Total questions: 13		BG: 1 st Semester
PHYSICS		Maximum marks : 56
Time allowed : 3 hrs		Minimum pass marks : 20
Note : Attempt all MC	Qs of Section A, and a	ny four questions from Section
B and C		
Section A: Multiple Choice Questions		(1×8 = 2m
Q1)		
i) Solid angle subtended by a	closed surface of any shape	at any point lying well within it is
a) O	b) 2 π	
c) 2 \pi /3	d) 4 π	
ii) What are the maximum va	lues of θ and Φ in polar coor	dinates?
a) 0, π	b)π,2	To the state of th
c) 0 , 2 π	d) 2π, 3	3π
iii) Which is not explicit functi	on of time	
a) velocity	b) acceleration	
c) potential energy	d) momentum	
iv) Newton's laws of motion a	re based on the assumption	that space is
a) homogeneous	b) isotropic	
c) both "a" & "b"	d) invariant under rotation	
v) Two photons recede from e	ach other Their relative velo	city will be

b) c/2

d) c

a) zero c) 2c vi) Gravitational potential due to point mass is

vii) What is the relation between Y, k and η for isotropic material

b)
$$\eta = 9kY/4k + Y$$

c)
$$\eta = 3kY/9k+Y$$

viii) Potential energy per unit volume is equal to

Section B: Short answer type questions

(4×4 = 16 marks)

Q 2) Show that plane polar coordinates are orthogonal.

Q 3) A particle moves in a plane with constant radial velocity 25 m/s and constant angular velocity 5 rad/s. Obtain the expression for velocity and acceleration of the particle if time is counted from r = 0 and $\theta = 0$. Also determine their magnitude at t = 2s.

- Q 4) Prove that four dimensional volume element dx , dy ,dz , dt is invariant under Lorentz transformation.
- Q 5) Does a particle moving along a circular path with uniform speed possess acceleration? Explain.
- Q 6) Give a graphical representation of total K.E. And P.E. Versus displacement and explain in brief.
- Q 7) What are elastic constants? Show that:

$$9/Y = 1/k + 3/\eta$$

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 and torque . 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 $\,\sigma\,$ represent Young's modulus, Bulk modulus and Poisson's ratio respectively, then prove that :

$$k = y \div 3(1 - 2\sigma)$$

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.