



21.12.2015

DOON UNIVERSITY, DEHRADUN

End Semester Examination, First Semester, 2015

School of Physical Sciences

Physics core test paper of 5 Years (Integrated) MSc Programmes

Course: PHC-102: Mechanics Core

Time Allowed: 3Hours

Maximum Marks: 30

Note: Attempt All Questions from Sections A,B, and C.

SECTION: A (Marks: 1 X 6 = 6)

1. What is the radius of gyration?
2. What do you understand by gravity and acceleration due to gravity?
3. What are elastic constants? Write down the dimensions of Poisson's ratio.
4. What are damped oscillations?
5. What is the reduced mass of O_2 molecule?
6. Define ultimate tensile strength and breaking point for stainless steel.

SECTION: B Attempt any four questions. (Marks: 3 X 4 = 12)

1. Explain the theorem of parallel axes on moment of inertia. Derive the moment of inertia of the whole disc about an axis.
2. Show that the ratio of rotational to translation kinetic energy for a solid cylinder rolling down a plane without slipping is 1:2.
3. Derive the work done per unit volume in volumetric strain. What force is required to stretch a steel wire of half square c.m. in cross-section to double its length? Given $Y = 2 \times 10^{11} \text{ N/m}^2$.
4. Explain the energy of simple harmonic oscillator. Express your illustrations with suitable graph. Mention the drawbacks of simple pendulum.
5. (i) Define conservative force.
(ii) Two particles, having the positions $r_1 = (3i + 5j)\text{m}$ and $r_2 = -(5i + 3j)\text{m}$ move with velocities $v_1 = (4i + 3j) \text{ m/s}$ and $v_2 = (9i + 7j) \text{ m/s}$.
(a) Find the value of a , if they collide.
(b) When and where the collision will take place?
6. (i) What is a compound pendulum? How does a compound pendulum differs from simple pendulum?
(ii) What is the displacement to amplitude ratio of S.H.M when K.E. is 80% of total energy.

SECTION: C (Marks: 6 X 2 = 12)

1. (i) Write down the hypothesis of Galilean invariance

(ii) Two bodies of masses M_1 and M_2 are placed distant d apart. Show that at the position, where the gravitational field due to them is zero, the potential is given by

$$V = -\frac{G}{d}(M_1 + M_2 + 2\sqrt{M_1 M_2})$$

2. (i) What do you understand by torsional rigidity?

(ii) Derive the couple required to twist a cylindrical.

(iii) A solid cylinder of radius 5 cm is converted in to a hollow cylinder of same mass and length and external radius 7 cm. If the restoring couple per unit radian twist in original cylinder is C , deduce the same for the new hollow cylinder.