Indian Maritime University

(A Central University, Govt of India)

May-June 2018 End Semester Examinations

B. Tech (Marine Engineering)

Semester-II

ENGINEERING MECHANICS-II (UG11T3206)

Date: 21.06.2018 Max Marks:100 Marks

Time: 3 Hrs Pass Marks: 50 Marks

PART A (3 X10=30)

Compulsory Questions

1.

a) What is moment of inertia and radius of gyration? (3 Marks)

b) Explain different types of friction. (3 Marks)

c) Explain of a governor. (3 Marks)

d) Explain the terms radial, transverse and centrifugal acceleration in a curvilinear motion. (3 Marks)

e) Explain with diagram what do you understand by open belt and cross belt. (3 Marks)

f) Explain 'amplitude', 'periodic time' and 'frequency' in S. H. M.? (3 Marks)

g) Differentiate between a governor and a flywheel. (3 Marks)

h) What is a differential band brake? (3 Marks)

i) What is a 'centre of percussion' related with compound pendulum? (3 Marks)

j) What is centrifugal tension in a belt and pulley system and why it is important for the same? (3 Marks)

PART B (5 X 14 = 70 Marks)

Answer Any Five of the following

2. A conical pivot bearing supports a load of 200 KN, the cone angle is 120^o and the intensity of normal pressure is not to exceed 0.35 N/mm^2. The external diameter is twice the internal diameter. Find the inner and outer diameter of the bearing surface. The shaft rotates at 250 R.P.M. and the coefficient of friction is 0.25. Find also power absorbed by the bearing in friction considering uniform pressure. (14 MARKS)

3. (a) A right circular disc which weighs 136.08 Kg and is 76.2 cm in diameter is free to rotate about it's geometric axis and is constantly accelerated from rest to 300 R.P.M. in 20 seconds. Determine the constant torque T to produce this acceleration. (07 MARKS)

(b) The motion of a block A on a smooth horizontal table controlled by the rod which rotates about a vertical axis at O as shown in the figure 1. At the position shown, A has the given values of velocity and acceleration relative to the rod which is rotating with the given values of angular velocity ω and angular acceleration α. If OA is 0.2 m and A weighs 98 N, what moment does it exert about O? (07 MARKS)

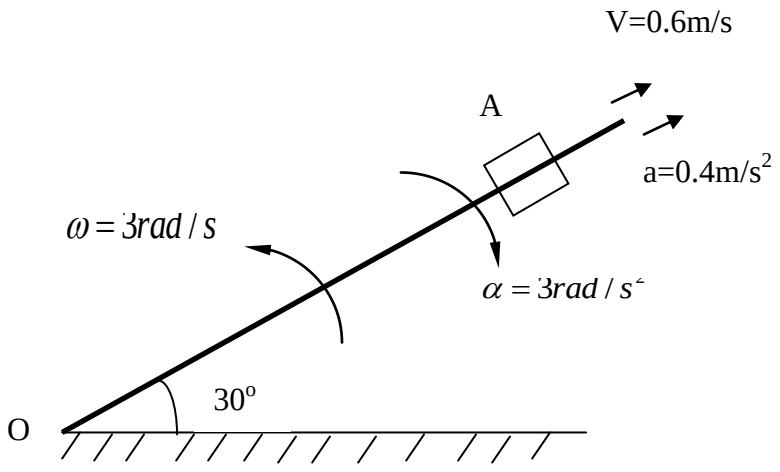


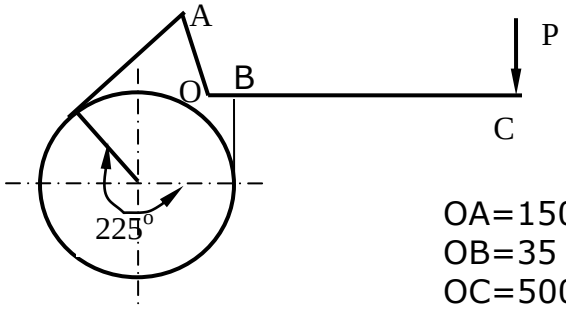
Fig.1

4. (a) A body moving in S.H.M. has an amplitude of 1 m and period of 1 complete oscillation is 2 s. What will be the speed and acceleration of the body $\frac{2}{5}$th of a second after passing the mid position? Also find the maximum velocity and maximum acceleration. (07 MARKS)

(b) A solid body of length 250 m having mass 85 kg is suspended in a vertical plane from one end and acts as a compound pendulum. The distance of centre of gravity from the other end is 150 mm and the body makes 100 oscillations in 145 seconds. Find the radius of gyration and moment of inertia of the flywheel about an axis through the centre of gravity. (07 MARKS)

5. An open flat belt drive connects two parallel shafts 1.2 m apart. The driving and driven shafts rotate at 350 r. p. m. and 140 r. p. m. respectively and the driven pulley is 400 mm in diameter. The belt is 5 mm thick and 80 mm wide. The coefficient of friction between the belt and pulley is 0.3 and maximum permissible tension in the belting is 1.4 MN/m^2. Determine:
(1) Diameter of driving pulley.
(2) Maximum power that may be permitted by the belting'
(3) Required initial tension. (14 Marks)

6. A differential band break, as shown in the figure 2, has an angle of contact of 225°. The band has a compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 N-m and the coefficient of friction between the band and the drum is 0.3. Find the necessary force(P) required for (1) clockwise and (2) anticlockwise rotation of the drum. (14 Marks)



OA=150 mm
OB=35 mm
OC=500 mm

Figure 2

7. A Hartnell Governor having a central sleeve spring and two right-angled bell crank levers moves between 290 r.p.m. and 310 r.p.m. for a sleeve lift of 15 mm. The sleeve arms and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the governor axis and mass of each ball is 2.5 kg. The ball arms are parallel to the s governor axis at the lowest equilibrium speed. Determine:
(1) Loads on the springs at the lowest and highest equilibrium speeds and (2) Stiffness of the spring. (14 MARKS)

8. A single plate clutch, with both sides effective, has outer and inner diameter 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm^2. If the coefficient of friction is 0.3, determine the power transmitted by the clutch at a speed of 2500 r.p.m. (14 MARKS)