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15AE44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Mechanisms and Machine Theory

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. Define Kinematic link, Kinematic chain, Kinematic pair with example. **(06 Marks)**
   b. With neat diagram, explain different types of constrained motions. **(04 Marks)**
   c. Differentiate between the following :
      (i) Higher pair and Lower pair.
      (ii) Machine and Structure. **(06 Marks)**

OR

2 a. Explain Whitworth quick return mechanism with neat diagram. **(10 Marks)**
   b. Explain Pantograph mechanism with neat sketch and state its application. **(06 Marks)**

Module-2

3 For the mechanism shown in Fig. Q3 crank OA rotates at 20 rpm C.C.W, gives motion to sliding blocks B and D. OA = 300 mm, AB = 1200 mm, BC = 450 mm, CD = 450 mm. Determine (i) Velocity of B and D   (ii) Angular velocity of CD   (iii) Linear acceleration of D.
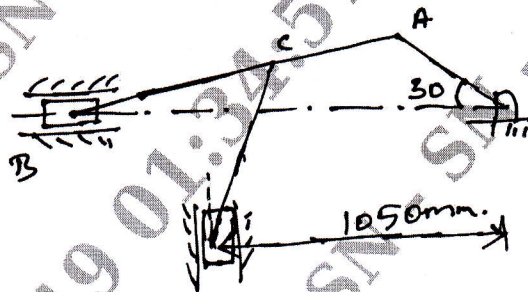

Fig. Q3   **(16 Marks)**

OR

4 A four bar mechanism under the action of 2 external forces as shown in Fig. Q4. Determine torque applied on AB for static equilibrium. AB = 50 mm, BC = 66 mm, CD = 55 mm, CE = 25 mm, CF = 30 mm, $\angle BAD = 60°$, AD = 100 mm.
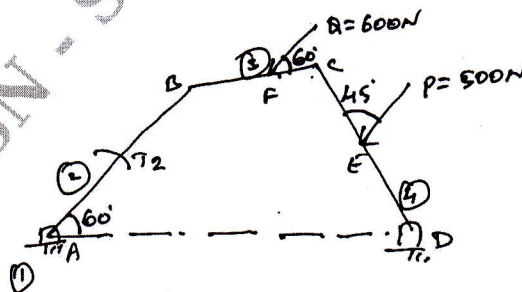

Fig. Q4   **(16 Marks)**

Module-3

5 a. Explain different types of gear trains with neat sketch. **(04 Marks)**

    b. An epicyclic gear train consists of 3 gears 1, 2, 3 as shown in Fig. Q5 (b). Internal gear 1 has 32 teeth. Gear 2 meshes with both 1 and 3 and carried an Arm A which rotates about O_2 at 20 rpm. If gear 1 is fixed find speed of 2 and 3.
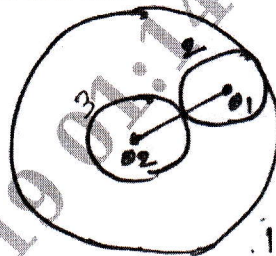

Fig. Q5 (b) **(12 Marks)**

OR

6 a. Derive the expression for length of path of contact and length of arc of contact for a pair of involute gears in contact. **(08 Marks)**

    b. A pinion having 30 teeth drives a gear having 80 teeth. The profile of gears is involute with 20° pressure angle 12 mm module and 10 mm addendum. Find the length of path of contact and length of arc of contact. **(08 Marks)**

Module-4

7   A 3.6 m long shaft carries 3 pulley's 2 at its ends and 3rd at the midpoint. The 2 end pulleys have masses 79 and 40 kg respectively, their C.G are 30 mm and 5 mm from the axis of shaft. The middle pulley has a mass of 50 kg and its C.G is 8 mm. The pulley are so keyed to shaft such that the assembly is statically balanced. The shaft rotates at 300 rpm in 2 bearings, 2 – 4 apart, with equal overhangs on either side. Determine

        (i)   Relative angular position of pulley.

        (ii)   Dynamic reaction on 2 bearings. **(16 Marks)**

OR

8   A piston of a 4 cylinder vertical incline engine each their uppermost position at 90° internal in order of their axial position. Pitch of cylinder = 0.35 m. Crank radius 0.12 m, length of C.R = 0.42 m. The engine runs at 600 rpm. If the reciprocating parts of each engine has mass of 2.5 kg. Find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference. **(16 Marks)**

Module-5

9   In a porter governor all the arms are 15 cm long. Upper and lower arms are pivoted to 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. **(16 Marks)**

OR

10   Define Gyroscopic couple and explain gyroscopic effect on aeroplane for different turning conditions. **(16 Marks)**

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