DCW-003-11002   Seat No. _____

B. Sc. (Sem. I) (CBCS) Examination

August - 2022

Physics : 101

(Mechanics & Semiconductor Electronics)
(New Course)

Faculty Code : 003
Subject Code : 11002

Time : $2\frac{1}{2}$ Hours]   [Total Marks : **70**

Instructions :   (1)   Any five questions are compulsory.
   (2)   Symbols have their usual meaning.
   (3)   Figures on right hand side indicates full marks.
   (4)   Full marks of each question to be indication a circle at the right end of the first line of each question.

1   (a)   Give the correct answer of the following questions :   4

   (1)   What will be the x, y and z components of $\hat{i} - \hat{j}$?

   (2)   What is the angle between $\hat{A}$ and $\hat{B}$, if $\hat{A} \cdot \hat{B} = 1$?
   (3)   Density is the _____ quantity.

   (4)   If $\vec{A} = 5\hat{i}$ and $\vec{B} = 3\hat{j}$, then $\vec{A} \cdot \vec{B} = $?

   (b)   Answer in brief :   2
   Show that the vectors $A = 2\hat{i} - 3\hat{j} - \hat{k}$ and $B = -6\hat{i} + 9\hat{j} + 3\hat{k}$ are parallel.

   (c)   Answer in detail :   3
   Explain addition of two vectors.
   (d)   Write a note :   5
   Explain scalar triple product.

2   (a)   Give the correct answer of the following questions :   4

   (1)   What will be the x, y and z components of $-\hat{j} + \hat{k}$?

   (2)   What is the angle between $\hat{A}$ and $\hat{B}$, if $\hat{A} \times \hat{B} = 1$?
   (3)   Semiconductor devices are passive components. (TRUE or FALSE)
   (4)   For resistor value measurement, GREEN color band is used for which digit.

(b) Answer in brief : **2**

A d.c. source generating 500V has an internal resistance of $970\,\Omega$. Find the load current if load resistance is (i) $30\,\Omega$ and (ii) $80\,\Omega$.

(c) Answer in detail : **3**

Explain primary cells and secondary cells of batteries.

(d) Write a note : **5**

Write note on resistors.

3 (a) Give the correct answer of the following questions : **4**

(1) In _____, there is no forbidden energy band gap between valence band and conduction band.

(2) _____ and _____ are tetravalent, most commonly used as semiconducting materials in different devices.

(3) Write one pentavalent element name.

(4) Define intrinsic semiconductor.

(b) Answer in brief : **2**

Define semiconductor materials.

(c) Answer in detail : **3**

Explain zener breakdown mechanism.

(d) Write a note : **5**

Explain V-I characteristics of a PN-junction diode.

4 (a) Give the correct answer of the following questions : **4**

(1) In _____ , the forbidden energy band gap is less than 2 eV.

(2) The crystal structure of Ge and Si is that of the _____ structure.

(3) Write one trivalent impurity name.

(4) Define extrinsic semiconductor.

(b) Answer in brief : **2**

Explain the ideal diode.

(c) Answer in detail : **3**

Explain the formation of a PN-junction.

(d) Write a note : **5**

Explain V-I characteristics of a zener diode.

5 (a) Give the correct answer of the following questions : **4**

(1) Work is a _____ quantity.

(2) Define : Power

(3) Write name of two main classified catagories of collisions.

(4) Write statement of law of conservation of energy.

(b) Answer in brief : **2**
A neutron having mass 1.67×10^{-27} Kg moving at 10^8 m/s collides with a deutron at rest and sticks to it. Mass of the deutron is 3.34×10^{-27} Kg. Calculate the speed of the combination from the law of conservation of momentum.

(c) Answer in detail : **3**
Explain Newton's laws of motion.

(d) Write a note : **5**
Explain the principle of conservation of linear momentum. If the external force acting on the system is zero, show the total momentum of the system is constant.

6 (a) Give the correct answer of the following questions : **4**
(1) Give the unit of work in CGS system.
(2) 1 Horsepower (HP) = _____ watt.
(3) Define : Work
(4) Write statement of law of conservation of linear momentum of the system.

(b) Answer in brief : **2**
Two particles of mass 1Kg and 3Kg have position vector $2i + 3j$ and $-2i + 3j - 4k$. Find the centre of mass.

(c) Answer in detail : **3**
State and prove work energy principle.

(d) Write a note : **5**
Explain the elastic collision in one dimension.

7 (a) Give the correct answer of the following questions : **4**
(1) What is the unit of angular speed?
(2) Write dimensional formula of torque.
(3) The vector product of _____ and _____ is defined as the angular momentum of the particle with respect to point O.
(4) Write statement of law of conservation of angular momentum.

(b) Answer in brief : **2**
Define rotational motion.

(c) Answer in detail : **3**
Explain moment of inertia.

(d) Write a note : **5**
State and prove the theorems of moment of inertia.

8   (a)   Give the correct answer of the following questions :   4
          (1)   The direction of angular _____ is determined by
                the right hand screw rule.
          (2)   What is the SI unit of torque?
          (3)   What is the SI unit of angular momentum?
          (4)   Write dimensional formula of moment of inertia.

    (b)   Answer in brief :   2
          Explain angular speed and angular velocity.
    (c)   Answer in detail :   3
          Explain the state of weightlessness.
    (d)   Write a note :   5
          What is escape velocity? Derive an expression for
          escape velocity.

9   (a)   Give the correct answer of the following questions :   4
          (1)   Write types of stress.
          (2)   Define : Strain
          (3)   Volume stress is same as _____.
          (4)   Write types of modulus of elasticity corresponding
                to different types of strains produced.

    (b)   Answer in brief :   2
          Define volume stress.
    (c)   Answer in detail :   3
          Explain longitudinal and shearing stress.
    (d)   Write a note :   5
          State Hooke's law and obtain the modulii of elasticity.

10 (a)   Give the correct answer of the following questions :   4
          (1)   Define : Frequency
          (2)   Write one example of physical pendulum.
          (3)   The system will oscillate only if the damping is
                _____ than the critical damping.
          (4)   Define : Critical damping

    (b)   Answer in brief :   2
          A particle of mass 100 gm executes a simple harmonic
          motion. The restoring force is provided by a spring of
          spring constant 80 N/m. Find the time period.
    (c)   Answer in detail :   3
          Describe : Simple harmonic motion.
    (d)   Write a note :   5
          Explain : Damped harmonic oscillation.

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