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10AE53

Fifth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Dynamics of Machines

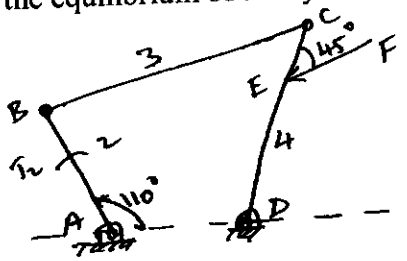
Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. What are conditions for a body to be in equilibrium under the action of two forces, three forces and two forces and a torque? **(06 Marks)**

b. In a four bar mechanism shown in Fig.Q1(b), calculate the required value of T_2 and various forces on links for the equilibrium of the system. **(14 Marks)**



F = 2000N
AD = 215mm
AB = 200 mm
BC = 370mm
DC = 350mm
CE = 100mm

Fig.Q1(b)

2 a. State and explain D'Alembert's principle. **(05 Marks)**

b. Prove that the maximum fluctuations of energy 'C' is given by C = 0.02 qE for a flywheel, where E = mean K.E. and q = Total percentage fluctuation of speed. **(05 Marks)**

c. A gas engine working on Otto cycle develops 22.08 kW at 300 rpm. The coefficient of fluctuation of energy is 1.85. The fly wheel mass is 1800 kg and its radius of gyration is 0.9m. What is the cyclic speed variation from the mean? **(10 Marks)**

3 a. Derive an expression for the ratio of belt-tension. **(08 Marks)**

b. An open belt-drive connects two pulleys 1.2 m and 0.6 m diameter, on parallel shafts 10 m apart. The mass of the belts is 1 kg/m length. The maximum tension in the belt is not to exceed 2000 N and the coefficient of friction is 0.25. The layer pulley, which is the driver, runs at 200 rpm. Due to belt slip on one of the pulleys, the speed of the driven pulley is 380 rpm. Calculation the torque on each of the two shafts, power transmitted, power lost in friction and the efficiency of the drive. **(12 Marks)**

4 a. Why is balancing of rotating parts necessary for high speed engines? Explain static and dynamic balancing. **(06 Marks)**

b. A, B, C and D are 4 masses carried by a rotating shaft at radius 100, 125, 200 and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and the masses B, C and D are 10 kg, 5 kg, 4 kg respectively. Find the required mass A and the relative angular positions of the 4 masses to keep the shaft in balance. **(14 Marks)**

PART – B

5 a. The following data relate to a single cylinder reciprocating engine:
Mass of reciprocating parts = 40 kg
Mass of revolving parts = 30 kg at 180 mm radius
Speed = 150 rpm
Stroke = 350 rpm
If 60 percent of the reciprocating parts and all the revolving parts are to be balanced, determine:
i) The balance mass required at a radius of 320 mm
ii) The unbalanced force when the crank has turned 45° from the top dead centre. **(05 Marks)**

b. Prove that the resultant unbalanced force is minimum when half of the reciprocating masses are balanced by rotating masses ie., when C = ½. **(10 Marks)**

c. What are In-line engines and state how they are balanced. **(05 Marks)**

6 a. Define the terms : i) Sensitiveness ii) Stability iii) Isochrome iv) Effort and v) Power **(05 Marks)**

b. The arms of a porter governor are each 30 cm long and are pivoted on the governor axis. Mass of each ball is 2 kg. At the mean speed of 150 rpm, the arm makes 30° with the vertical. Determine the central load and the sensitivity of the governor if the sleeve movement is ± 2.5cm. **(15 Marks)**

7 a. Explain the following terms:
i) Gyroscopic effect ii) Linear momentum iii) Angular momentum iv) Spin
v) Precession. **(10 Marks)**

b. Each road wheel of a motor cycle has a moment of inertia of 2 kg m^2. The rotating parts of the engine of the motor cycle has a moment of inertia of 0.2 kg m^2. The speed of the engine is 5 times the speed of the wheel and is in the same sense. The mass of the motor cycle with rider is 200 kg and its CG is 500 mm above ground level. The diameter of the wheel is 500 mm. The motor cycles is travelling at 15 m/s on a curve of 30 m radius. Determine (i) Gyro couple, centrifugal couple, over turning couple and balancing couple in terms of angle of heel and iii) Angle of heal. **(10 Marks)**

8 The following data relate to a symmetrical circular cam operating on a flat faced follower. Least radius = 25 mm, nose radius = 8 mm, lift of the valve = 10 mm, angle of action of cam = 120°. Cam shaft speed = 1000 rpm. Determine
i) Flank radius ii) Maximum velocity iii) Maximum acceleration iv) Maximum retardation.
If the mass of the flowers and valve with which it is in contact is 4 kg, find the minimum force exerted by the spring to overcome the inertia of the moving parts. **(20 Marks)**

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