

USPHT02 - Physics Paper-II - Gravitation, Oscillation and Properties of Matter

P. Pages : 3

GUG/W/24/11561

Time : Three Hours



Max. Marks : 50

Either:

1. A) i) Explain the terms : Gravitational field and Gravitational potential. 2
- ii) Derive the expression for gravitational potential due to thin spherical shell at point 6
 i) Outside ii) On the structure iii) Inside the shell
- iii) A uniform hollow sphere has a radius 0.4m and a mass of 10kg calculate the gravitation 2
 potential at a point on its surface and at a point 0.2m outside from the surface.
- B) a) Derive an expression for Gravitational self energy of a body. 2½
- b) State the Kepler's law of planetary motion. 2½
- c) Define angular momentum show that angular momentum is conserved under central 2½
 force.
- d) State the applications of satellite. 2½

Either:

2. A) i) What is simple Harmonic Motion? 1
- ii) Derive a general differential equation of motion of a simple Harmonic oscillator and 5
 obtain their solution.
- iii) Derive an expression for total energy of simple harmonic oscillator. 2
- iv) A particle performs SHM of period 10 sec and amplitude 5cm. Calculate the 2
 maximum velocity & maximum acceleration of particle.

OR

- B) a) State Damped & force harmonic Oscillations. 2½
- b) obtain an expression for power dissipation in damped Harmonic motion. 2½
- c) State the condition under which the motion of damped harmonic oscillation becomes 2½
 i) Dead beat ii) Critical damped iii) Damped oscillatory.
- d) In an oscillatory circuit $L = 0.5H$, $C = 1.8\mu F$. What is maximum value of resistance 2½
 to be connected so that the circuit may produce oscillations.

Either:

3. A) i) Explain angle of twist & angle of shear with diagram. 2
- ii) Deduce an expression for the couple required to twist a uniform solid cylinder by an angle. 4
- iii) What is the value of couple for a hollow cylinder of inner radius r_1 and outer radius r_2 ? 2
- iv) What couple must be applied to a wire one meter long, 1mm in diameter in order to twist one end of it through 90° , the other end remaining fixed 2
(Rigidity of material of wire is $2.8 \times 10^{10} \text{ N/m}^2$).

OR

- B) a) State Poisson's ratio what are limiting values of Poisson's ratio. $2\frac{1}{2}$
- b) What is Torsional Pendulum? Deduce an expression for time period of Torsional Pendulum. $2\frac{1}{2}$
- c) Explain $2\frac{1}{2}$
a) Elastic limit b) Yield point c) Elastic
fatigue with help of stress-strain diagram.
- d) Find the steps and force required to double the length of wire of cross-sectional area $0.5 \times 10^{-4} \text{ m}^2$ and $y = 2 \times 10^{11} \text{ N/m}^2$. $2\frac{1}{2}$

Either:

4. A) i) Define coefficient of viscosity of a liquid. 1
- ii) Describe with necessary theory Poiseuille's method of determining the coefficient & viscosity of a liquid. State clearly the assumption made. 6
- iii) Give an account of molecular theory of surface tension. 3

OR

- B) a) Obtain the equation of continuity for a flow flignite. $2\frac{1}{2}$
- b) Derive an equatum for excess of pressure inside bubble in air. $2\frac{1}{2}$
- c) State the Bernoulli's theorem and its application. $2\frac{1}{2}$
- d) A soap bubble of radius 10cm is blown calculate the work done in blowing a soap bubble having surface tension 30 dyne/cm. $2\frac{1}{2}$

5. Solve **any ten** of the following.

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| a) What is central force? | 1 |
| b) What is weightlessness? | 1 |
| c) Write the condition to set a satellite into circular orbit. | 1 |
| d) Explain free harmonic oscillations. | 1 |
| e) What is sharpness of resonance? | 1 |
| f) Define quality factor. | 1 |
| g) State Hooke's law. | 1 |
| h) What is stress? | 1 |
| i) Define Poisson's ratio. | 1 |
| j) What is stream line flow and turbulent flow of a liquid? | 1 |
| k) What is surface tension? State its unit. | 1 |
| l) Define angle of contact. | 1 |
