



B-003-2011002

Seat No. _____

B. Sc. (Sem. I) Examination

March - 2021

Physics : Paper - 101

(Mechanics & Semiconductor Electronics)

(New Course)

Faculty Code : 003

Subject Code : 2011002

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :** (1) Symbols and notations have their usual meaning.
(2) Total marks of the question is indicated on the right side of the question.
(3) Attempt any five questions out of the following TEN questions.

- 1 (a) Give answer to the following questions : 4
(1) What is vector ?
(2) What is scalar ?
(3) If the angle between two vectors is 90° their scalar product will be _____
(4) What will be the x,y and z components of $\hat{i} - \hat{k}$?
- (b) Prove that $(A \times B) \times C + (B \times C) \times A + (C \times A) \times B = 0$ 2
- (c) If vector $\vec{A} = \hat{i} + 2\hat{j} - 2\hat{k}$, $\vec{B} = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{C} = \hat{i} - 3\hat{j} - 2\hat{k}$ 3
find the Magnitude and unit vector of the vector $(\vec{A} + \vec{B} + \vec{C})$.
- (d) Answer in detail : 5
Describe vector triple product.
- 2 (a) Give answer to the following questions : 4
(1) What is active component ?
(2) What will be the internal impedance of an ideal voltage source ?
(3) Secondary cell are rechargeable. (True/False)
(4) If the resistors $R_1, R_2, R_3, \dots, R_n$ are connected in parallel then $1/R = 1/R_1 + 1/R_2 + 1/R_3 + \dots + 1/R_n$
(true/false)

- (b) Mention the types of cells. 2
- (c) In a circuit a resistor of $10\text{ M}\Omega$, a capacitor of $0.2\ \mu\text{f}$ and a battery of 20 Volt are connected in a series, calculate growth of charge. 3
- (d) Answer in detail :
Obtain the expression of growth and decay of charge in RC circuit. 5
- 3 (a) Give answer to the following : 4
- (1) The electrical resistivity of insulators is very high. (True/False)
- (2) Si and Ge are the most commonly used _____. (insulator, semiconductor, conductor)
- (3) What is meant by doping ?
- (4) Draw the symbol of (1) PN diode and (2) zener diode.
- (b) What is Zener breakdown ? 2
- (c) Explain ideal diode. 3
- (d) Answer in detail. 5
Explain V-I characteristics of a PN junction diode.
- 4 (a) Give answer to the following : 4
- (1) What is intrinsic semiconductor ?
- (2) As the temperature is increased above room temperature the electrical conductivity of semiconductor is _____ (increase, decrease)
- (3) What is extrinsic semiconductor ?
- (4) Pentavalent and trivalent impurity added to semiconductor. (True/False)
- (b) Explain the formation of a PN junction. 2
- (c) Explain static and dynamic resistance of a diode. 3
- (d) Explain in detail energy band of conductor, semiconductor and insulator. 5
- 5 (a) Give answer to the following : 4
- (1) State Newton's second law of motion.
- (2) Define inertia.
- (3) What is frame of reference ?
- (4) What is elastic collision ?

- (b) What is conservative force ? 2
- (c) How much power is required to carry a body of mass 100 kg at a height of 60 m in 1 minute ? 3
- (d) Describe the system of variable mass and rocket propulsion. 5
- 6 (a) Give answer to the following : 4
- (1) Define work.
- (2) Define power.
- (3) What is centre of mass ?
- (4) State Newton's first law of motion
- (b) State and prove work-energy theorem. 2
- (c) A 20 gm bullet travelling with 100 m/s penetrates 10 cm into a wooden block. What will be average force it exerts on the block? 3
- (d) Explain the principle of conservation of linear momentum in the absence of external force acting. 5
- 7 (a) Give answer to the following : 4
- (1) What is rotational motion ?
- (2) Write definition of moment of inertia.
- (3) SI unit of kinetic energy is _____.
- (4) Write Kepler's first law of planetary motion.
- (b) Derive relation between linear velocity and angular velocity. 2
- (c) A sphere of mass 40 kg is attracted by second sphere of mass 15 kg, when their centre are 20 cm apart with a force equal 10^{-4} gm.wt. calculate the constant of gravitational. 3
- (d) Answer in detail. 5
- What is escape velocity ? Derive an expression for escape velocity.
- 8 (a) Give answer to the following : 4
- (1) Write Kepler's third law of planetary motion.
- (2) What is state of weightlessness ?
- (3) The value of velocity of escape on the surface of earth is _____ km/s.
- (4) SI unit of gravitational potential.
- (b) Explain angular acceleration. 2

- (c) The moment of inertia of a body of mass 10 kg about an axis 2 m away from its centre of mass in 50 kg.m^2 find its moment of inertia about a parallel axis 3 m away from its centre of mass. **3**
- (d) State and prove the theorem of moment of inertia. **5**
- 9** (a) Give answer to the following : **4**
- (1) Define stress.
 - (2) Define strain.
 - (3) What are the theoretical values of Poisson's ratio ?
 - (4) Write Hook's law.
- (b) Explain bulk's modulus. **2**
- (c) A load of 8 kg is suspended from a support using a wire of radius 0.2 cm find the tensile stress at equilibrium. **3**
 $G = 3.1 \text{ m/s}^2$.
- (d) Explain the method of determine Young's modulus of a long wire. **5**
- 10** (a) Give answer to the following : **4**
- (1) Define simple harmonic motion.
 - (2) Define resonance.
 - (3) Define force constant.
 - (4) What is damped oscillation ?
- (b) Describe the energies possessed by a simple harmonic motion. **2**
- (c) A particle of mass 20 g executes a simple harmonic motion of amplitude 3 cm. If the time period is 0.30 s find the total mechanical energy of the system. **3**
- (d) Explain the following terms regarding simple harmonic motion : **5**
- (1) Amplitude
 - (2) Time period
 - (3) Frequency
 - (4) Phase and
 - (5) Linear velocity and acceleration.