

**B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering) /
BTCLEVI / BTMEVI / BTELVI / BTECVI / BTCSVI**

Term-End Examination

01490

June, 2016

ET-105(A) : PHYSICS

Time : 3 hours

Maximum Marks : 70

Note : Attempt all questions. Internal choices are provided. Assume missing data suitably, if any. Use of scientific calculator is allowed.

1. (a) Define an electric field. Mention any four properties of line of forces. 6

OR

Define equipotential surface. Derive the expressions for the equivalent capacitance when a number of capacitors are connected (i) in series, and (ii) in parallel. 6

- (b) A wire of length 1 m, and a cross-section area of 1 mm^2 carries a current of 1.5 A. When a potential difference of 3 V is applied between its two ends, find the conductivity of the wire. 4

- (c) A battery, when connected to a resistance of 5Ω gives a current of 1 A. The same battery when connected to a resistance of 10Ω gives 0.6 A current. Find the emf and the internal resistance of the battery. 4

OR

What is the resistance of a 5000 W 125 volt water heater ? Assuming the resistance to be unchanged, what would be the power if connected to a 125 V supply ? 4

2. (a) Define a Simple Harmonic Motion and derive a relation for the velocity and acceleration of a particle executing Simple Harmonic Motion. 6

OR

What is diffraction ? Discuss the Fraunhofer diffraction of a single slit. Obtain the condition for principal maxima and minima. 6

- (b) A grating with 15000 lines has a width of 3 cm. Find the angular separation (in the first order) of the visible spectrum which extends from 400 nm to 700 nm. 4

- (c) Explain polarization by Double Refraction. 4

OR

Find the thickness of a quarter wave plate made of calcite for light of wavelength 589 nm. $\mu_o = 1.658$ and $\mu_e = 1.486$. 4

3. (a) What is impulse-momentum principle ? Find the moment of inertia of a uniform rectangular bar of length L, width b and mass m about an axis perpendicular to its plane and passing through its centre. 6

OR

Explain the physical significance of the moment of inertia. Explain the theorem of perpendicular axis. 6

- (b) A thin homogeneous circular disk of radius R and mass M is suspended as a compound pendulum in a vertical plane from a point located at a distance 'a' from the centre. Find the distance 'a' which gives the maximum frequency of oscillation and also determine this frequency. 4
- (c) Explain the working principle of a simple gyroscope. 4

OR

Find the moment of inertia of a flat disk about any diameter. 4

4. (a) What is the centre of mass and frame of reference ? Two particles of masses 1 kg and 3 kg have positions $2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}$ and $-2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k}$. Find the centre of mass. 6

OR

State Newton's law of universal gravitation. Find the relation between G and g . 6

- (b) What are elastic and inelastic collisions ? 4
- (c) If the mean distance of Mars from the Sun is 1.525 times that of the Earth from the Sun, calculate the number of years in which Mars will complete one revolution about the Sun. 4

OR

The Earth's mass is 80 times that of the Moon and their diameters are 1600 km and 800 km respectively. What is the value of g on the Moon ? g on Earth = 9.8 m/s^2 . 4

5. (a) What is Biot-Savart law ? Discuss its application. 6

OR

Describe the construction and action of a cyclotron. Discuss its limitations. 6

- (b) A solenoid of length 50 cm has 40 turns/cm and the cross-sectional area is 6 cm^2 . Calculate the work done in establishing a current of 200 mA in the solenoid. 4

- (c) A 50 pF parallel plate capacitor is being charged at such a rate that the voltage is increasing at 300 V/s. The plates are circular with a radius of 10 cm. Find the displacement current density and the magnetic field of induction at a distance of 5 cm from the axis of the capacitor. 4

OR

Discuss the Maxwell's equations from the basic laws of electromagnetism. 4

Physical Constants :

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

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ F/m}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ Wb/A-m}$$

$$G = 6.67 \times 10^{-11} \text{ N-m}^2/\text{kg}^2$$

$$\text{Avogadro's number} = 6.022 \times 10^{26} \text{ atoms}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg}$$

$$m_p = 1.7 \times 10^{-27} \text{ kg}$$
