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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Automobile Engineering

Semester End Examination; Dec - 2017 / Jan - 2018

Theory of Machines - II

Time: 3 hrs *Max. Marks: 100*

***Note**: i)* Answer ***FIVE** full questions, selecting **ONE** full question from each unit*
ii) Graphical solutions must be done on drawing sheet only
iii) Missing data, if any, may be suitably assumed and stated.

UNIT - I

1. For the static equilibrium of the mechanism shown in Fig.1, find the required input torque on link2. The dimensions are : AD = 200 mm, AB = 60 mm, BC = 200 mm, DE = 160 mm, CE = 40 mm and EF = 180 mm. 20

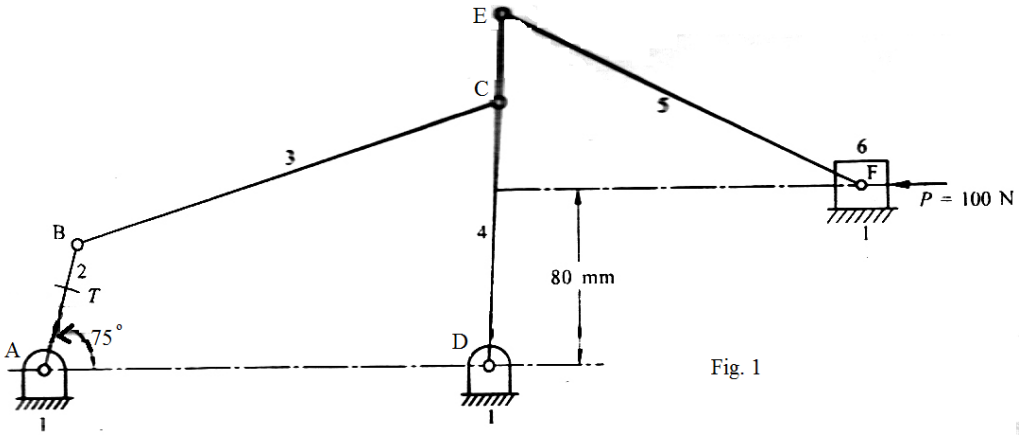

Fig. 1

2. A four link mechanism shown in Fig.2. A known couple T_4 = 20 N-m is applied to the link 4, and a known force p = 600 N is applied to the link 3. What couple T_2 must be applied to the link 2 for equilibrium. The dimensions are AD = 270 mm, AB = 100 mm, BC = 160 mm, CD = 140 mm and CE = 80 mm. 20

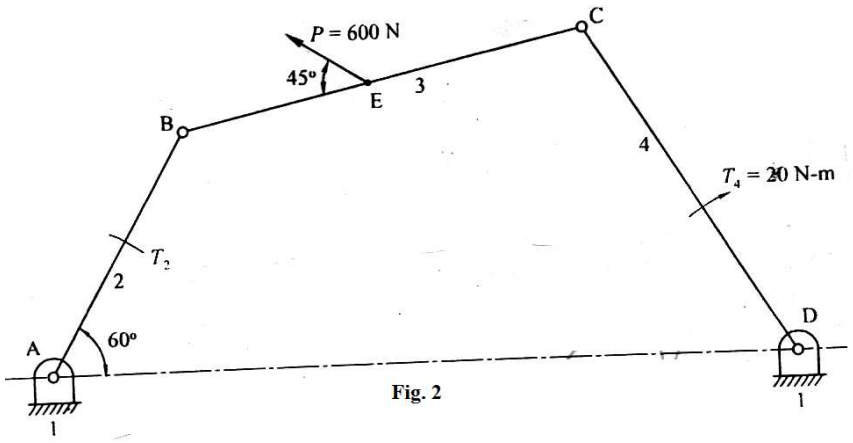

Fig. 2

UNIT - II

3 a. What do you mean by dynamically equivalent system? Explain. 6

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b. The following data relate to a horizontal reciprocating engine: Mass of reciprocating parts = 120 kg, crank length = 90 mm, Engine Speed = 600 rpm, Mass of Connecting rod = 90 kg, Length of Connecting rod = 450 mm, Distance of center of mass from big end Centre = 180 mm, Radius of gyrations about an axis through center of mass = 150 mm. Find the magnitude and direction of the inertia torque on the crank shaft when the crank has turned 30º from the inner dead centre. 14

4 a. What is turning moment diagram? Explain the use of Turning moment diagram. 6

b. An Otto cycle engine develops 40 kW at 160 rpm with 80 explosions per minutes. The change of speed from the commencement to the end of power stroke must not exceed 0.5% of mean speed on either side. Find the dimensions of a rectangular rim section having width four times the depth so that hoop stress does not exceed 4 MPa. Assume the fly wheel stores 16/15 times the energy stored by the rim and that the work done during the power stroke is 1.4 times the work done during the cycle the mass density of the rim material is 7200 kg/m^3. 14

UNIT - III

5 a. What is static and dynamic balancing? 4

b. A shaft carries four masses A, B, C and D rigidly attached to it in this order. The mass centers are 1.25 m, 1.5 m, 1.625 m and 1.375 m respectively form the axis of rotation. The mass A, C and D are 15 kg, 10 kg and 8 kg respectively. The axial distance between A and B is 16 m and that of B and C is 20 m. The angle between the masses A and C 90º. For complete balance. 16
Determine; i) The angle between A & B and A & D
ii) The axial distance between the planes of revolution of C and D
iii) The magnitude of mass B.

6. A 2 m long shaft carries three pulleys A, B and C one at each end and the pulley B at the middle of the shaft. The shaft is mounted on two bearings 1.6 m apart with equal overhangs on either side. The masses of the pulleys are 15 kg, 20 kg and 16 kg respectively and their centers of gravity are 6 mm, 5 mm and 8 mm from the centre of rotation of the shaft. 20
Determine; i) Angular position of the pulleys are adjusted until there is a static balance
ii) Dynamic forces produced on the bearings when the shaft rotates at 150 rpm.

UNIT - IV

7 a. Discuss partial balancing of single cylinder engine. 6

b. A four cylinder in line engine has the two outer cranks at 120º to each other and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 0.4 m, 0.7 m and 0.5 m. The length of each crank is 0.35 m, the length of each connecting rod is 1.7 m and the engine runs at 500 rpm. Find the reciprocating masses and the relative angular position for each of the inner cranks, if the engine is to be in complete primary balance. 14

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8. Show that a six cylinder inline, four stroke engine that has equal reciprocating masses and cylinder spacing is in complete balance for a firing order 1-5-3-6-2-4. 20

UNIT - V

9 a. Explain sensitiveness, stability and hunting of a governor. 6

b. A spring controlled governor of Hartnell type with a central spring under compression has balls each of mass 2 kg. The ball and sleeve arms of the bell crank levers are respectively 0.1 m, 0.06 m long and are at right angles. In the lowest position the radius of rotation of balls is 0.08 m and the balls arms are parallel to the governor axis. Find the initial load on the spring in order that the sleeve may begin to lift at 300 rpm if the stiffness of the spring is 30 N/mm , what is the equilibrium speed corresponding to a sleeve lift of 20 mm? Also find the governor power and effort. 14

10 a. Explain the effect of gyroscopic couple on Aeroplane. 8

b. A truck with four wheels, each of 0.75 m diameter travels on rails round a curve 75 m radius at a speed of 50 kmph the total mass of the truck is 5000 kg and its C.G is mid-way between the axles, 1.05 m above the rails and mid-way between them. Each pair of wheels is driven by a motor rotating in opposite direction to the wheels and at four times the speed. The moment of inertia of each pair of wheels is 15 kg-m^2 .The rail lie on a horizontal plane and 1.45 apart. Determine the load on each rail. 12

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