



B-003-0011002

Seat No. _____

B. Sc. (Sem. I) Examination

March - 2021

Physics : P-101

(Mechanics & Semiconductor Electronics) (New Course)


Faculty Code : 003

Subject Code : 0011002

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

[Total Marks : 70

- Instructions :** (1) Right hand side number indicates marks.
(2) Attempt any five questions.

- 1 (a) Answer in short : 4
- (1) What will be the x, y and z components of $\hat{j} + \hat{k}$?
 - (2) If two vectors \vec{A} and \vec{B} are perpendicular (i.e. $\theta = 90^\circ$) then $\vec{A} \cdot \vec{B} =$ _____.
 - (3) For unit vector $\hat{i} \cdot \hat{j} =$ _____.
 - (4) $\vec{A} \cdot \vec{B} = AB \cos\theta$. (True/False)
- (b) Define scalar and vector. 2
- (c) Explain scalar product of two vectors. 3
- (d) Describe vector product of two vectors and discuss their properties. 5
- 2 (a) Answer in short : 4
- (1) What will be the x, y and z components of \hat{i} ?
 - (2)  is the symbol of _____.
 - (3) Give the name of a transistor terminals.
 - (4) The total resistance of series combinations of resistors R_1, R_2 and R_3 is _____.
- (b) What is called active component ? Give example. 2
- (c) Describe colour code of resistor. 3
- (d) Discuss in detail capacitors. 5

- 3 (a) Answer in short : 4
- (1) Define elasticity.
 - (2) The force per unit cross area is stress. (True/False)
 - (3) The unit of stress in MKS unit is _____.
 - (4) Strain is unitless. (True/False)
- (b) Explain Hook's law. 2
- (c) Explain Poisson's ratio. 3
- (d) Explain the method of determining Young's modulus of a long wire. 5
- 4 (a) Answer in short : 4
- (1) What is the full form of S.H.M. ?
 - (2) The unit of frequency is _____.
 - (3) Define amplitude.
 - (4) Time period $T = 2\pi\omega$. (True/False)
- (b) Define resonance. 2
- (c) Define damped harmonic motion and discuss the factors affecting on it. 3
- (d) Describe the simple pendulum. Show that it executes simple harmonic motion when θ is small and obtain its time period. 5
- 5 (a) Answer in short : 4
- (1) Give the names of semiconductors.
 - (2) What is intrinsic semiconductor ?
 - (3) Draw the symbol of PN junction diode.
 - (4) What is meant by doping ?
- (b) Explain the energy bands in crystal-semiconductor. 2
- (c) Explain the formation of a P-N junction. 3
- (d) Explain V-I characteristics of a PN junction diode. 5
- 6 (a) Answer in short : 4
- (1) Define the drift current.
 - (2) Draw the symbol of Zener diode.
 - (3) Zener diode normally operated under reverse bias. (True/False)
 - (4) Draw the crystal structure of Germanium (Ge).

- (b) Write a note on extrinsic N-type semiconductor. **2**
- (c) Explain the ideal diode. **3**
- (d) Explain V-I characteristics of a zener diode. **5**
- 7** (a) Answer in short : **4**
- (1) Give the name of types of frame of reference.
- (2) Define work.
- (3) The frame of reference which obeys Newton's first law is called _____.
- (4) Newton's 2nd law states that $\vec{F} = m\vec{a}$ (True/False)
- (b) Show that the work done by a conservative force round a closed path is zero. **2**
- (c) Obtain an expression for centre of mass of two particle system. **3**
- (d) Define elastic collision. Discuss one dimensional elastic collision and obtain an expression for the final velocity of two colliding bodies. **5**
- 8** (a) Answer in short : **4**
- (1) Work is a scalar quantity. (True/False)
- (2) 1 Joule = _____ erg.
- (3) The unit of work is _____. (SI unit)
- (4) Give the names of two main types of collisions.
- (b) Explain the frame of reference. **2**
- (c) State and prove work-energy theorem. **3**
- (d) Describe the system of variable mass and rocket propulsion. **5**
- 9** (a) Answer in short : **4**
- (1) What is rigid body ?
- (2) Give the unit of angular speed ω .
- (3) $V = r\omega$. (True/False)
- (4) The dimensional formula of torque (τ) is _____.
- (b) Explain angular speed. **2**
- (c) Derive an expression for the torque acting on a particle. **3**
- (d) State and prove the theorems of moment of inertia. **5**

- 10 (a) Answer in short. 4
- (1) The SI unit of kinetic energy is _____.
 - (2) Moment of inertia of a circular disc is _____.
 - (3) The velocity of escape on the surface of the earth is _____ km/s.
 - (4) Torque acting on the particle is maximum when angle between \vec{r} and \vec{F} is _____.
- (b) Explain gravitational potential energy. 2
- (c) State and prove Kepler's first law of planetary motion. 3
- (d) What is escape velocity ? Derive an expression for escape velocity. 5
-