

INDIAN MARITIME UNIVERSITY

(A CENTRAL UNIVERSITY, GOVT. OF INDIA)

SEMESTER- II, B.TECH. (MARINE ENGINEERING) – JUNE 2014 EXAMS

ENGINEERING MECHANICS - II (T 2206)

(AY 2013-14 batch onwards)

Time:- 3 Hrs
Date: 30.06.2014

Max Marks : 100
Pass Marks : 50

PART - A Compulsory Questions

(3 X10 = 30 Marks)

1. a) Define co-efficient of friction and angle of friction. (3)
- b) Explain an open and closed belt pulley. (3)
- c) Define the terms Amplitude, Phase difference in S.H.M. (3)
- d) What is radius of gyration? (3)
- e) What is D'Alembert's principle? (3)
- f) do you understand by 'open belt and crossed belt pulley'? (3)
- g) What is the rise of a governor? How does a governor differ from that of flywheel? (3)
- h) What is a simple band brake? When it becomes self locking? (3)
- i) What is the moment of inertia? Why it is important in curvilinear motion? (3)
- j) What is centrifugal tension in a belt and how it affects the power transmitted? (3)

PART - B

(5 X14 = 70 Marks)

Answer Any Five of the following

2. A thrust shaft of a marine ship has 6 collars of 600 mm external diameter and 300 mm internal diameter. The total thrust from the propeller is 100 KN. If the co-efficient of friction is 0.12 and speed of the engine is 90 R.P.M., find the power absorbed in friction at the thrust block, assuming
a) Uniform pressure b) Uniform wear. (14)
3. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 R.P.M., if the maximum permissible tension in the belt is 1.0 KN and the coefficient of friction between the belt and pulley is 0.25? (14)

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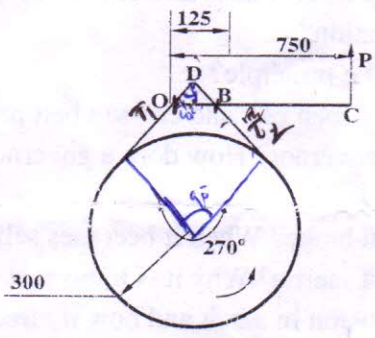
0.023625
0.0625

$T = \frac{v}{r} = \frac{15}{0.85} = 17.65 \text{ rad/s}$

4. A point moves with SHM and when this point is 0.85 m from the mid path it's velocity is 15 m/s and when 2.5 m from the centre of its path its velocity is 5m/s. Find its angular velocity, amplitude, time period and maximum acceleration. (14)

5. A simple band brake operates on a drum of 600 mm in diameter that is rotating at 200 R.P.M. as shown in the figure 1. The coefficient of friction is 0.25. The brake band has a contact of 270° , one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the angle of contact. (14)

- a) What is the pull necessary on the end of brake arm to stop the wheel if 35 KW is being absorbed? What is the direction of the minimum pull?
- b) What width of steel band of 2.5 mm thick is required for this brake if the maximum tensile stress is not to exceed 50 N/mm^2 ?



$P = T_2 \times \frac{r}{L}$
 $T_1 = T_2 e^{\mu \theta}$
 $P = 35 \times 1000 / (200 \times \frac{\pi}{30})$
 $T = T_1 = T_2 e^{0.25 \times \frac{3\pi}{2}}$

Fig. 1, All Dimensions are in mm.

6. In a marine engine governor of the porter type, the upper and lower arms are 260 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load of 24 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40° , find, (14)

- a) Without friction
- b) With friction, the range of the speed of the governor.

7. A Proell governor has equal arms of length 300 mm. The upper and lower ends of the arms are pivoted on the axis of the governor. The extension arms of the lower links are each 80 mm long and parallel to the axis when the radii of rotation of the balls are 150 mm and 200 mm. The mass of the each ball is 15 kg and the mass of the central load is 100 kg. Determine the range of the speeds. (14)

0.577

0.577

8. The rotation of a rod OA about O is defined by the relation, $\theta = 2.0t^2$, where θ is expressed in radians and t in seconds. Collar B slides along the rod in such a way that its distance from O is $r = 260t^2 - 20t^3$, where r is in mm and t in seconds. When $t=1$ determine (14)
- The velocity of the collar
 - The total acceleration of the collar
 - The acceleration of the collar w.r.t. the rod.

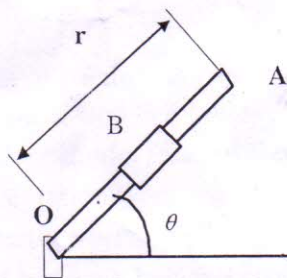


Fig.2

9. a) A body resting on a rough horizontal plane required a pull of 180 N inclined at 30° to the plane just moves it. It was found that a push of 220 N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. (7)

- b) Show that the time period of a compound pendulum is given by

$$T = 2\pi \sqrt{\frac{k^2 + a}{g}}$$

where, T is the time period, a is the distance of centre

of gravity from the point of suspension and k is the radius of gyration, g is the acceleration due to gravity. (7)
