Code No: 115DY **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2018
DYNAMICS OF MACHINERY
(Common to ME, MCT, AME, MSNT)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) What is the effect of gyroscopic couple on ships and explain the terms pitching and rolling. [2]
b) How does the gyroscopic couple influence the stability of four wheeler when it is taking a turn? [3]
c) How does screw-jack works? [2]
d) How does hydrodynamic journal bearings works, write different parameters that influence the frictional resistance. [3]
e) Write the formula for energy stored in the flywheel when it has fluctuation in its speed. [2]
f) Explain the terms isochronous and hunting. [3]
g) Define the terms static balancing and dynamic balance. [2]
h) What are different forces needs to be balanced in the locomotive. [3]
i) Write about Rayleigh's method of finding the natural frequency of transverse vibrations. [2]
j) What is critical speed of shaft? And the effect of eccentricity on critical speed. [3]

PART - B

(50 Marks)

2. An aircraft consists of a propeller. It also consists of engine and propeller of mass moment of inertia 150 kg m^2. The engine rotates at 3600 r.p.m. in a sense clockwise looking from rear. The aircraft completes half circle of radius 100 m towards left when flying at 360 km per hr. Determine the gyroscopic couple on the air-craft and state its effect. [10]

OR

3. In a four-link mechanism ABCD, AB= 350 mm, BC = 500 mm, CD = 400 mm, AD = 700 mm, DE = 150 mm, angle DAB = 60^0 (AD is the fixed link). A force of 35 N acts at E on link DC as shown in the figure-1. Determine the force on the link AB required at the midpoint in the direction shown in the diagram for the static equilibrium of the mechanism. The coefficient of friction is 0.4 for each revolving pair. Assume impending motion of AB to be counter–clockwise. Radius of each journal is 50 mm. Also, find the torque on AB for its impending clockwise motion. [10]

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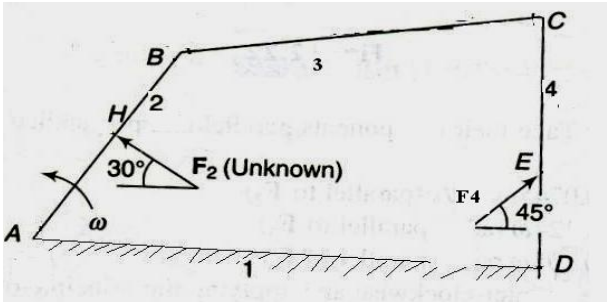

Figure 1

4. Figure 2 shows a differential band brake of drum diameter 400 mm. The ends of the band are fixed to the points on the opposite side of fulcrum of the lever at a distance of 50 mm and 160 mm from the fulcrum as shown in the Figure 2. The brake is to sustain a torque of 300 Nm. The co-efficient of friction between band and the brake is 0.2. The angle of contact is 210^0 and the length of lever from the fulcrum is 600 mm. Determine:
a) The force required at the end of the lever for the clockwise and anti-clockwise rotation of the drum.
b) Value of OB for the brake to be self-locking for clockwise rotation. [5+5]

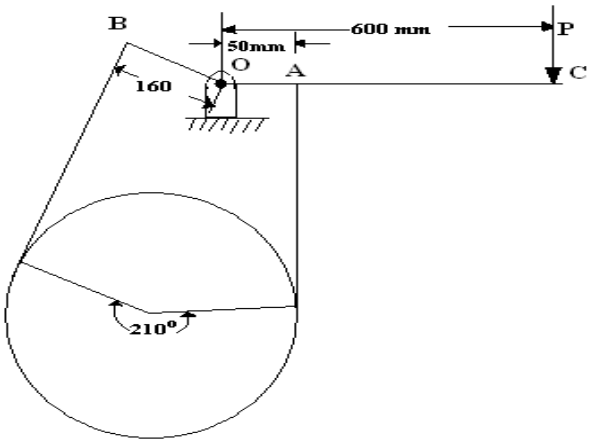

Figure 2

OR

5. A screw jack is used to raise a load of 5 tonnes (1 tonne = 9.81 KN). The pitch of single start square threads used for the screw is 24 mm. the mean diameter is 72 mm. determine the force to be applied at the end of 1.2 m long handle when the load is lifted with constant velocity and rotate with the spindle. Take μ = 0.2. [10]

6. Calculate the minimum speed, maximum speed and range of the speed of a Porter governor, which has equal arms each 200 mm long and pivoted on the axis of rotation. The mass of each ball is 4 kg and the central mass on the sleeve is 20 kg. The radius of rotation of the ball is 100 mm when the governor begins to lift and 130 mm when the governor is at maximum speed. [10]

OR

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7. In a machine, the intermittent operations demand the torque to be applied as follows:
a) During the first half revolution, the torque increases uniformly from 800 N.m to 3000 N.m
b) During next one revolutions, the torque remains constant
c) During next one revolution, the torque decreases uniformly from 3000 N.m to 800 N.m
d) During last $1^1/_2$ revolution, the torque remains constant.
Thus, a cycle is completed in 4 revolutions. The motor to which the machine is coupled exerts a constant torque at a mean speed of 250 rpm. A fly wheel of mass 1800 Kg and radius of gyration of 500mm is fitted to the shaft. Determine
i) The power of the rotor
ii) The total fluctuation of speed of the machine shaft. [10]

8. A shaft carries four rotating masses A, B, C and D in this order along its axis. The mass A may be assumed to be concentrated at radius of 18 cm, B of 24 cm, C of 12 cm and D of 15 cm. The masses of B, C and D are 30 kg, 50 kg and 40 kg respectively. The planes containing B and C are 30 cm apart. The angular spacing of the planes containing C and D are 90^0 and 210^0 respectively relative to B measured in the same plane. If the shaft and masses are to be in complete dynamic balance, find:
a) The mass and the angular position of mass A
b) The position of planes A and D. [5+5]

OR

9.a) Explain the terms : Primary disturbing force and secondary disturbing force.
b) Explain the procedures for balancing of V-engine. [5+5]

10. A shaft of length 1.25 m is 75 mm in diameter for the first 275 mm of its length, 125 mm in diameter for the next 500 mm length, 87.5 mm in diameter for the next 375 mm length and 175 mm in diameter for the remaining 100 mm of its length. The shaft carries two rotors at two ends. The mass moment of inertia of the first rotor is 75 kg m^2 whereas of the second rotor is 50 kg m^2. Find the frequency of natural torsional vibrations of the system. The modulus of the rigidity of shaft material may be taken as 80 GN/m^2. [10]

OR

11. A shaft 1.5 m long is supported in flexible bearings at the ends and carries two wheels each of 50 kg mass. One wheel is situated at the centre of the shaft and the other at a distance of 0.4 m from the centre towards right. The shaft is hollow of external diameter 75 mm and inner diameter 37.5 mm. The density of the shaft material is 8000 kg/m^3. The Young's modulus for the shaft material is 200 GN/m^2. Find the frequency of transverse vibration. [10]

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