2008 PUNJAB TECHANICAL UNIVERSITY
B.TECH MECHANICAL ENGINEERING
DYNAMIC OF MACHINARY

TIME: 3 HOUR
MARK: 80

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Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Discuss the equilibrium of two and three force members.

(b) In a four link mechanism the dimensions of the links are given below. Fixed link AD=60mm, driving link AB=50mm, coupler BC=100mm, driven link DC=80mm, and DE=40mm. The driving link is making an angle 1200 with AD. The driven link is acted upon by a force of 80 6 1500 N on link DC at E. Determine the input torque T on the link AB.

2. (a) Derive the expression for the force required to move the body down the rough inclined plane.

(b) A square threaded bolt of root diameter 22.5 mm and pitch 5 mm is tightened by screwing a nut whose mean diameter of bearing surface is 50 mm. if the coefficient of friction for the nut and bolt is 0.1 and for nut and bearing surface is 0.16, find the force required at the end of a spanner 500 mm long when the load on the bolt is 10kN.

3. (a) Derive the expression for the torque transmitting capacity of a single plate clutch by considering uniform pressure.

(b) A friction clutch is required to transmitted 34.5kW at 2000rpm. It is to be single plate disk type with both sides of the plate effective, the pressure is being applied axially by means of springs and limited to 70kPa on the plate. If the outer diameter of the friction limit is 1.5 times the internal diameter, find the required dimensions d1 and d2 of the clutch ring and the total force exerted by the springs. Assume uniform wear condition (coefficient of friction=0.3).

4. Write short notes on the following:

(a) Turning moment diagram

(b) Piston effort

(c) Coefficient of fluctuation of speed.

5. A Porter governor carries a central load of 30 kgf and each ball weighs 4.5 kgf. The upper links are 20cm long and the lower links are 30 cms long. The points of suspension of upper and lower links are 5cms from axis of spindle. Calculate:

(a) The speed of the governor in rpm if the radius of revolution of the governor ball is 12.5 cm and

(b) The effort of the governor for increase of speed of 1%.

6. A shaft carries four masses A, B, C and D of 12, 20, 30 and 16 kg respectively spaced 18 cms apart. Measuring angle anti clockwise from A, B is 2400, C is 1350 and D is 2700. The radii are 15 cm, 12 cm, 6 cm and 18 cm and the speed of the shaft is 120 rpm. Find the magnitude and direction relative to A of the resultant moment at a plane midway between A and B.

7. The following data apply to an outside cylinder unbalanced locomotive: Mass of rotating parts per cylinder per cylinder = 360 kg.
Mass of reciprocating parts per cylinder = 300 kg.
Angle between cranks = 900
Crank radius = 300 mm
Cylinder centers = 1.75 m
Radius of balance masses = 750 mm
Wheel centers = 1.45 m

If the whole of rotating and 2/3 of the reciprocating parts are to be balanced in planes of driving wheels. Find:

(a) Magnitude and angular position of balance masses.

(b) Speed in kilometers per hour at which the wheel will lift off the rails when the load on each driving wheel is 50 KN and the diameter of tread of driving wheel is 1.8 m.

(c) Swaying couple at the speed arrived in the (b) above.

8. (a) Determine natural frequency of the pendulum system.

(b) Define:

i. Free vibrations

ii. Forced vibrations

iii. Damping.