Code No: 115DY

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech III Year I Semester Examinations, February/March - 2016
DYNAMICS OF MACHINERY
(Common to ME, MCT, MSNT, AME)

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.

Illustrate your answers with NEAT sketches wherever necessary

Part- A

(25 Marks)

1.a) In what way the inertia of the connecting rod is taken into account in the dynamic analysis of a reciprocating engine? [2]

b) What are the factors which are responsible for making a four – wheel vehicle to turn outwards while taking a turn? [3]

c) Do you recommend the uniform pressure theory or uniform wear theory for computing the friction torque of a bearing? Justify your answer. [2]

d) What is the advantage of self – expanding shoe brake? Explain. [3]

e) What are centrifugal governors? How do they differ from inertia governors? [2]

f) Find a relation for the coefficient of fluctuation of speed of a flywheel in terms of the maximum fluctuation of energy and the kinetic energy of the flywheel at mean speed. [3]

g) Explain the primary unbalance and secondary unbalance in reciprocating engines. [2]

h) When can we say that several masses rotating in different planes are in dynamic balance? [3]

i) Define the terms : Damping coefficient', 'Critical damping coefficient', and 'Damping factor'. [2]

j) What do you mean by 'whirling speed' of shafts, and when does it occur? [3]

Part-B

(50 Marks)

2. The rotor of a motor used for electric traction weighs 4.9 kN, and has a radius of gyration 20 cm. The centre of mass of the rotor is midway between the bearings. The speed of the motor and the train are 1500 rpm and 75 km/h respectively. The rotor shaft is parallel to the axles of the track wheels which rotate in two bearings 80 cm apart. Find the force on each bearing when the train turns in a curve of 150 m radius. [10]

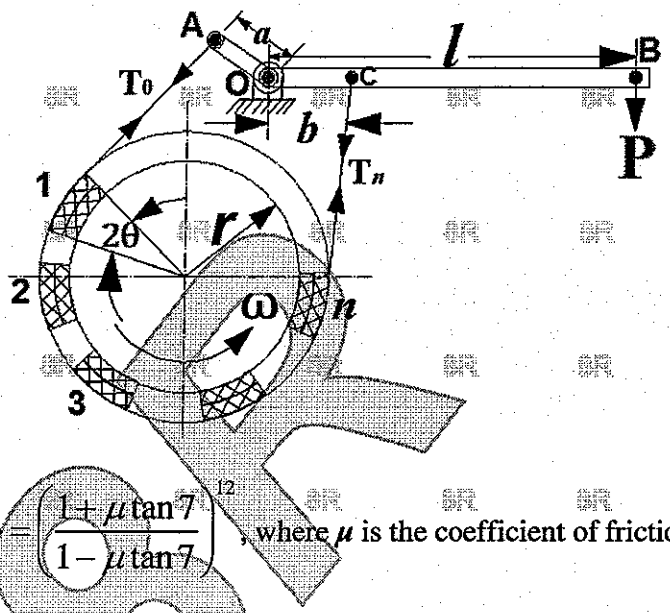
OR

3. In a vertical petrol engine, the crank radius is 6 cm, and the connecting rod is 22 cm long. The piston weighs 9.8 N. The connecting rod may be regarded as being equivalent to a mass of 0.5 kg at the piston together with a mass of 1 kg at the crank pin. Find the amount and the direction of the force exerted on the crank pin when the crank has moved 30^0 from the top dead centre. The engine speed is 2000 rpm, and in this position the force on the piston due to gas pressure is 7.35 N. [10]

4. A conical friction clutch with C.I. contact surfaces transmits 30 HP at 1000 rpm. The cone angle is 12^0 and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 30 cm, and the intensity of normal pressure is not to exceed 0.07 MPa, find the dimensions of the contact surfaces and the axial load required. The breadth of the conical surface is not to be greater than one – third of its mean radius. [10]

OR

5. In the band and block brake shown in Figure, the band is lined with 12 blocks each of which subtends an angle of 14^0 at the centre of wheel. If, when the brake is in action, the greatest and least tensions in the brake strap are P and Q,



show that $\frac{P}{Q} = \left(\frac{1+\mu\tan\gamma}{1-\mu\tan\gamma}\right)^{12}$, where μ is the coefficient of friction for the blocks. [10]

6. A horizontal steam engine running at 250 rpm has a bore of of 50 cm and stroke of 60 cm. The connecting rod is 120 cm long, and the reciprocating parts weigh 2.5 kN. When the crank is 60^0 past the IDC, the steam pressure on the cover side of the piston is 4.4×10^5 Pa, while that on the crank side is 9.8×10^4 Pa. Neglecting the area of the piston rod, determine the force in the piston rod and the turning moment on the crankshaft. [10]

OR

7. Sketch a Hartnell governor. Describe its working and deduce a relation to find the stiffness of the spring. [10]

8.a) What is 'Partial balancing' of locomotives? Explain.
b) Derive the relations for 'Variation of tractive force' and 'Swaying couple' in locomotives. [4+6]

OR

9. A shaft carries five masses *A*, *B*, *C*, *D* and *E* which revolve at the same radius in equidistant planes. The masses in planes *A*, *C* and *D* weigh respectively 500, 400 and 800 N. The angle between *A* and *C* is 90^0 and that between *C* and *D* is 135^0. Find the weights in planes *B* and *E* and their angular positions so that the shaft may be completely balanced. [10]

10.a) Deduce the expression for the of a compound pendulum in terms of its radius of gyration and the distance of radius of gyration and the distance of C.G. from the axis of suspension for the same frequency of oscillation of a simple pendulum.

b) Prove that the critical speed for a rotating shaft is the same as the frequency of natural transverse vibration. [4+6]

OR

11. A steel shaft of 9 cm diameter has two flywheels keyed to it at a distance of 75 cm apart. The flywheels weigh 4 kN and 6 kN and their radii of gyration are 67.5 cm and 62.5 cm respectively. Neglecting the inertia of the shaft, find the frequency of free torsional vibrations. [10]

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