

Code.No: 45035

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SET-1

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
III.B.TECH - I SEMESTER REGULAR EXAMINATIONS NOVEMBER, 2009

KINEMATICS OF MACHINERY
MECHANICAL ENGINEERING
(MECHATRONICS)

Time: 3hours

Max.Marks:80

Answer any FIVE questions
All questions carry equal marks

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- 1.a] Distinguish between completely constrained motion and successfully constrained motion with suitable examples.
- b] Explain how the I.C. engine mechanism and steam engine mechanism are kinematically different? [8+8]
- 2.a] Show how the Hart mechanism satisfies the condition for exact straight line motion.
- b] Derive the condition to be satisfied by a mechanism required to produce an exact straight line motion. [8+8]
- 3.a] Explain how you determine the various instantaneous centres in a crossed four bar mechanism.
- b] The crank and connecting rod of a reciprocating engine are 150 mm and 600 mm long respectively. The crank makes an angle of 60° with the inner dead centre, and revolves at a uniform speed of 300 rpm. Find the velocity of the mid-point of the connecting rod by Klein's construction method. Assume any other data. [8+8]
- 4.a] What is the use of double Hooke's joint? Explain why two Hooke's joints are used to transmit motion from the engine to the differential of an automobile.
- b] In a double Hooke's joint, the angle of the driving and driven shafts with the intermediate shaft is 20° . The driving shaft is rotating at 500 rpm. If the forks of the intermediate shaft lie in a plane perpendicular to each other, find the maximum and the minimum speeds of the driven shaft. [8+8]
- 5.a] Derive the expression for displacement, velocity and acceleration of the roller, when it is in contact with convex flank of the cam.
- b] The follower of a tangent cam is operated through a roller of 5 cm in diameter, and its line of stroke intersects the axes of the cam. The minimum radius of the cam is 2.5 cm, the nose radius is 1.5 cm and the lift is 1 cm. If the speed of the rotation of the cam is 1000 rpm. Find the velocity and acceleration of the follower at the instant when the cam is 30° from the full lift position. [8+8]

- 6.a] Explain by means of neat sketch the generation of cylindrical teeth?
- b] A three start worm rotating at 1000 rpm drives a 31-tooth worm gear. Pitch of teeth is 2 cm and a 6 cm pitch diameter. The coefficient of friction is 0.05.
Find
- i) The helix angle of the worm;
 - ii) The speed of worm gear;
 - iii) The efficiency of the drive; and
 - iv) The lead angle for maximum efficiency and corresponding value of efficiency. [8+8]
- 7.a] What is the maximum center distance for which open type belt can be used? State what happens if the open type belt is employed for a center distance of more than the limited value.
- b] The motion of a vessel drifting away from a dockside is retarded by a rope secured to the vessel and given 3 complete turns round a bollard on the dockside. A pull of 400 N is applied to the free end of the rope at an instant when the speed of the vessel, which weights 40 MN, is 10 cm/s. After 10 sec, the rope begins to slip. Assuming the rope stretches elastically, calculate the stretch in the rope between the bollard and the vessel and the speed of the vessel when the rope slips, take μ between the rope and the bollard as 0.25. [8+8]
8. A three-speed gear box of the sliding gear type is to have the following forward speed ratios as nearly as possible-Bottom gear 5:1, second gear 3:1, top gear $\chi^1_2 : 1$. The input and output are to be in line and the horizontal centre distance between them and the lay shaft is to be 15 cm exactly. The diametrical pitch is to be six for all wheels and no wheel must have less than 20 teeth. The pressure angle is to be 20° . Determine suitable number of teeth and pitch circle diameter for all the wheels. Compute the actual speed ratios achieved. [16]
