CBCS SCHEME

USN | | | | | | | | | | |

15AU52

Fifth Semester B.E. Degree Examination, July/August 2022
## 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 Static Equilibrium of : i) Two force   ii) Three force   iii) Two force and Torque Member. **(04 Marks)**

   b. A slider crank mechanism is shown in Fig. Q1(b). The force applied to piston is 1000N, when the crank is at 60° from IDC. Calculate the drive Torque T_2. AB = 100mm , BC = 300mm. **(12 Marks)**


Fig. Q1(b)

OR
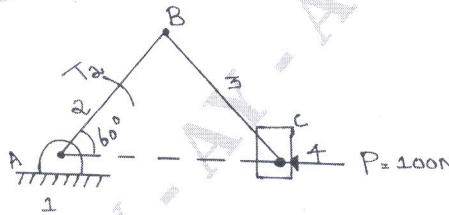
2   a. Explain the D'Alembert's principle. **(04 Marks)**

   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 : $O_2 O_4 = 500mm$, $O_2A = 250mm$, $O_4B = 300mm$; AB = 300mm ; Mass H_O links = O_2A = 1.52kg , AB = 3.06kg , O_4B = 5.09kg. Mass moment's of inertia of links ; $O_2A = 0.012 \ kgm^2$, $AB = 0.036 \ kgm^2$, $O_4B = 0.02 kgm^2$. Find the inertia force and Inertia torque on each link. **(12 Marks)**

Fig. Q2(b)
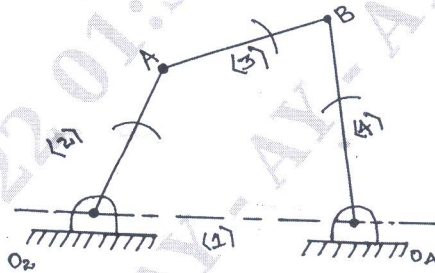
Module-2

3   a. Define Static and Dynamic Balancing. **(04 Marks)**

   b. Four Masses A, B, C and D revolve at equal radii and equally speed along the shaft. The mass B is 6kg and radii of C and D make 90° and 240° with respect to B. Find the magnitude of all masses and angular position of "A" so that the system may completely be balanced. **(12 Marks)**

OR

4   The pistons of 4 – cylinder vertical inline engine reach their upper most position at 90° interval in the order of their axial position. Pitch of cylinder = 0.35 meter. Crank radius = 0.12m , Length of connecting rod = 0.42m. Then engine runs at 600 rpm. If the reciprocating parts of engine has a mass of 2.5kg. Find the unbalanced primary and secondary forces and couple's. (Take central plane of engine as Reference plane). **(16 Marks)**

Module-3

5 a. Define the following :
   i) Coefficient of fluctuation of Speed   ii) Co-efficient of fluctuation of Energy
               (04 Marks)

   b. A Engine develop 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 dimensions of the square section for a mean speed of 900m/min. Assuming that 90% of the flywheel effect is provided by the rim. Assume that the density of C.I = 7.08 gm/cc. **(12 Marks)**

OR

6 a. Define the following : i) Sensitiveness   ii) Stability   iii) Isochronous governor
   iv) Controlling face. **(06 Marks)**

   b. In a porter governor all the arm's are 15cm long upper and longer arm pivoted to the links 2cm and 3cm respectively from the axis. Central mass is 40kg , Mass of each ball is 4kg. Force of friction is 30N and the extreme radii of rotation are 8cm and 10cm. Determine the range of speed of governor. **(10 Marks)**

Module-4

7 a. Give the Laws of friction. **(02 Marks)**

   b. Determine an expression for friction torque in flat pivot bearing. **(06 Marks)**

   c. In a thrust bearing the external and internal diameters of the contact surface are 300mm and 200mm respectively. The total axial load is 100kN and the intensity of pressure is $250kN/m^2$. The speed of shaft is 500rpm and co-efficient of friction equal 0.05. Calculate
   i) No. of Collar's required   ii) Power lost due to friction (No – Number*). **(08 Marks)**

OR

8 a. With usual notation drive the expression $T_1/T_2 = e^{\mu\theta}$. **(06 Marks)**

   b. A Belt which is embracing 165° of pulley of effective diameter 1000mm is transmitting 10kW. The pulley is running at 250rpm. The co-efficient of friction is 0.3mass of belt material is 0.0012 gm/mm³. Thickness of belt equal 10mm. Considering centrifugal tension find width of belt. Safe working stress equal 1.5MPa. Also determine the initial tension in the Belt drive. **(10 Marks)**

Module-5

9 a. Explain Gyroscopic Couple with Equation. **(06 Marks)**

   b. An Aeroplane makes a complete half circle of 50m radius towards left when flying at 200km/hr. The mass of the rotary engine and propeller is 400kg with radius of gyration 300mm. The engine runs at 300 rpm counter clockwise when viewed from the rear. Determine the gyroscopic couple and its effect on the Air craft. **(10 Marks)**

OR

10 The following data related to a symmetrical circular cam operating on flat faced follower. Least radius equals 25mm. Nose radius equals 8mm. Lisf of the valve equals 10mm , Angle of action of CAM = 120°. Cam shaft speed 1000rpm. Determine :
   a. Flank Radius.
   b. Maximum Velocity.
   c. Maximum Acceleration.
   d. Maximum Retardation.
               (16 Marks)

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