

Code: 9A14402

B.Tech II Year II Semester (R09) Supplementary Examinations November/December 2012

THEORY OF MACHINES

(Mechatronics)

Time: 3 hours

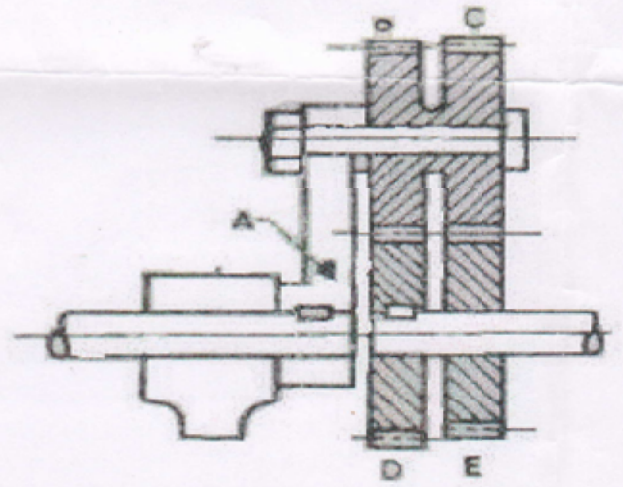
Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

1. (a) Explain the classification of the kinematic pairs with the help of examples.
(b) Explain the inversion of single slider crank mechanism which is used in Whitworth quick return motion mechanism.
2. Give a neat sketch of the straight line motion Hart mechanism. Prove that it produces an exact straight line motion.
3. (a) Explain, with the help of a neat sketch, the space centrode and body centrode.
(b) In a four bar chain ABCD, AD is fixed and is 15 cm long. The crank AB is 4 cm long and rotates at 120 r.p.m. clockwise, while the link CD (=8 cm) oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD=60°.
4. (a) Sketch the Davis gear and show that it satisfies the condition for correct steering. Also, explain why Ackermann steering gear is preferred to Davis gear in actual practice.
(b) The driving shaft of a Hooke's joint has a uniform angular speed of 300 r.p.m. Determine the maximum permissible angle between the axes of the shafts to permit a maximum variation in speed of the driven shaft by 6% of the mean speed.
5. (a) Differentiate between; (i) Base circle and prime circle (ii) Cam angle and pressure angle.
(b) Design a cam to raise a valve with simple harmonic motion through 5 cm in $\frac{1}{3}$ rd of a revolution, keep fully raised through $\frac{1}{12}$ revolution and to lower it with simple harmonic motion in $\frac{1}{6}$ revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is 2 cm and the minimum radius of the cam is 2.5 cm. The diameter of the cam shaft is 2.5 cm. The axis of the valve rod passes through the axis of the cam shaft rotates at uniform speed of 100 r.p.m; find the maximum velocity and acceleration of a valve during raising and lowering.
6. (a) Define and explain the terms: path of approach, path of recess and path of contact between two mating gears.
(b) The number of teeth on each of the two equal spur gears in mesh is 30. The teeth have 20° in profile and the module is 8 mm. If arc of contact is 1.3125 times the circular pitch, find the addendum.
7. (a) Define and explain the following terms relating to governors (i) Sensitiveness and (ii) Isochronisms.
(b) The arms of a Porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35 mm from the axis of rotation. The load on the sleeve is 54 kg and the mass of each ball is 7 kg determine the equilibrium speed when the radius of the balls is 225 mm. What will be the range of speed for this position if the frictional resistance to the motion of the sleeve are equivalent to a force of 30 N?
8. (a) Explain the term train value. How is it related to velocity ratio?
(b) An epicycle speed reduction gear is shown in the figure in page number 2. The driving shaft carries on the arm A a pin on which the compound wheel BC is free to revolve. Wheel C meshes with the fixed wheel E and wheel B meshes with wheel D, keyed to the driven shaft. The numbers of teeth on the wheels are $T_B=40$, $T_D=45$, $T_C=42$ and $T_E=43$. Find the ratio of the speed of the driving shaft to the speed of the driven shaft. If the input torque to the driving shaft is 5 kg meters, what are load torque on D and the holding torque on E?

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