9. (a) Write the background of nanoscience and nanotechnology. 5

(b) Discuss the possible applications of nanotechnology. 5

Or

10. (a) Describe the plasma are discharge technique for material fabrication. 5

(b) Discuss with the labelled diagram the working of pulsed-laser deposition technique. 5

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UG Odd Semester Examination, 2022

EDUCATION B.Sc. B.Ed

(1st Semester)

Course No.: BSPH-102

(Mechanics & General Properties of Matter)

Full Marks: 50

Pass Marks: 20

Time: 2 hours

The figures in the right margin indicate full marks for the question.

Answer the following five (5) questions

1. (a) Show that the horizontal displacement of a freely falling body due to Coriolis force is

$$x = \left(\frac{8}{9g}\right)^{1/2} h^{3/2}\,\omega\cos\phi$$

The symbols have this usual meanings. 5

(b) Suppose a body of mass m in projected horizontally with an initial velocity v_0 in a medium which offers resistance proportional to the velocity. Show that the velocity and displacement after time t are $v = v_0 e^{-Kt}$ and

$$x = \frac{v}{K}(1-e^{-Kt})$$

where K is the resistive force of the medium per unit velocity per unit mars. Also show that at $t\to\infty$ the body comes to a halt at distance $\frac{v_0}{K}$. 5

Or

2. (a) What is non-intertial frame of reference? 1

(b) Show that the acceleration of a particle as we observe from a rotating frame of reference is given by

$\vec{a} = a - 2\omega \times v' - \omega \times (\omega \times r')$

Also obtain the equation of motion with respect to the rotating frame of reference. 8+1=9

3. (a) What is central force? Show that the angular momentum of a particle under the influence of a central force always remains conserved. 3

(b) Show that the total angular momentum of a system of particles is the vector sum of its orbital and spin angular momenta. And deduce the expression of the torque acting on the system. 6+1=7

Or

4. (a) State perpenducular axes theorem. 1

(b) Find themoment of inertia of a circular disc of radius R and mars m about.

(i) the axis passing through its centre and perpenducular to its plane.

(ii) about its diameter. 5

(c) Find the moment of interia of a solid sphere of radius R and mar m. 4

5. (a) Find the gravitational potential at a point (i) inside (ii) on the surface (iii) outside a solid sphere of radius R and mar m. Also show that the ratio of gravitational potential at the centre to that on the surface is 3/2. 7

(b) Obtain the gravitational fields at a point (i) inside, (ii) on the surface and (iii) outside the sphere. 3

Or

6. (a) What is gravitational potential energy? 1

(b) Derive the expression for gravitational potential energy of a solid sphere of radius R given by-

$U = -\,{}^{3}/_{5}\,\frac{M^2}{R}\,G$ 6

(c) Obtain the differential equation of simple harmonic motion of a simple pendulum when its amplitude is very small. 3

7. (a) Define Poisson's ratio. 1

(b) Show that a shear strain is equal to the sum of mutually perpendicular compressional and extensional strain. 3

(c) Derive the expression for the total depression of a cantilever of length l given by

$y = \frac{Wl^3}{3YI}$ 6

Or

8. (a) Define Reynold's number of fluid. 1

(b) Show that the pressure of fluid flowing in a capillary tube is inversely proportional to a^4 where 'a' is the radius of the tube. 7

(c) A tube of radius R and length L is connected in series with another tube of radius ${}^{R}/_{2}$ and length ${}^{L}/_{4}$. If the pressure across the two tubes taken together is p, show that the pressure the tubes separately are ${}^{p}/_{5}$ and ${}^{4p}/_{5}$. 2