B.Sc. F.Y. (CBCS Pattern) Semester - I

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

P. Pages : 2 **GUG/S/23/11561**

Time : Three Hours * 1 6 9 2 * Max. Marks : 50

Notes : 1. Draw neat and well labelled diagrams wherever necessary.
2. All questions are compulsory.

Either :-

1. a) i) What is gravitational self energy of a body? Why it has negative value? **2**

ii) Show that the gravitational self energy of a galaxy is given by **5**
$Us = -GN^2M^2/2R$
Where, N = number of stars
M = Mass of each star
R = Average distance between each pair of stars.

iii) Calculate the gravitational self energy of the Sun, taking mass of Sun $M = 2x10^{30}$ kg the radius of the Sun $R = 7x10^8$ m ($G = 6.67 \times 10^{-11}$ Nm^2 kg^{-2}). **3**

OR

b) a) State Kepler's law of planetary motion. **2½**

b) Give basic idea about Global Positioning System (GPS). **2½**

c) State Newton's law of gravitation. Give the dimensions of gravitational constant. **2½**

d) Find the mass of sun from the following data: Radius of earth's orbit $r = 1.5x10^8$ km ($G = 6.67x10^{-11}$ Nm2 Kg^{-2}). **2½**

Either :-

2. a) i) State free and damped oscillations? **2**

ii) Establish differential equation of motion of a damped harmonic oscillator and Obtain general solution of a damped harmonic oscillator. **6**

iii) In an oscillatory circuit L = 0.5 henry, C = 1.8 μF. What is the maximum value of resistance to be connected so that circuit is oscillatory? **2**

OR

b) a) Define quality factor of a harmonic oscillator and find the equation of quality factor of a damped harmonic oscillator. **2½**

b) Derive the differential equation of linear SHMs. **2½**

c) Derive the equation of power dissipation in damped harmonic oscillations. **2½**

d) If the resonance frequency of an acoustic system is 280Hz and the half power frequency are 200Hz and 360Hz respectively. Calculate the Quality Factor. **2½**

Either :-

3. a) i) Find the expression for work done in stretching a wire under the load. **2**

ii) What is torsion of cylinder? Derive an expression for the torque required to twist a given cylindrical wire through Q radian. **5**

iii) What couple is required to twist the wire of length 1 m and diameter 1mm, through an angle 90°. Modulus of rigidity = $2.8x10^{10}$ N/M^2. **3**

OR

b) a) Define : **2½**
i) Young's modulus (Y)
ii) Bulk modulus (K)
iii) Modulus of rigidity (η)

b) State and explain Hooks law. **2½**

c) Prove that $9/Y = 1/K + 3/\eta$ **2½**

d) Find the work done in stretching a wire of length 0.5 m and 1 sq. mm in cross section through 1 mm. ($Y = 1.24 \times 10^{11}$ N/M^2). **2½**

Either :-

4. a) i) Define coefficient of viscosity. State its unit in CGS system. **2**

ii) Deduce Poiseuille's formula for flow of liquid through narrow capillary tube. State the assumption made in deducing the formula. **6**

iii) Calculate the mass of water flowing in 10 minute through a tube of 0.1cm in diameter, 40cm in length. If there is a constant pressure head of 20cm of water. The coefficient of viscosity of water is 0.0089 poise. **2**
(Given : density of water = 10^3 kg/m^3, acceleration due to gravity = 9.8 m/s^2).

OR

b) a) State Bernoulli's theorem. Derive equation of continuity. **2½**

b) Explain surface tension on the basis of molecular interpretation. **2½**

c) Derive an expression for excess pressure inside in spherical bubble in air. **2½**

d) Calculate the excess pressure inside a soap bubble of radius 3×10^{-3} m. surface tension of soap solution is 20×10^{-3} N/m. Also calculate surface energy in joule. **2½**

5. Answer **any ten** questions from the following:

a) Define Gravitational Potential. **1**

b) Define Gravitational field. **1**

c) What is a central force? Give examples. **1**

d) What is S.H.M.? **1**

e) What is sharpness of resonance? **1**

f) What is damping coefficient? **1**

g) Define the term elasticity. **1**

h) Define Poisson's ratio. **1**

i) What is stress? Write its SI unit and dimensions. **1**

j) What is streamline and Turbulent flow of liquid? **1**

k) What is surface tension of a liquid? States its units. **1**

l) What is Capillarity? **1**

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