

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)

June 2016 End Semester Examinations
B.Sc. (Nautical Science) - 2013 batch onwards
Semester I
Nautical Physics – I
(UG21T2105)

Date : 18.06.2016/A.N

Time: 3 Hrs

Maximum Marks: 70

Pass Marks : 35

NOTE: Attempt any SEVEN questions. All questions carry equal marks **7x10=70**
Use of Non-programmable scientific calculator is allowed.

Q1. Define and explain moment of inertia. Determine moment of inertia and radius of gyration of a solid disc whose density is 3200 kg/m^3 , radius is 4cm and height is 4cm about an axis perpendicular to its plane and passing through its centre.

Q2. With the help of a neat labelled diagram, explain the differential pulley and derive an expression for its efficiency.

Q3.a) Explain gyroscopic inertia and gyroscopic motion.

b) Define mechanical advantage, velocity ratio and efficiency as applied to machines. Derive a relation between them.

Q4. State Pascal's law. Demonstrate with the help of an experiment.

Q5 A horizontal tube has different areas of cross-section at two points P_1 and P_2 . The diameter at P_1 is 4cm and the diameter at P_2 is 2cm. The manometer limbs are fixed at P and Q. When a liquid of density 0.8 g/cm^3 flows through the difference in pressure between the manometer limbs is 8cm. Calculate the rate of flow of the liquid through the tube.

Q6.a) State and prove Bernoulli's equation for the flow of liquid.

b) Calculate the horizontal force required to move a metal plate of area 2 m^2 with a velocity of 0.05 m/s , when it rests on a layer of oil 0.001 m thick. Given $\eta = 2 \text{ Ns/m}^2$.

Q7.a) Define surface tension. Derive an expression for the excess pressure inside a spherical liquid drop of radius r .

b) A steel wire 4 m in length and $2.4 \times 10^{-7} \text{ m}^2$ in cross-sectional area is stretched by a force of 36 N . Calculate i) stress, ii) strain, iii) increase in length and iv) work done in stretching the wire. Given $Y = 1.8 \times 10^{12} \text{ N/m}^2$.

Q8.a) What do you understand by viscosity? Define the coefficient of viscosity. Describe an experiment to compare the coefficients of viscosity of two liquids.

b) Explain the term metacentre and centre of buoyancy. Why should the metacentre lie above the centre of gravity of the floating body.

Q9 Define the terms Coefficients of real and apparent expansion of a liquid. Hence explain the thermal expansion of liquid.