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B.E END SEMESTER EXAMINATIONS, NOV / DEC 2013

MECHANICAL ENGINEERING BRANCH

THIRD SEMESTER – (Regulation 2012)

ME 8302 KINEMATICS OF MACHINES

Time : 3 hr Max Mark : 100

Drawing sheet will be provided on request

Part A (10 X 2 = 20 mark)

Answer all questions

1. Define kinematic chain.
2. Identify the following to which mechanism they belong to :
   i. Wind shield wiper mechanism ii. Coupler rod mechanism
   iii Oldham's coupling iv. Oscillating cylinder engine
3. Explain Coriolis component of acceleration?
4. A point B on a rigid link AB moves with respect to A with angular velocity ω rad/sec. What is the radial component of the acceleration of B with respect to A?
5. For high speed follower motion of a cam, cycloidal motion is preferable than other types Justify.
6. Explain the working of a radial cam and a cylindrical cam with sketch
7. State the law of gearing?
8. What do you understand by the term 'interference' as applied to gears
9. What is the minimum force required to drag a body on rough horizontal surface.
10. For the same contact angle and same friction coefficient , V belt can transmit more power than flat belt. Why ?

Part B (5 X 16 mark = 80 mark)

11. A cam is to be designed for a knife edge follower with the following data :

1). Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion. 2). Dwell for the next 30°. 3). During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion. 4). Dwell during the remaining 180°. Draw the profile of the cam when the line of stroke of the follower passes through the axis of the cam shaft, and the radius of the base circle of the cam is 40 mm. Determine the maximum velocity andacceleration of the follower during its ascent and descent, if the cam rotates at *240 r.p.m.*

12. a. Explain the following :

i. lower and higher pairs with examples (4 marks)

ii. Kutzbach criterion for planar mechanism (4 marks)

iii. Find the mobility of each mechanism shown in the fig 1 and 2 (8 marks)

OR

Contd..2

b. (i) Explain any one quick return motion mechanism (8 marks)

(ii) In a crank and slotted lever quick return motion mechanism, the distance between the fixed centers is 240mm and the length of the driving crank is 120mm. Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke.

(8 marks)

13. a. The mechanism of a wrapping machine, as shown in Fig. 3, has the following dimensions: O_1A = 100 mm; AC = 700 mm; BC = 200 mm; O_3C = 200 mm; O_2E = 400 mm; O_2D = 200 mm and BD = 150 mm. The crank O_1A rotates at a uniform speed of 100 rad/s. Find the velocity of the point E of the bell crank lever by instantaneous centre method.

OR

b. In the mechanism shown in Fig. 4, the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s^2.The dimensions of various links are AB = 3 m inclined at 45° with the vertical and BC = 1.5 m inclined at 45° with the horizontal. Determine: 1. The magnitude of vertical and horizontal component of the acceleration of the point B, and 2. the angular acceleration of the links AB and BC.

14 . a i 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 marks)

ii.Compare between Involute and Cycloidal Gears (6 marks)

OR

b. In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have the same module and the number of teeth are : T_C = 28; T_D = 26; $T_E = T_F$ = 18.

1. Sketch the arrangement ; 2. Find the number of teeth on A and B ; 3. If the arm G makes 100 r.p.m. clockwise and A is fixed, find the speed of B ; and 4. If the arm G makes 100 r.p.m. clockwise and wheel A makes 10 r.p.m. counter clockwise ; find the speed of wheel B

15. a.(i) A plate clutch has three discs on the driving shaft and two discs on the driven shaft. The outside diameter of the contact surfaces is 240 mm and inside diameter is 120mm. Assuming uniform pressure and coefficient of friction 0.3, determine the total axial force on the springs to transmit 25 kW at 1500 rpm. If there are 6 springs each of stiffness 10kN/m and each of contact surface has worn away by 0.5mm, what is the maximum power that can be transmitted at the same speed with uniform wear? (10 marks)

(ii) A conical pivot bearing supports a vertical shaft of 200 mm diameter. It is subjected to a load of 30 kN. The angle of the cone is 120° and the coefficient of friction is 0.025. Find the power lost in friction when the speed is 140 r.p.m., assuming uniform pressure (6 marks)

OR

b. An open belt running over two pulleys of diameter 200mm and 600 mm connects two parallel shafts placed at a distance of 2.5m. The smaller pulley rotates at 300 rpm and transmit 7.5kW. The coefficient of friction between the belt and the pulley is 0.3. determine (i) length of belt (ii) Initial tension (iii) minimum width if the safe working tension is 12 N/mm width.

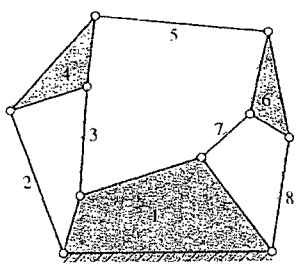

Fig 1

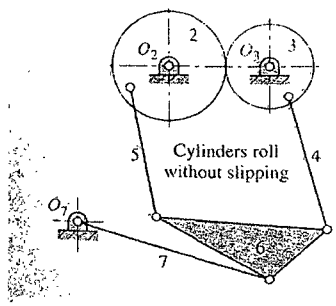

Fig 2

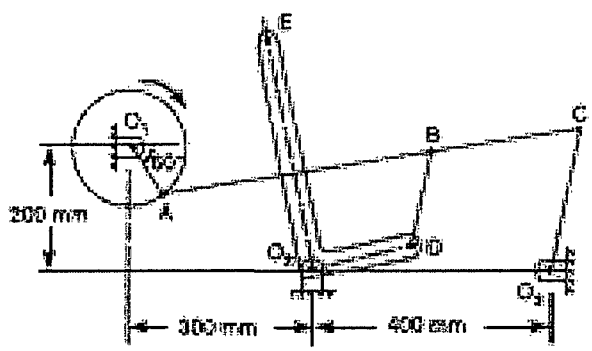

Fig 3

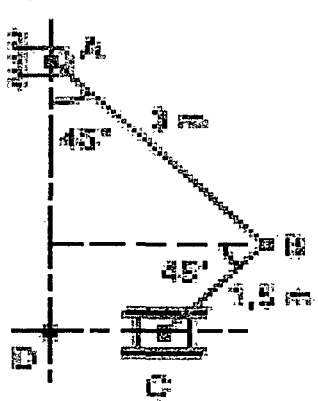

Fig 4