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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 Machines

Time: 3 hrs *Max. Marks: 100*

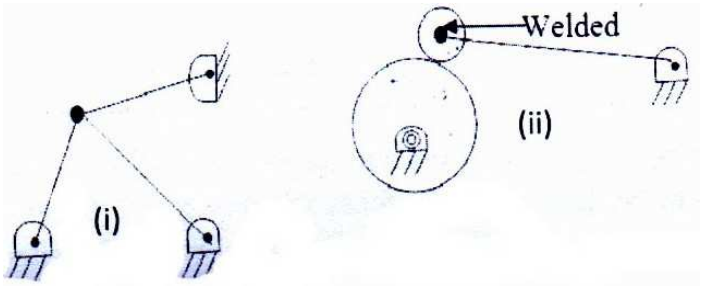
***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Define the following : 4

i) Higher pair ii) Kinematic chain iii) Mobility of Mechanism iv) Inversion

b. Determine the mobility of the following mechanisms : 4



c. Explain with the help of neat sketches : 12

i) Elliptical trammel ii) Pantograph mechanism

2. With the help of neat sketches, explain the following :

a) Toggle mechanism 6

b) Crank and slotted lever motion mechanism 7

c) Ackermann steering mechanism for correct steering 7

UNIT - II

3 a. Locate all the instantaneous centers for the four bar mechanism. 5

b. State and prove Kennedys theorem of instantaneous center. 5

c. In a four bar chain ABCD, AD is fixed and 300 mm long. The crank AB is 150 mm long and rotates at 100 rpm clock wise while the link CD = 180 mm oscillates about D. BC and CD are of equal length. Locate all instantaneous centers and find the angular velocity of link BC and linear velocity of link CD, When angle AB = 60°? 10

4. For the configuration of a slider crank mechanism shown in the Fig.1, find:

i)The acceleration of slider at B ii) The acceleration of point E

iii) The angular acceleration of link AB. 20

The crank rotates at 20 rad/s counter clock wise.

Given: OA = 480 mm; AB = 1600 mm; AE = 450 mm.

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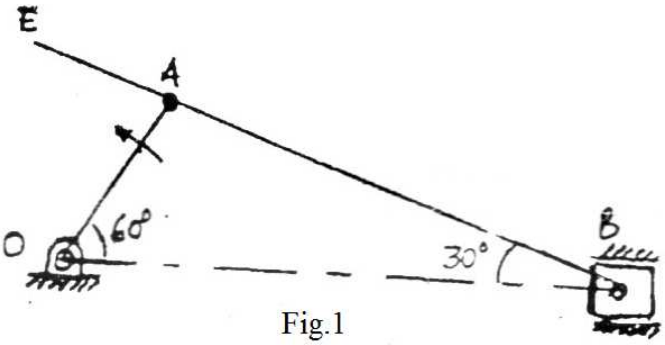

Fig.1

UNIT - III

5 a. Derive an expression for the length of the path of contact. 8

b. Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 6 mm, addendum = one module; pressure angle = 20°. The pinion rotates at 90 rpm. Determine; 12

i) The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel

ii) The length of path and arc of contact iii) The number of pairs of teeth in contact

iv) The maximum velocity of sliding

6 a. Write the terminology of gears with a neat sketch. 6

b. State and prove the law of gearing. 6

c. Two gear wheels each 25 teeth of involute shape and pressure angle 20° are required to give an arc of contact equal to 1.6 times circular pitch. Find the addendum in terms of P_c (Circular Pitch). 8

UNIT - IV

7 a. Sketch and explain; 6

i) Reverted gear train ii) Epicyclic gear train

b. An epicyclic gear consists of three gears A, B and C, the gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the center of A at 18 rpm. Sketch the arrangement and determine the speed of gears B and C, if the gear A is fixed. 14

8 a. Determine an expression for the ratio of belt tension for V-belt drive. 8

b. An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 meters apart and transmits 3.75 kW from the smaller pulleys that rotates at 300 rpm. Coefficient of friction between the belt and the pulleys is 0.3 and the safe working tension is 10 N per mm width. Determine; 12

i) Minimum width of the belt

ii) initial belt tension

iii) Length of the belt required

Contd…3

UNIT - V

9 a. Classify the type of follower according to surface in contact. 8

b. A cam with 30 mm minimum radius drives a flat faced reciprocating follower, during first 120° rotation of the cam in CW direction follower moves outwards through a distance of 30 mm with cycloidal. The flower dwells during next 60° cam rotation. During next 90° cam rotation, the follower moves inwards with UV. Followers dwell for the remaining period of cam rotation, develop the cam profile. 12

10. Draw the profile of a cam operating a roller reciprocating follower and with the following data: Minimum radius of cam = 30 mm, lift = 30 mm, roller diameter = 16 mm. Axis of the follower is off set to the right of the cam axis by 20 mm. The cam lifts the follower for 120° with SHM followed by a dwell period of 45°. Then the follower lowers down during 150° of cam rotations with UARM followed by dwell period. The cam rotates at a uniform speed of 150 rpm (CW direction). Calculate the maximum velocity and acceleration of the follower during the ascent and descent period. 20

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