



VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

[Central Technological Institute, Maharashtra State]

Matunga, Mumbai-400 019

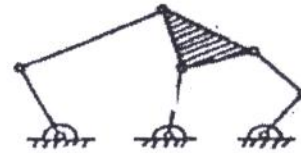


SEMESTER EXAMINATION	<i>End Semester Exam. May 2011</i>	DATE OF EXAM	<i>14/05/2012</i>
SEMESTER & PROGRAM	<i>Sem IV S.Y. B.Tech (Mechanical)</i>	TIME	<i>1.30-04.30 pm</i>
TIME ALLOWED	<i>3 HRS.</i>	MARKS	<i>100</i>
COURSE (Course Code)	<i>Theory of machines (ME0208)</i>		

- Instructions
1. Q.No.1 is compulsory.
 2. Attempt any four from the remaining Question.
 3. Figures to the right indicate full marks.
 4. Assume suitable data, if required.

Q.1. Solve any five 20

- a Determine the degree of freedom of the given mechanism as shown in fig.



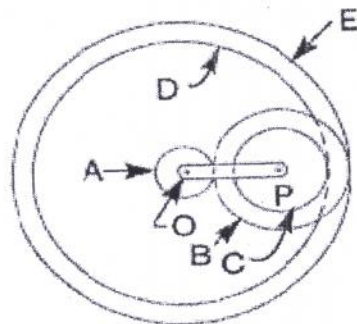
- b Identify the kinematic chains to which the following mechanisms belong : 1. Steam engine mechanism 2. Beam engine 3. Whitworth quick return motion mechanism 4. Elliptical trammels
- c Sketch and explain any one inversions of a double slider crank chain
- d What is a machine ? Giving example differentiate between a machine and a structure.
- e What is the difference between piston effort, crank effort and crank-pin effort?
- f How the velocity ratio of epicyclic gear train is obtained by tabular method?
- g Explain the terms 'fluctuation of energy' and 'fluctuation of speed' as applied to flywheels.

Q.2. a. Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find : 1. The angle turned through by pinion when one pair of teeth is in mesh and 2. The maximum velocity of sliding. 10

b. A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below : 1. To move outwards through 40 mm during 100° rotation of the cam 2. To dwell for next 80° 3. To return to its starting position during next 90° , and 4. To dwell for the rest period of a revolution i.e. 90° . The displacement of the follower is to take place with uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 r.p.m. Draw the displacement, velocity and acceleration diagrams for one complete revolution of the cam 10

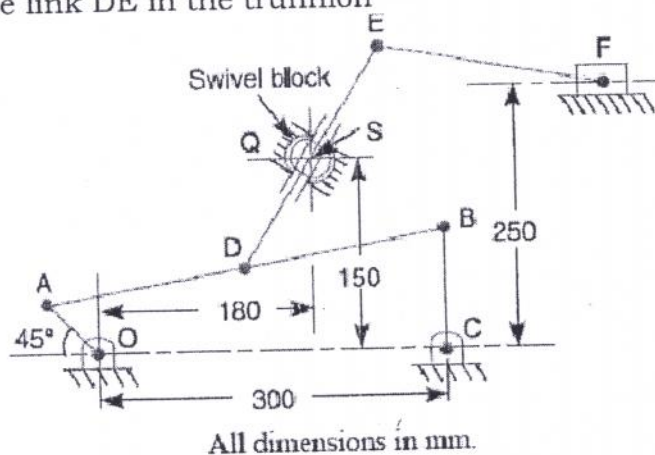
Q.3. a. Fig. shows diagrammatically a compound epicyclic gear train. 10
Wheels A, D and E are free to rotate independently on spindle O, while B and C are compound and rotate together on spindle P, on

the end of arm OP. All the teeth on different wheels have the same module. A has 12 teeth, B has 30 teeth and C has 14 teeth cut externally. Find the number of teeth on wheels D and E which are cut internally. If the wheel A is driven clockwise at 1 r.p.s. while D is driven counter clockwise at 5 r.p.s., determine the magnitude and direction of the angular velocities of arm OP and wheel E. 10 gear train



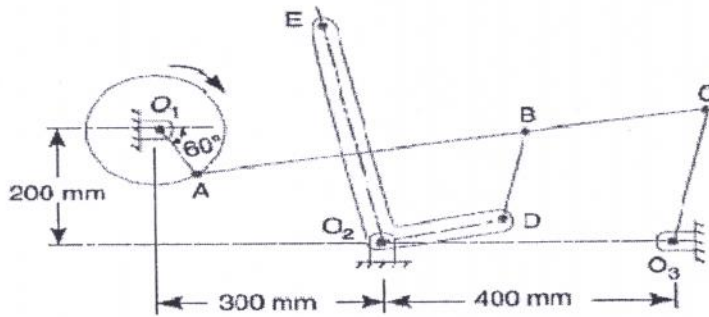
- b. In a swivelling joint mechanism, as shown in Fig. 8.36, the driving crank OA is rotating clockwise at 100 r.p.m. The lengths of various links are : OA = 50 mm ; AB = 350 mm; AD = DB ; DE = EF = 250 mm and CB = 125 mm. The horizontal distance between the fixed points O and C is 300 mm and the vertical distance between F and C is 250 mm. For the given configuration, determine: 1. Velocity of the slider block F, 2. Angular velocity of the link DE, 3. Velocity of sliding of the link DE in the swivel block, and 4. Acceleration of sliding of the link DE in the trunnion

10



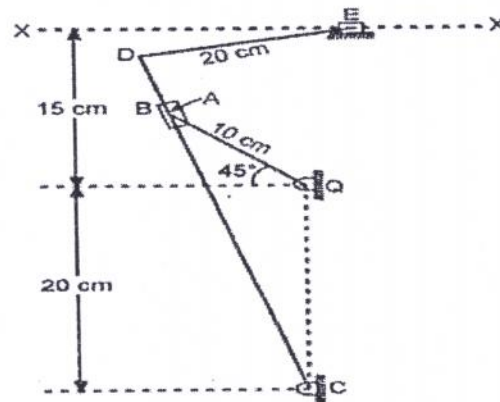
- Q.4. a. The mechanism of a warping machine, as shown in Fig. has the dimensions as follows: O1A = 100 mm AC = 700 mm BC = 200 mm BD = 150 mm O2D = 200 mm O2E = 400 mm O3C = 200 mm. The crank O1A rotates at a uniform speed of 100 rad/s. For the given configuration, determine: 1. linear velocity of the point E on the bell crank lever, 2. acceleration of the points E and B, and 3. angular acceleration of the bell crank lever

10



- b. What are straight line mechanisms? Describe one type of exact straight line motion mechanism with the help of a sketch. And Explain the phenomena of 'slip' and 'creep' in a belt drive 10

- Q.5. a. Fig shows a shaper mechanism crank QA=10 CM link CD=35 cm, DE=20 cm crank QA rotates at 200 rpm draw velocity diagram for the configuration when the crank makes 45° determine 1.linear velocity of ram e 2angular velocity of CD.3velocity of sliding block b along the slotted link CD 10



- b. Obtain an expression for the length of a belt in. a cross belt drive 10
- Q.6. a. A shaft rotating at 200 r.p.m. drives another shaft at 300 r.p.m. and transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4m. The smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is 1. an open belt drive, and 2. A cross belt drive. Take $\mu = 0.3$. 10
- b. Draw the sketch of a mechanism in which a point traces an exact straight line. The mechanism must be made of only revolute pairs. Prove that the point traces an exact straight line motion. 10
- Q.7. a. Obtain an expression for the correction couple to be applied to make two mass system dynamically equivalent. 10
- b. State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing 10

