Code: TED(15) 2003

SECOND SEMESTER DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY

MODEL QUESTION PAPER

ENGINEERING PHYSICS - II

(Time: 3 Hours) (Max. Marks: 100)

Part A

(*Answer all questions. Each question carries two marks*)

I.

1. State the theorems related to moment of inertia.
2. What are geostationary satellites?
3. State Kirchhoff's laws?
4. State Biot-Savart law.
5. What is meant by nuclear chain reaction? (2x5=10)

Part B

(*Answer any five questions. Each question carries six marks*)

II.

i. Derive the expression for moment of inertia of a circular disk about the axis passing through the centre and perpendicular to its plane.

ii. Derive the expression for total kinetic energy of a rolling disk and use this formula to calculate the kinetic energy of a disk of mass 2 kg and radius 20 cm rolling with an angular velocity of 10 rad/s.

iii. Derive the expression for variation of acceleration due to gravity with altitude and depth.

iv. Derive the expression for orbital velocity and period of an artificial satellite in a circular orbit around the Earth.

v. With the help of a neat diagram explain the theory and working of Wheatstone's bridge.

vi. Explain photoelectric effect and describe Einstein's theory.

vii. With the help of a neat diagram explain the theory and working of ruby laser. (6x5=30)

(PTO)

Part C

(*Answer one full question from each module.. Each question carries fifteen marks*)

Module I

III.

a) How is centripetal force provided in each of the three cases :
Moon going around the earth,Electron moving around the nucleus,A stone tied to a string and having uniform circular motion. (3)

b) A ring of mass 2 kg and diameter 20 cm gains an angular velocity of 20 rad/s in 5 s. Calculate angular acceleration and torque. (6)

c) Five masses each of 2 kg are placed along a straight rod of negligible mass with distance between adjacent masses being 0.2 m. Find the moment of inertia and radius of gyration of the system about an axis passing through the central mass and perpendicular to the rod. (6)

OR

IV.

a) Explain the idea of banking of rails and write down the expression for super elevation. (3)

b) A disk of mass 2 kg and diameter 20 cm is rolling on a horizontal surface at 12 rpm. Calculate (i) moment of inertia about its axis, (ii) rotational kinetic energy and (iii) total kinetic energy. (6)

c) A string can sustain a maximum tension of 100 N without breaking. A mass of 200 g is attached to the end of the string of length 50 cm. Find the maximum angular velocity that the system can sustain. Also calculate the linear velocity at which the mass will fly off when the string breaks. (6)

Module II

V.

a) Derive the expression for acceleration due to gravity at the surface of the Earth in terms of universal gravitational constant G, mass of the Earth and the radius of the Earth. (3)

b) Calculate the centripetal acceleration and orbital velocity of a geostationary satellite. ($g=9.8\ ms^{-2}$,Radius of the Earth(R)=6400 km and altitude(h)=36000 km) (6)

c) Imagine a planet X having 10 times the radius of the Earth and made of material of the same density. Find the acceleration due to gravity on the surface of the planet X and also the escape velocity.(For the Earth, R= 6400 km and $g=9.8\ ms^{-2}$) (6)

OR

VI.

a) Mention applications of different types of artificial satellites. (3)

b) India's first artificial satellite Aryabhatta was orbiting the Earth at an average altitude of 600 km. Find its orbital velocity and period. (For the Earth, R= 6400 km and g=9.8 ms^{-2}) (6)

c) A comet of mass 10^{12} kg moves from a distance of 20 AU to a distance of 2AU from the Sun within a few months. Calculate its gain in kinetic energy. (1 Astronomical Unit (AU)= $1.5x10^{11}$ m, Mass of the Sun = $2x10^{30}$ kg, G = $6.67x10^{-11}$ N m^2 kg^{-2}) (6)

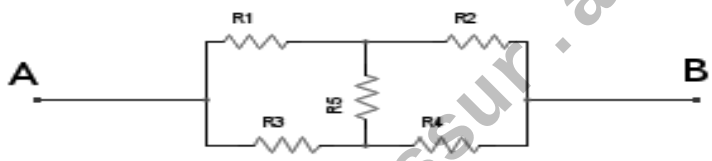
Module III

VII.

a) Using Biot-Savart law derive an expression for the magnetic field at the centre of a circular coil carrying a steady current. (3)

b) Discuss the theories of conversion of a galvanometer into an ammeter and a voltmeter (6)

c) Calculate the effective resistance between points A and B of the combination of resistances shown in figure if the values are R1 = 4 Ω, R2 = 2 Ω, R3 = 8 Ω, R4 = 4 Ω, R5 = 2 Ω. (6)



OR

VIII.

a) Find the resistance of copper wire of diameter 1 mm and length 1 m. (Resistivity of copper $1.7x10^{-8}$ Ωm) (3)

b) With the help of a neat diagram, explain the working of metre bridge. (6)

c) Explain the term effective resistance. Derive the relations for effective resistances in the case parallel and series connection of two resistors. (6)

Module IV

IX.

a) Discuss the applications of photoelectric effect. (3)

b) Discuss the characteristics and application of lasers (6)

c) Explain the use of moderator, control rods and coolant in a nuclear fission reactor. (6)

OR

X.

a) Explain the advantages of gas lasers over solid state lasers (3)

b) With the help of a neat figure explain the working of He-Ne laser. (6)

c) When a metal is irradiated with ultraviolet light of wavelength 100 nm, the maximum

kinetic energy of liberated electrons is 10^{-18} J. Calculate the work function of the metal. Also find the threshold frequency. (Speed of light(c)= $3x10^{8}$ ms^{-1}, Planck's constant(h)=$6.63x10^{-34}$ Js) (6)