[56]
E+G

Seat No: _____ No. of printed pages: 4

SARDAR PATEL UNIVERSITY

Course: B. Sc. (II - Semester) Examination

Code No.: US02CPHY51 **Paper Title: Mechanics - II, Basic Electronics and LASER**

Date: 26 - 04 - 2022, Tuesday Time: 12 pm to 2 pm

Note: (i) The symbols have their usual meaning. **Total Marks: 70**
(ii) The figure to the right side indicates marks.

Q.1 Choose the correct answer from the given options below: [10]

(1) The scalar triple product of rectangular unit vectors $\hat{\imath}, \hat{\jmath}$ and $\hat{k}$ may be __.
(a) 1 (b) -1 (c) 1 or -1 (d) zero

(2) $\vec{A} = x\,\hat{\imath} + (y - z)\,\hat{\jmath} + (x - az)\,\hat{k}$ is a solenoidal vector for the constant 'a' = ___.
(a) 1 (b) -1 (c) 2 (d) -2

(3) $\vec{A} \times (\vec{B} \times \vec{C}) =$ _____.
(a) $\vec{B}\,(\vec{A}\cdot\vec{C}) - \vec{C}(\vec{A}\cdot\vec{B})$ (b) $\vec{B}\,(\vec{C}\cdot\vec{A}) - \vec{C}(\vec{B}\cdot\vec{A})$
(c) $(\vec{A}\cdot\vec{C})\,\vec{B} - (\vec{A}\cdot\vec{B})\,\vec{C}$ (d) All of these

(4) A frame of reference in which law of inertia holds true is called__.
(a) Non-inertial frame of reference (b) Inertial frame of reference
(c) Cartesian frame of reference (d) Absolute frame of reference

(5) According to special theory of relativity, mass _____with increase of velocity.
(a) Increases (b) Decreases (c) Does not change (d) None of these

(6) _____ converts ac power into dc power.
(a) Transformer (b) Inductance (c) Resistance (d) Rectifier

(7) The ripple factor of a full wave rectifier is _____.
(a) 0.48 (b) 1.21 (c) 40.6 (d) 81.2

(8) In a PNP transistor, the collector is made up of _____.
(a) P-type semiconductor (b) N-type semiconductor (c) Metal (d) Insulator

(9) Laser is an acronym of _____.
(a) Light Amplification by Stimulated Emission of Radiation
(b) Light Amplification by Semiconductor Emission of Radiation
(c) Light Absorption by Stimulated Emission of Radiation
(d) Light Absorption by Semiconductor Emission of Radiation

(10) The Nd: YAG laser is a _____ level laser.
(a) Two (b) Three (c) Four (d) Five

CP. T. O.)

Q.2 Do as directed: [08]

(a) **Write True or False.**

(1) If $\vec{V}$ is a vector point function then div $\vec{V}$ is a vector.
(2) Special theory of relativity states that time is a relative physical quantity.
(3) The PIV of center-tapped full wave rectifier circuit is V_m.
(4) Nd: YAG laser gives output in infrared region.

(b) **Fill in the blank:**

(5) ____ theorem gives the relation between volume integral and surface integral. (Gauss'/Stoke's)
(6) Theory of relativity was first given by _____. (Einstein/Fermi)
(7) The middle region of a transistor is known as ____. (Emitter/Base)
(8) Normally in CD ROM, a laser beam of ___is used for writing. (25W/ 25 mW)

Q.3 Answer the following questions in short [Attempt any TEN] [20]

(1) Write mathematical formula of curl $\vec{V}$.
(2) Define irrotational vector. Give an example.
(3) Prove that $\vec{\nabla} \cdot \vec{r} = 3, where\ \vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$.
(4) Define (i) Event and (ii) Observer.
(5) What is ether? write main features of ether.
(6) Write Lorentz transformation equations.
(7) What is a filter circuit? Draw labelled diagram of any two filter circuits.
(8) Draw the circuit of a center-tap rectifier and label its components.
(9) What are the advantages of LED over ordinary incandescent lamp?
(10) State any four applications of Laser.
(11) State four different methods of pumping in lasers.
(12) Explain stimulated absorption.

Q.4 Long Answer Questions: [Attempt any FOUR] [32]

(1) Obtain scalar triple product of three vectors in the form of a determinant and discuss its geometrical interpretation. Write its any two characteristics.
(2) Define $\vec{\nabla}\phi$ and explain its physical interpretation. Prove that $grad\ \phi = \vec{\nabla}\phi$.
(3) Discuss Lorentz-FitzGerald length contraction and time dilation.
(4) Discuss Galilean transformations. Prove that acceleration of an object is invariant under Galilean transformations.
(5) What is a half-wave rectifier? Draw the waveform of rectified voltage of a half-wave rectifier. Obtain an expression for its output dc voltage.
(6) What is zener diode? Explain avalanche effect and zener effect in a zener diode and explain its use as a voltage regulator.
(7) Discuss in details properties of lasers.
(8) Write a note on the CO_2 laser.