CBCS SCHEME

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15AU52

Fifth Semester B.E. Degree Examination, Aug./Sept.2020
Dynamics of Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Discuss the equilibrium of two force and three force members. **(04 Marks)**

b. Determine various forces on the links and couple T_2 shown in Fig.Q1(b) where AB = 300 mm, BC = 600 mm, BD = 200 mm.

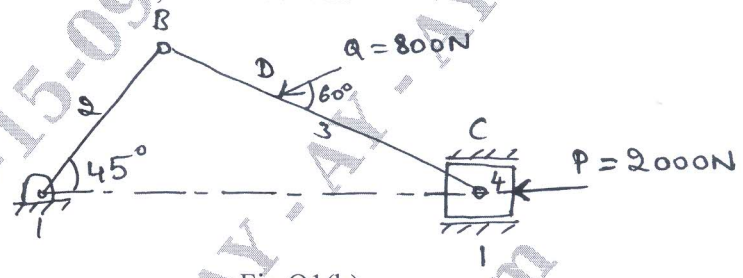

Fig.Q1(b) **(12 Marks)**

OR

2 a. State and explain D'Alembert's principle. **(06 Marks)**

b. A gas engine working on Otto cycle develops 22.08 KW at 300 rpm. The coefficient of fluctuation of energy is 1.85. The flywheel mass is 1000 kg and its radius of gyration is 0.9 m. What is the cyclic speed variation from the mean? **(10 Marks)**

Module-2

3 A shaft 3m span between bearings carries two masses 5 kg and 10 kg acting at the extrimities of the arm of length 0.45 m and 0.6 m respectively. The planes in which the masses rotate are 1.2 m and 2.4 m respectively from the left bearing and the angle between their arms is 60°. If these two masses are to be balanced by two additional rotary masses acting at radius of 0.3 m and rotating in planes 0.3 m to the right of the left bearing and 0.3 m to the left of the right bearings respectively. Determine the magnitude of the two masses and the angle at which they may be set. **(16 Marks)**

OR

4 The firing order in a 6 cylinder vertical 4 stroke in line engine is 1-4-2-6-3-5, the piston stroke is 100 mm. Length of each C.R = 200 mm. The piston distance between cylinder centerlines are 100 mm, 100 mm, 150 mm, 100 mm and 100 mm. Determine the out of balance primary and secondary forces and couples on this engine taking a plane midway between cylinders 3 and 4 as reference plane. The reciprocating mass per cylinder is 2 kg and the engine runs at 1500 rpm. **(16 Marks)**

Module-3

5 a. Derive an expression for "size of flywheel". **(06 Marks)**

b. A vertical double acting steam engine develops 73.6 Kilo-Watts at 250 rpm. The maximum fluctuation of energy is 30% of WD/Stroke. The maximum and minimum speeds are not to vary more than 1% on either side of mean speed, find the mass of flywheel required, if the radius of gyration is 0.6 m. **(10 Marks)**

OR

6 a. Derive an expression for height of porter governor neglecting frictional resistance. **(06 Marks)**

b. Each arm of a porter governor is 300 mm long and is pivoted on the axis of the governor. Each ball has a mass of 6 kg and the mass of Sleeve is 18 kg. The radius of rotation of ball is 200 mm. When the governor begins to lift and 250 mm when the speed is maximum. Determine the maximum and minimum speed and the range of speed of governor. **(10 Marks)**

Module-4

7 a. Derive an expression for frictional torque in a flat pivot bearing. Assuming uniform pressure across the bearing surface. **(06 Marks)**

b. The thrust of a propeller shaft in a marine engine is taken up by a number of collars integrated with the shaft which is 300 mm in diameter. The thrust on the shaft is 200 kN and the speed is 75 rpm. Taking μ constant and equal to 0.05 and assuming intensity of pressure equal to 0.3 N/mm^2. Find the external diameter of collar and the number of collars required, if the power lost in friction is not to exceed 16 KW. **(10 Marks)**

OR

8 a. Derive an expression for ratio of tensions in flat belt drive. **(08 Marks)**

b. Two pulley one 450 mm diameter and 200 mm diameter are on parallel shaft 1.95 m apart and are connected by cross belt. Find the length of the belt, angle of contact between belt and pulley. What power can be transmitted by the belt when larger pulley rotates at 200 rpm? If the maximum permissible tension in the belt is 1 kN and coefficient of friction is 0.25. **(08 Marks)**

Module-5

9 A rear engine automobile is travelling along a track of 100 m mean radius. Each of four road wheels has a moment of inertia of 2kgm^2 and an effective diameter of 60 cm. The rotating parts of the engine has a moment of inertia of 1 kgm^2. The engine axis is parallel to the rear axel. The crank shaft rotates in the same sense as the road wheels. The gear ratio of engine to back axle is 3:1. The mass of the vehicle is 1500 kg and has its C.G. 500 mm above road level. Width of track is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface if this is not cambered. **(16 Marks)**

OR

10 For a symmetrical tangent cam operating a roller follower, the least radius of cam is 30 mm and roller radius is 15 mm. The angle of ascent is 60°, the total lift is 15 mm and the speed of the cam shaft is 300 rpm. Calculate:

(i) Principal dimensions of cam

(ii) Acceleration of the follower at the beginning of the lift, where the roller just touches the nose and at the apex of the circular nose. Assume that there is no dwell between ascent and descent. **(16 Marks)**

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