

Code: 9A14402

R09

B.Tech II Year II Semester (R09) Supplementary Examinations December/January 2015/2016

THEORY OF MACHINES

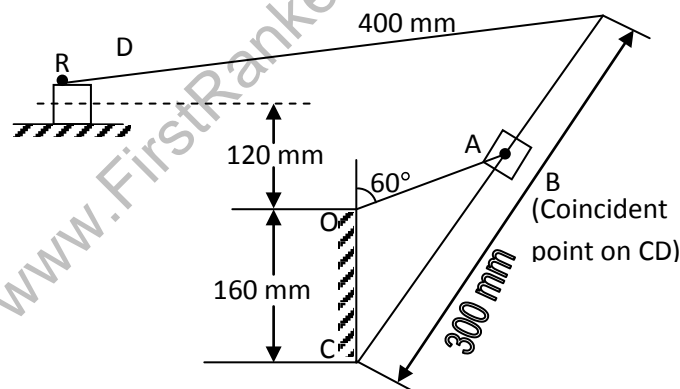
(Mechatronics)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

- 1 (a) What do you mean by degrees of freedom of a mechanism? Explain the Grubler's criterion for plane mechanism to obtain the degrees of freedom.
(b) What is meant by the inversion of a chain? Sketch and describe the mechanisms obtained by the inversions of the four bar chain.
(c) Describe elliptical trammel. How does it enable us to describe a true ellipse?
- 2 (a) Differentiate between exact and approximate straight line motion mechanisms with applications.
(b) With a neat sketch, explain the working principle of hart and T-Chebicheff mechanism.
- 3 (a) What do you mean by Coriolis acceleration? Show that coriolis acceleration is $2\omega v$. Also suggest the procedure to find the direction of Coriolis acceleration.
(b) A quick return mechanism, as shown in figure, the driving crank OA is 60 mm long and rotates at a uniform speed of 200 r.p.m in clockwise direction. For the positions shown, find
(i) Velocity of the ram R. (ii) Acceleration of the ram R.
(iii) Acceleration of the sliding block A along with the slotted bar CD.



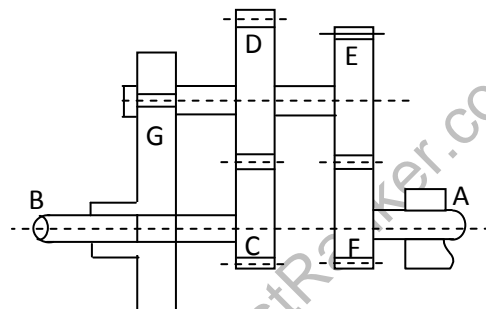
- 4 (a) Name the two different types of steering gear mechanism. What are their merits and demerits?
(b) Two shafts are coupled together by a Hookes joint, the driving shaft rotates uniformly at 600 rpm. Find the greatest permissible angle between the shafts if the maximum speed of the follower shaft is 5% greater than the driving shaft. What is then the minimum speed of this shaft? State the conditions under which two shafts connected together by a double Hookes joint shall have the same angular velocities.

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- 5 (a) Why a roller follower is preferred to that of a knife edged follower?
 (b) A flat ended valve tappet is operated by a symmetrical cam with circular arc for flank and nose. The straight line path of the tappet passes through the cam axis. Total angle of action = 150° , lift = 6 mm. Base circle diameter = 30 mm. Period of acceleration is half the period of retardation during the lift. The cam rotates at 1250 rpm. Find: (i) Flank and nose radii.
 (ii) Maximum acceleration and retardation during the lift.
- 6 (a) Derive an expression for the velocity of sliding between a pair of involute teeth. State the advantages of involute profile as a gear tooth profile.
 (b) Following data refer to two meshing gears having 20° involute teeth: Number of teeth of gear wheel = 52, number of teeth of pinion = 24, speed of pinion = 360 rpm, module = 8 mm. If addendum of each gear is such that the path of approach and the path of recess are half of their maximum possible values, determine the addendum for the gear and the pinion and the length of arc of contact.
- 7 In the epicyclic gear shown in figure below the wheel C is keyed the shaft B and the wheel F is keyed to the shaft A, D and E rotate together on a pin fixed to the arm G, C has 35 teeth, D has 65 teeth, E has 32 teeth and F has 68 teeth. If A rotates at 60 r.p.m and B rotates at 28 r.p.m in the opposite direction to A, find the speed and direction of arm G.



- 8 (a) Classify the types of governors and explain with a neat sketch any one type of inertia governor.
 (b) In a porter governor the arms and links are each 25 cm long and intersect on the main axis. Each ball weighs 4.5 kg and the central load is 20 kg. The sleeve is in its lowest position when the arms are inclined at 30° to the axis. The lift of the sleeve is 5 cm. What is the force of friction at the sleeve, if the speed at ascent from the lowest position is equal to the speed at the beginning of descent from the highest position? What is then the range of speed of the governor, all other things remaining the same?
