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B.E DEGREE EXAMINATIONS, NOVEMBER 2012 (R 2008)
III Semester B.E. Mechanical Engineering
ME 9203 KINEMATICS OF MACHINES

2

Time: 3 hours

Max.Marks:100

Answer all the questions
Sketches should be drawn neatly
Give brief procedure for graphical constructions.
A3 size drawing sheet will be given on request, Use both sides of the sheet, if necessary.
Assume missing data, if any, suitably and state them clearly.

PART-A

(10x2=20 Marks)

1. Classify the following kinematic pair in terms of number of degrees of freedom
 - a) a ball and socket joint such as human shoulder and arm pit
 - b) lead screws operating in nuts to transmit motion in lathe
 - c) a prism on a plane
 - d) a sphere on a plane
2. In a four bar mechanism the length of driver crank, coupler and follower link are 150mm, 250mm and 300mm respectively. The fixed link length is L_0 . Find the range of values for L_0 , so as to make it crank-crank mechanism.
3. Schematically identify the instantaneous centres of a four bar mechanism.
4. With an example, illustrate a link experiencing coriolis component of acceleration and what will be the magnitude.
5. What is the maximum value of acceleration, when the follower of a cam is executing SHM.?
6. For which motion of the follower, the jerk experienced will be high. Draw the jerk diagram.
7. In a single gear tooth profile figure, relate addendum & dedendum with face and flank.
8. Disadvantages and advantages of cycloidal tooth profile.
9. Compare the effect of friction on V-thread over square thread
10. When design considerations are made in the contact friction surfaces, the assumption of uniform pressure Vs uniform wear, which assumption is conservative and why?

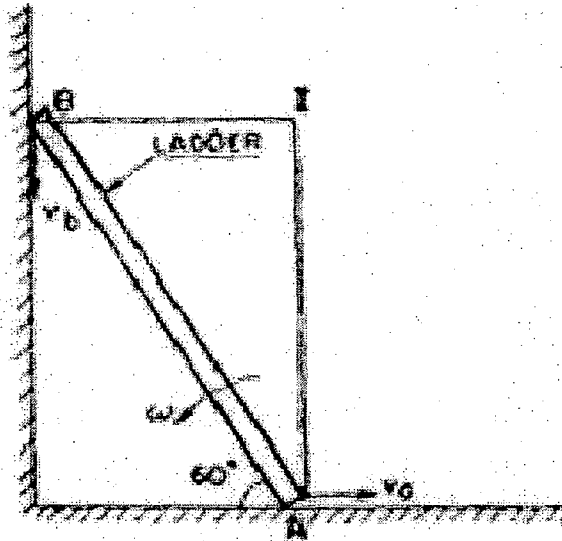
PART-B

(5x16=80 Marks)

11. i) In a slotted lever quick return mechanism, distance between the fixed centres is 7.5cm and radius of driving crank is 4cm. Find the ratio of the time taken during cutting stroke and return stroke. (4 Marks)
- ii) Enumerate the four inversion of a single slider crank mechanism and the four inversion of double slider crank mechanism. Explain with a neat sketch about any one of them. (9 Marks)
- iii) The distance between two parallel shafts is 18mm and they are connected by an Oldham's coupling. The driving shaft revolves at 160rpm. What will be maximum sliding velocity of the tongue of the intermediate piece along its groove? (3 Marks)

12. a) i) What is the need for the velocity and acceleration analysis for mechanism? (6 Marks)

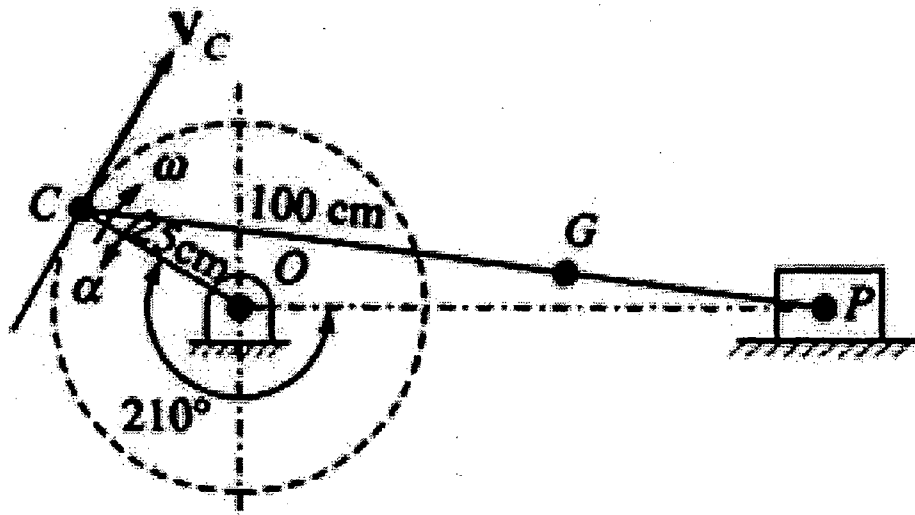
ii) A ladder AB of 3.0m length with edge A on the ground and edge B is on a vertical wall. The ladder is making an angle of 60° with horizontal at edge A. When the lower end at A is constrained to move on the horizontal floor with a linear velocity of 10 m/s, what would be the linear velocity at edge B and angular velocity of ladder AB. For the same position, if the linear acceleration of end A is 5cm/sec^2 what would be the linear acceleration of the end B and resultant acceleration of ladder AB. (10Marks)



(OR)

12.b) i) State and prove Kennedy's theorem for 3 plane bodies. (4 Marks)

ii) The crank of a steam engine mechanism is 25 cm long and the connecting rod is 100cm long. At the given instant, the crank has turned through an angle of 210° degrees clockwise from inner dead centre. Assuming the crank to rotate at 180 rpm, find the velocity and acceleration of the piston and angular velocity and angular acceleration of the connecting rod when (a) crank rotates uniformly, and (b) when the crank is subjected to an angular acceleration of 100rad/sec^2 in a direction opposite to that of rotation. (12 Marks)



13. a) i) Classify and explain different types of the cams and followers with sketches (6 Marks)

ii) The following data relate to a cam profile in which the follower moves with uniform acceleration and deceleration during ascent and decent:

Minimum radius of the cam = 25 mm

Roller radius = 7.5 mm

Lift = 28 mm

Offset of follower axis = 12 mm towards right

Angle of ascent = 60°

Angle of decent = 90°

Angle of dwell between ascent and decent = 45°

Speed of the cam = 200 rpm

Draw the profile of the cam and determine the maximum velocity and the uniform acceleration of the follower during the outstroke and return stroke. (10 Marks)

(OR)

13. b) i) What are the main considerations influencing the choice of the cam? (4 Marks)

ii) A radial cam operating a flat mushroom follower rotates at 200 rpm. The follower rises through 20 mm with SHM during 120° of cam rotation. It dwells for 30° of cam rotation and return to the initial position by SHM in next 150° of cam rotation. Assuming a minimum radius of the cam to be 25 mm, draw the cam profile. Determine V_{max} & A_{max} during outstroke. Also determine minimum face width of follower required. (12 Marks)

14. a) i) Explain herringbone gears and its advantages. (3 Marks)

ii) Explain and derive the fundamental law of gearing. (5 Marks)

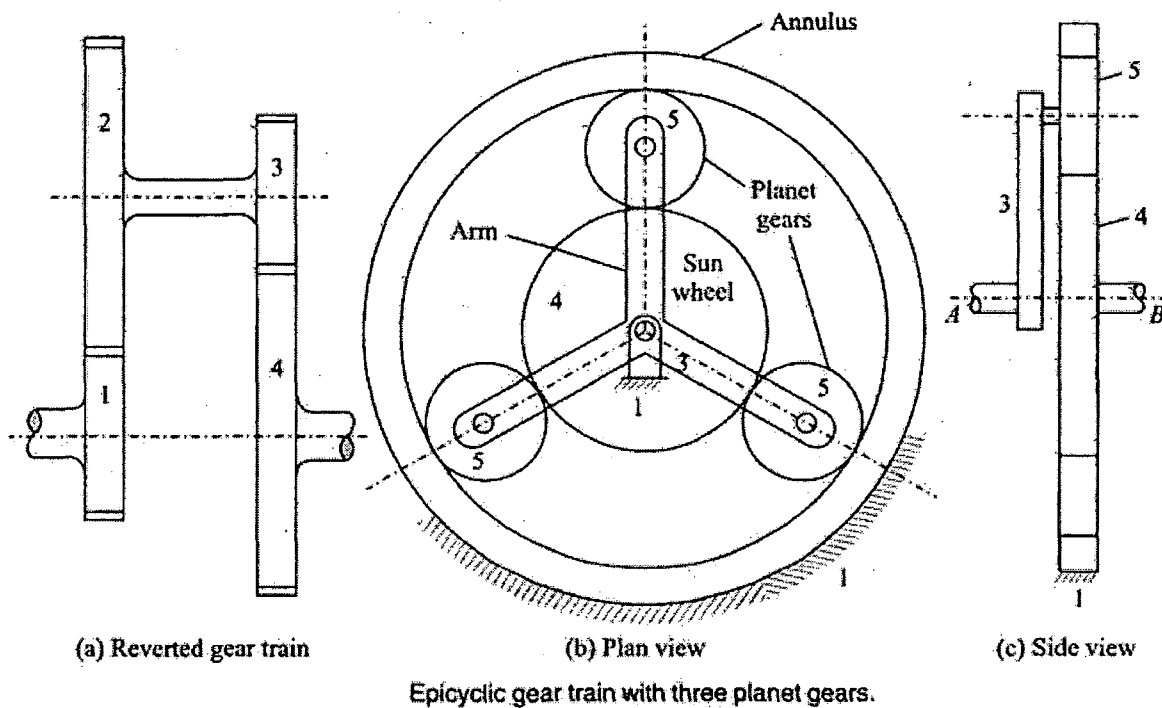
iii) A pair of 20° full depth involute spur gear having 30 and 50 teeth respectively of module 4mm are in mesh, the smaller gear rotates at 1000rpm. Determine (a) sliding velocities at engagement and at disengagement of a pair of teeth and (b) the contact ratio. Take addendum = 1 module. (8 Marks)

(OR)

14. b. i) How to avoid interference and under cutting? (4 Marks)

ii) In an epicyclic gear train of the sun and planet type, shown in fig below, the pitch circle diameter of the annular wheel is to be nearly 216mm and module 4mm. When the annular wheel is stationary, the spider which carries three planet wheels of equal size is to make one revolution for every five revolutions of the driving spindle carrying the sun wheel.

Determine the suitable number of teeth for all the wheels and the exact diameter of the pitch circle of the annular wheel. If an input torque of 19.6 N.m is applied to the spindle carrying the sun wheel, determine the fixing torque on the annular ring. (12Marks)



- 15.a. i) Describe the effect of the centrifugal tension on stresses in belts (4 Marks)
- ii) A shaft running at 100 rpm is to drive another shaft at 250 rpm and transmit 11 Kw. The belt is 11.5 cm wide and 12mm thick and the coefficient of friction between the belt and the pulley is 0.25. The distance between the shafts is 2.8 m and the smaller pulley is 60 cm in diameter. Calculate the stress in belt, connecting the two pulleys, when the belt is arranged as (a) open belt and (b) crossed belt. (12 Marks)

(OR)

15. b. Write short notes on the following

- i) Enumerate the various types of clutches and explain conical clutch (6 Marks)
- ii) Oil pressure distribution in journal bearing (5 Marks)
- iii) Rolling friction (5 Marks)