inside the solenoid carrying current. 6

OR

Using Biot - Savart's law derive an expression for the magnetic field at a point on the axis of the circular coil carrying current and hence at the centre of the coil.

(b) A bar magnet when suspended perpendicularly to earth's field experiences a torque of 3×10^{-4} Nm. What is the magnetic moment of magnet ? Horizontal component of earth's magnetic field at that place is 0.4×10^{-4} Tesla. 4

(c) (i) A coil having 100 turns and area 0.20 m^2 is placed normally in a magnetic field. The field changes from 0.20 Wb/m^2 to 0.60 Wb/m^2 uniformly over a period of 0.01 sec. Calculate the emf induced in coil. 4

OR

(ii) An electron is moving northwards with a velocity of 3.0×10^7 m/s in a uniform magnetic field of 10 Tesla directed towards east. Find the magnitude and direction of magnetic force on the electron.

4. (a) Find the moment of inertia of a uniform solid cylinder of radius 'R' and mass 'M' about the axis of symmetry. 6

OR

State and prove theorem of parallel axis for moment of inertia.

(b) Find the angle through which a cyclist bends when he covers a circular path 34.3 m long in $\sqrt{22}$ sec. Given $g = 9.8\ m/s^2$ 4

(c) (i) A shell of mass 'm' moving through air splits into two fragments m/3 and 2m/3. The process of explosion provides an additional energy E to the fragments. Find relative velocity of fragments after the explosion. 4

OR

(ii) A uniform sphere of Mass 'M' and radius 'R' is spinning on an axis through its centre at a rate of 5 rev/sec. It comes to stop in 20 sec. How large is the frictional torque that brings the sphere to a stop ?

5. (a) Define work and kinetic energy. Prove that work done on a system appears as a change in kinetic energy of a system. 6

OR

Define 'collision'. Define two types of collision with their essential characteristics.

(b) A gun fires a shell of mass 5 kg in horizontal direction. The gun recoils at 0.4 m/s and its mass is 3 tonnes. Calculate the velocity of shell. 4

(c) (i) Find the angle between the two vectors : 4

$\mathbf{A} = 3i + 4j + 5k \quad \mathbf{B} = 3i + 4j - 5k$

OR

(ii) A car is travelling with a constant speed negotiates a turn of radius 147 m. If the coefficient of static friction between the car tyres and the road is 0.6 N, determine the maximum speed of car can have without sliding.

Physical Constants :

$e = 1.6 \times 10^{-19}$ C

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ $C^2/(Nm^2)$

$\frac{\mu_0}{4\pi} = 10^{-7}$ N/A^2

$\varepsilon_0 = 8.85 \times 10^{-12}$ $C^2N^{-1}m^{-2}$