

## Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019

**Dynamics of Machines**

Time: 3 hrs.

Max. Marks:100

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

**PART - A**

- 1 a. Explain the following:
- Equilibrium of two force members
  - Equilibrium of three force members
  - Member with two forces and a torque
- (06 Marks)
- b. A slider crank mechanism is shown in Fig.Q1(b). The force applied to the piston is 1000 N when the crank is at  $60^\circ$  from IDC. Calculate the driving torque,  $T_2$ .  $AB = 100$  mm,  $BC = 300$  mm.

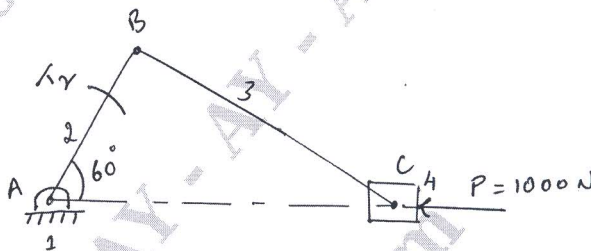


Fig.Q1(b)

(14 Marks)

- 2 a. Explain the D' Alembert's principle. (05 Marks)
- b. The four bar mechanism is shown in Fig.Q2(b), the centre of gravity (C.G) of each link is at its mid point. Length of links :  $O_2O_4 = 500$  mm,  $O_2A = 250$  mm,  $O_4B = 300$  mm,  $AB = 300$  mm, Mass of the links =  $O_2A = 1.52$  kg,  $AB = 3.06$  kg,  $O_4B = 5.09$  kg. Mass moment of inertia of links:  $O_2A = 0.012$   $\text{kgm}^2$ ,  $AB = 0.036$   $\text{kgm}^2$ ,  $O_4B = 0.02$   $\text{kgm}^2$ . Find the inertia force and inertia torque on each link.

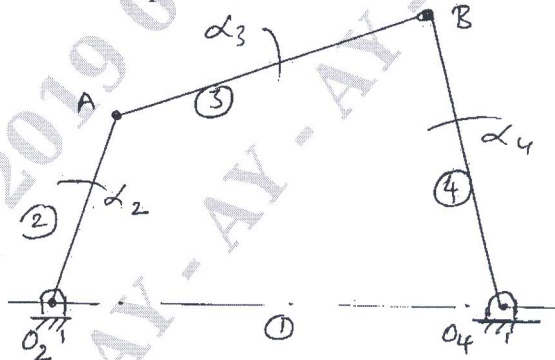


Fig.Q2(b)

(15 Marks)

- 3 a. Define the following:
- Coefficient of fluctuation of speed
  - Coefficient of fluctuation of energy
- (04 Marks)
- b. A engine develops 36.8 kW at 300 rpm the maximum variation of energy per revolution has been found to be 30% of mean energy and the total speed variation is 1%. Determine the mass of rim and the dimension of the square section for a mean speed of 900 m/min assuming that 90% of the flywheel effect is provided by the rim, assume that the density of C.I = 7.08 gm/cc. (16 Marks)

- 4 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  $60^\circ$ , the total lift is 15 mm and the speed of the cam shaft is 300 rpm. Calculate:
- Principal dimensions of cam (i.e., the distance between the cam centre and nose centre, nose radius and angle of contact of cam with straight flank)
  - Acceleration of the follower at the beginning of the lift, where the roller just touches the nose (i.e., flank merges into the nose) and at the apex of the circular nose. Assume that there is no dwell between ascent and descent. (20 Marks)

**PART – B**

- 5 A 3.6 m long shaft carries 3 pulleys, 2 at its 2 ends and the 3<sup>rd</sup> at the midpoint. The two end pulleys have masses 79 and 40 kg respectively their C.G. are 3 mm and 5 mm from the axis of shaft respectively. The middle pulley has a mass of 50 kg and its C.G is 8 mm. The pulleys are so keyed to the shaft that the assembly is in static balance. The shaft rotates at 300 rpm in 2 bearings, 2.4 m apart, with equal overhangs on either side. Determine:
- Relative angular position of pulley
  - Dynamic reaction on the 2 bearings. (20 Marks)
- 6 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 pitch 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. (20 Marks)
- 7 a. Define the following:
- Sensitiveness
  - Stability
  - Isochronous Governor
  - Controlling force (08 Marks)
- b. In a porter governor all the arms are 15 cm long. Upper and lower arms are pivoted to the links 2 cm and 3 cm respectively from the axis. Central mass is 40 kg mass of each ball is 4 kg. Force of friction is 30 N and the extreme radii of rotation are 8 cm and 10 cm. Determine the range of speed of governor. (12 Marks)
- 8 a. Explain Gyroscopic couple with equation. (08 Marks)
- b. An aeroplane makes a complete half circle of 50 m radius towards left when flying at 200 km/hr. The mass of the rotary engine and propeller is 400 kg with radius of gyration 300 mm. The engine runs at 3000 rpm counter clockwise when viewed from the rear. Determine the gyroscopic couple and its effect on the air craft. (12 Marks)

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