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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Mechanical Engineering

Semester End Examination; May / June - 2018

Kinematics of Machinery

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Define the terms: i) Kinematics chain ii) Lower pair iii) Machine iv) Closed pair v) Helical pair vi) Incomplete constrained motion — 6

b. With neat sketches, explain: — 14

i) Whitworth quick return motion mechanism ii) Oldham's Coupling

2. With neat sketches, explain the following mechanisms : — 20

i) Toggle Mechanism ii) Geneva wheel iii) Ratchet and Pawl Mechanism iv) Pantograph

UNIT - II

3 a. State and prove Kennedy's theorem. — 5

b. Fig.1 show a mechanism in which crank OA is rotating clockwise at 240 rpm. At the instant shown, locate all instantaneous centres for the mechanism and find out the velocity of slider E as well as the angular velocity of link BC using instantaneous centre method. — 15

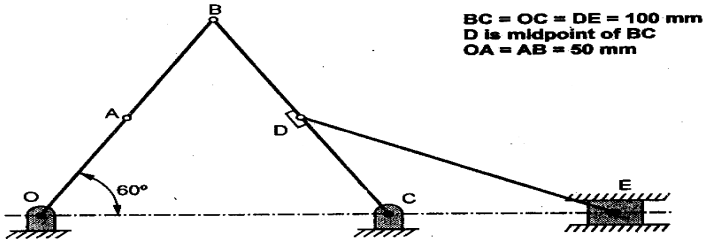

Fig. 1

4. Fig. 2 shows a mechanism in which crank OA is rotating clockwise at 20 rad/s. Determine the angular velocity and angular acceleration of link BC and DE. — 20

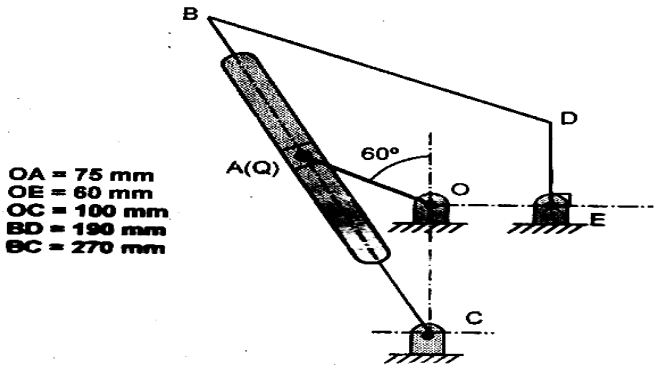

Fig. 2

UNIT - III

5a. Define interference in involute gears. Derive the relation for the minimum number of teeth for a pair of involute profile of teeth to avoid interference. — 10

Contd…2

b. Two gears having 40 and 50 involute teeth respectively are in mesh. The module of gears is 10 mm and angle of obliquity is 20°. The line of contact on each side of the pitch point is two third of maximum possible length. Find addendum on pinion and gear, length of path of contact and contact ratio. 10

6a. Derive an expression for Length of path of contact of gears. 10

b. The mating gears have 20° involute teeth, the number of teeth on pinion is 24 and on gear are 48. Assume, the pinion is driver the it rotates at 300 rpm. If the addendum on each gear is such that the path of approach and the path of recess are half of their maximum values. Find; 10

i) Addendum on pinion and gear ii) Length of arc of contact

iii) Maximum sliding velocity of gears iv) Contact ratio. Take module pitch = 6 mm

UNIT - IV

7. Pinion A has 15 teeth and is rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with annular fixed wheel D. Pinion C has 15 teeth and is integral with B (C-B being compound gear wheel). Gear C meshes with annular wheel E, which is keyed to the machine shaft. The arm rotates about the shaft on which A is fixed and carries the compound wheel B-C. If the motor runs at 1000 rpm CCW, find the speed of the machine shaft. Find the torque exerted on the machine shaft, if the motor develops a torque of 100 N-m. Assume diametrical pitch as same for all gears. 20

8a. Derive an expression for the ratio of tension in a flat belt drive. 10

b. A flat belt is required to transmit 35 kW from a pulley of 1.5m effective diameter running at 300 rpm. The angle of contact is spread over 11/24 of circumference and coefficient of friction between belt and pulley rim is 0.3. If the safe working stress for the belt material is 2.5 MPa and mass of the leather is 1.1 mg/m^3 and thickness of belt is 9.5 mm. determine the width of the belt taking centrifugal tension into account. 10

UNIT - V

9. Draw full size cam profile with roller of 25 mm diameter attached to the follower to give lift of 35 mm. Axis of the follower is offset to the right of cam axis by 18 mm. Ascent of the follower takes place with SHM in 0.05 s, followed by a period of rest 0.0125 s. The follower then descends with UARM during 0.125 s and the remaining period rest at the minimum lifted position, the acceleration being 3/5 times retardation. The cam rotates in CW direction at constant speed 240 rpm and the base circle radius is 50 mm. 20

10a. With a sketch classify the types of follower based on the surface in constant. 8

b. Draw the profile of the cam with the Knife edge type follower moves with cycloidal motion during out stroke with maximum displacement of 40 mm during 180° of cam rotation. Return stroke with uniform velocity for the next 150° of cam rotation. Dwell for the remaining 30° of cam rotation. The minimum radius of the cam is 20 mm. 12

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