



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; June - 2017

Kinematics of Machines

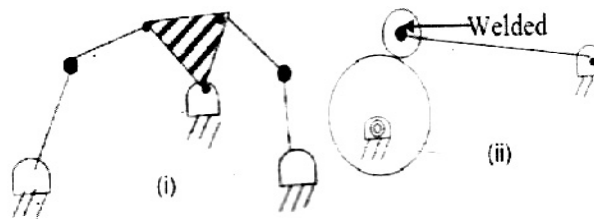
Time: 3 hrs

Max. Marks: 100

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

UNIT - I

- 1 a. Define the following : 4
 i) Right body ii) Resistant body iii) Kinematic pair iv) Inversion.
- b. Determine the mobility of the following :



- c. Explain with the help of neat sketches : 10
 i) Beam engine ii) Geneva mechanism.
2. Explain with the help of neat sketches : 6
 i) Pantograph mechanism. 6
 ii) Peasucelliar's straight line mechanism. 6
 iii) Devis steering gear mechanism. 8

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. Locate all the instantaneous centres of the slider crank mechanism as shown in Fig. Q.3.c. The length of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, Find ; 10
 i) Velocity of the slider A ii) Angular velocity of the connecting rod AB

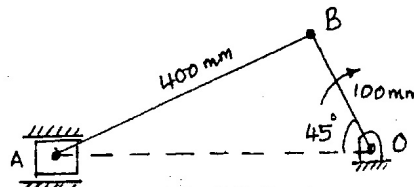


Fig.Q.3.C.

- 4 a. PQRS is a four bar chain with link PS is fixed. The lengths of the links are PQ = 6.25 mm, QR = 175 mm, RS = 112.5 mm and PS = 200 mm. The crank PQ rotates 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of the PS. Find the angular velocity and angular acceleration of links QR and RS. 20

UNIT - III

- 5 a. Derive an expression for minimum number of teeth required on the pinion in order to avoid interference in involute gear tooth when it meshes with wheel. 8

- b. Two gear wheels mesh externally and are to give a velocity ratio 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 ;
- i) The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel. 12
 - ii) The length of path and arc of contact
 - iii) The numbers of pairs of teeth in contact
 - iv) The maximum velocity of sliding.
- 6 a. Classify the gears. 4
- b. What is conjugate action? Discuss fundamental law of gearing. 10
- c. Two gear wheels each 25 teeth of involute shape and angle 20° are required to give an arc of contact equal to 1.6 times circular pitch. Find the addendum in terms of Pc (circular pitch). 6

UNIT - IV

- 7 a. Sketch and explain : i) Reverted gear train ii) Epicyclical gear train. 6
- b. An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels, D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft A co-axial with F. If the wheels have the same pitch and the shaft A make 800 rpm, what is the speed of shaft F? Sketch the arrangement. 14
- 8 a. Explain the following terms in a belt drive : 4
- i) Centrifugal tension
 - ii) Creep.
- b. Determine an expression for the ratio of belt tension for V - belt drive. 6
- c. Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and the pulley is 0.25? 10

UNIT - V

- 9 a. Classify the type of follower with the neat schematic according to motion and path of motion of the follower. 8
- b. A cam with 30 mm as minimum radius is rotating clockwise at a uniform speed of 1200 rpm and has to give the motion to the knife edge follower as defined below : 12
- i) Follower to move out word through 40 mm during 120° of cam rotation with SHM.
 - ii) Dwell for the next 60°
 - iii) Follower to return to its initial position during next 120° with UARM
 - iv) Dwell for the remaining period. Develop the cam profile, if the follower axis passes through the cam axis.
10. Draw the profile of a cam operating a roller reciprocating follower and with the following data: Minimum base 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 18 mm. Ascent of the follower takes place with SHM is 0.05 seconds followed by a period of rest 0.0125 seconds.. Then the follower descends with UARM during 0.125 second, the acceleration being 3/5 times of retardation and the cam rotates at a uniform speed of 240 rpm (CW direction). Calculate the maximum velocity and acceleration of the follower during the ascent period. 20