CBCS Scheme

USN | | | | | | | | | | 15AU52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. What is point of concurrency? Explain equilibrium with respect to four force member. **(06 Marks)**

b. For the mechanism shown in Fig.Q1(b), find the required input torque for the static equilibrium. The lengths OA and AB are 250 mm and 650 mm respectively and force is 500 N.

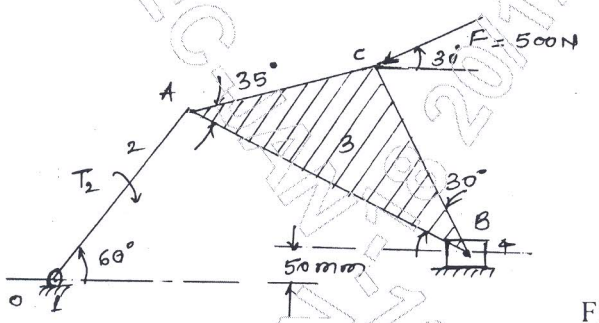

Fig.Q1(b) **(10 Marks)**

OR

2 a. Explain the following terms with respect to I.C. engine:
i) Piston effort ii) Crank effort **(04 Marks)**

b. The crank and connecting rod of a vertical single cylinder gas engine running at 1800 rpm are 60 mm and 240 mm respectively. The diameter of the piston is 80 mm and the mass of the reciprocating parts is 1.2 kg. At a point during the power stroke, when the piston has moved 20 mm from the top dead centre position, the pressure on the piston is 800 kN/m^2. Determine: i) Net force on the piston, ii) Thrust in the connecting rod, iii) Thrust on the sides of cylinder walls, iv) Engine speed at which the above values are zero. **(12 Marks)**

Module-2

3 a. Why is balancing of rotating parts necessary for high speed engine? **(02 Marks)**

b. A shaft carries four masses A, B, C and D are 200 kg, 300 kg, 240 kg and 360 kg respectively, revolving at radii 90 mm, 70 mm, 100 mm and 120 mm respectively. The distance from the plane A are 270 mm, 420 mm and 720 mm. Angle between the crank A and B is 45°, B and C is 75 °, C and D is 130°. Balancing masses are placed 120 mm and 100 mm from D and A respectively. The distance between them being 500 mm. Find the balancing masses and their angular position, if they are placed at a radius of 100 mm. **(14 Marks)**

OR

4 a. What is "primary balancing" and "secondary balancing" as applied to balancing of reciprocating masses? **(04 Marks)**

b. The pistons of a 4-cylinder vertical inline engine reach their uppermost position at 90° interval in order of their axial position. Pitch of cylinder = 0.35 m, crank radius = 0.12 m, length of connecting rod = 0.42 m. The engine runs at 600 rpm. If the reciprocating parts of each engine has a mass of 2.5 kg. Find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. **(12 Marks)**

Module-3

5 a. Define the following terms: i) Total fluctuation of speed, ii) Coefficient of fluctuation of energy, iii) Coefficient of steadiness. **(06 Marks)**

b. The turning moment diagram of single cylinder double acting engine consists of two isosceles triangles. The maximum turning moments are 2000 Nm and 1500 Nm respectively. When the engine works against a uniform resistance at a mean speed of 240 rpm. Find, power of the engine, maximum fluctuation of energy and mass of flywheel. Radius of gyration is 0.75 m and the fluctuation of speed is limited to ±1% of mean speed. **(10 Marks)**

OR

6 a. What is the function of a governor? How does it differ from that of a flywheel? **(04 Marks)**

b. In a Hartnell governor, the length of ball and sleeve arms are 12 and 10 cm respectively. The distance of fulcrum of the bell crank lever from the governor axis is 14 cm. Mass of each governor ball is 4 kg, when the governor runs at the mean speed of 300 rpm, the ball arms is vertical and sleeve arm is horizontal. For an increase speed of 4% of mean speed, the sleeve moves 10 mm upward. Neglect the friction. Find:

i) Minimum equilibrium speed, if total sleeve movement is 20 mm.
ii) Spring stiffness.
iii) Sensitiveness of governor.
iv) Spring stiffness, if governor is to be isochronous at 300 rpm. **(12 Marks)**

Module-4

7 a. Explain the following: (i) Pivot bearing, (ii) Collar bearing. **(06 Marks)**

b. In a thrust bearing, the external and internal diameter of the contact surfaces are 300 mm and 200 mm respectively. The total axial load is 100 kN and the intensity of pressure is 250 kN/m^2. The speed of the shaft is 500 rpm and coefficient of friction is 0.05. Assume uniform pressure theory. Calculate: (i) Number of collars required, (ii) Power lost due to friction **(10 Marks)**

OR

8 a. Write a short note on power transmission chains. **(06 Marks)**

b. A belt drive is required to transmit 10 KW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density of 0.001 grams/mm^3. Safe stress in the belt is not to exceed 2.5 N/mm^2. Diameter of the driving pulley is 250 mm, whereas the speed of the driven pulley is 220 rpm. Two shafts are 1.25m apart. The coefficient of friction is 0.25. Determine the width of the belt. **(10 Marks)**

Module-5

9 A rear engine automobile is traveling along a track of 100 mm mean radius. Each of four road wheels has a moment of inertia of 2 kg-m^2 and an effective diameter of 60 cm. The rotating parts of the engine has a moment of inertia of 1 kg-m^2. The engine axis is parallel to the rear axle. 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 centre of gravity 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 read surface, if this is not cambered. **(16 Marks)**

OR

10 In a four stroke petrol engine, the crank angle is 4° after top dead centre, when the suction valve opens and 50° after bottom dead centre, when the suction valve closes. The lift is 10 mm, the nose radius is 2.5 mm and the least radius of the cam 20 mm. The shaft rotates at 600 rpm. The cam is of the circular type with a circular nose and flanks while the follower is flat faced. Determine the maximum velocity, maximum acceleration and retardation of the valve. What is the minimum force exerted by the springs to overcome the inertia of moving parts weighing 250 gm? **(16 Marks)**