Fifth Semester B.E. Degree Examination, July/August 2022
Dynamics of Machines

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART – A

1   a. State the conditions for the equilibrium of :
       i) Member with two forces and a torque
       ii) Three force member   **(06 Marks)**

   b. The four bar linkage mechanism shown in Fig Q1(b) has crank 2 driven by an input torque T_2. An external load of 570N acts at point Q on link 4 as shown in Fig Q1(b). Determine the magnitude and direction of torque T_2 and various forces on links for the equilibrium of the system. Take : $O_2O_4 = 500mm$, $O_2A = 450mm$ $\lfloor O_2O_4B = 90°$, $AB = 850mm$, $O_4Q = 200mm$.
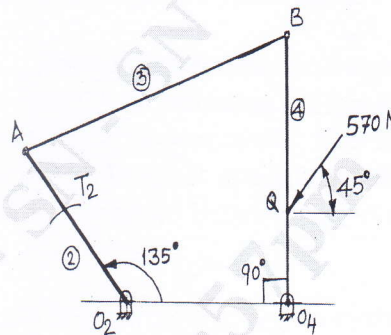

Fig Q1(b)   **(14 Marks)**

2   a. What is Turning Moment Diagram? Mention its uses.   **(05 Marks)**

   b. The turning moment diagram for an engine consists 2 isosceles triangles. Maximum height for each triangle represents a turning moment 100N-m. The base of each triangle equals π radians. If the engine runs at 200rpm and total fluctuation of speed is not to exceed 3%, find :
       i) Power of the engine
       ii) Mass of rim type flywheel concentrated at 0.25m radius, neglecting the effects of arms and boss.   **(15 Marks)**

3   a. Stat laws of dryfriction.   **(04 Marks)**

   b. In a collar thrust bearing, the external and internal radii are 250mm and 150mm respectively. The total axial load is 50kN and the shaft is rotating at 150rpm. The coefficient of friction is equal to 0.05. Find the power lost in friction assuming uniform wear.   **(06 Marks)**

   c. A 8mm thick belt is required to transmit 15kW running over a pulley at a speed of 15m/sec. If the coefficient of friction between the belt and the pulley surface is 0.3, and the angle of lap is 180°, find the width of the belt required. The maximum tension in the belt material is not to exceed 20N/mm width of the belt. The density of the belt material is $1000kg/m^3$.   **(10 Marks)**

4   a. Explain briefly the balancing of single disturbing mass by two balancing masses in different planes.   **(06 Marks)**

b. A shaft carries four masses A, B, C, and D in parallel planes perpendicular to the shaft axis and in this order along the shaft. The masses B and C are 40Kg and 28Kg and each has an eccentricity of 160mm. The masses A and D have an eccentricity of 200mm. The angle between masses B and C is 100° and that between masses B and A is 190°, both being measured in same direction. The axial distance between the planes A and B is 250mm, and that between B and C is 500mm. For the complete balance of the shaft, determine :
   i) The magnitude of masses A and D
   ii) The distance between planes A and D
   iii) The angular position of mass D. **(14 Marks)**

PART – B

5 a. What are the In-line engines? State how they are balanced. **(05 Marks)**
  b. The pistons of a 4 cylinder vertical In-line engine reaches their uppermost position at 90° interval in order of their axial position. Pitch of cylinder is 0.35m, crank radius is 0.12m, length of connecting rod is 0.42m. The engine runs at 600rpm. If the reciprocating parts of each engine has mass of 2.5Kg, find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. **(15 Marks)**

6 a. State the function and uses of a governor. **(05 Marks)**
  b. Each arm of a porter governor is 250mm long. The upper and lower arms are pivoted to links of 40mm and 50mm respectively, from the axis of rotation. Each ball has a mass of 5Kg and the sleeve mass is 50Kg. The force of friction on sleeve of the mechanism is 40N. Determine the range of speed of the governor for extreme radii of 125mm and 150mm. **(15 Marks)**

7 a. What is the effect of gyroscopic couple on an aeroplane when it negotiates a RIGHT curve of certain radius as viewed from rear end. The propeller of the aeroplane spins in clockwise direction as viewed from rear end? Explain with angular momentum vectors. **(08 Marks)**
  b. A ship is propelled by a rotor of mass 2000Kg which rotates at speed of 2400 rpm. The radius of gyration of rotor is 0.4m and spins clockwise when viewed from the bow end. Find the gryoscopic couple and its effect when ;
    i) The ship takes a left turn at a radius of 350m with a speed of 35Kmph.
    ii) The ship pitches with the bow raising at an angular velocity of 1 rad/sec. **(12 Marks)**

8 A tangent cam with a base circle diameter of 50mm operates a roller follower 20mm in diameter. The line of stroke of the roller follower passes through the axis of the cam. The angle between the tangential faces of the cam is 60°, speed of cam shaft is 200rpm and the lift of the follower is 15mm. Calculate :
    (i) Main dimensions of the cam
    (ii) Acceleration of the follower at
       a) The beginning of the lift
       b) Where the roller just touches the nose,
       c) The apex of the circular nose. **(20 Marks)**

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