

Total questions : 13

BG : 1stSemester

PHYSICS

Maximum marks : 56

Time allowed : 3 hrs

Minimum pass marks : 20

Note : Attempt all MCQs of Section A, and any four questions from Section B and C

Section A: Multiple Choice Questions

(1 × 8 = 8 marks)

Q 1)

i) Solid angle subtended by a closed surface of any shape at any point lying well within it is

- a) 0
b) 2π
c) $2\pi/3$
d) 4π

ii) What are the maximum values of θ and Φ in polar coordinates?

- a) $0, \pi$
b) $\pi, 2\pi$
c) $0, 2\pi$
d) $2\pi, 3\pi$

iii) Which is not explicit function of time

- a) velocity
b) acceleration
c) potential energy
d) momentum

iv) Newton's laws of motion are based on the assumption that space is

- a) homogeneous
b) isotropic
c) both "a" & "b"
d) invariant under rotation

v) Two photons recede from each other. Their relative velocity will be

- a) zero
b) $c/2$
c) $2c$
d) c

Section C : Long answer type questions

(8×4=32marks)

Q 8) What is spherical polar co ordinate system r, θ, Φ ? What are the limits of r, θ and Φ . Derive the relation between spherical polar co ordinates and three dimensional Cartesian co ordinates.

Q 9) Define angular moments \vec{J} and torque $\vec{\tau}$. Show that torque is given by the rate of change of angular momentum.

Q 10) On the basis of Lorentz transformation, derive an expression for length contraction.

Q 11) State Kepler's laws of planetary motion. Show that the square of the time period of revolution of a planet is proportional to the cube of semi-major axis of the orbit.

Q12) If Y, k and σ represent Young's modulus, Bulk modulus and Poisson's ratio respectively, then prove that :

$$k = \frac{Y}{3(1 - 2\sigma)}$$

Q13) Derive an expression for total energy of a body executing SHM. At what displacement from the mean position is the kinetic energy of SHO half of its maximum value.