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B.E / B. Tech (Full Time) END SEMESTER EXAMINATIONS, NOV / DEC 2013

MECHANICAL ENGINEERING BRANCH

THIRD SEMESTER –(Regulation 2002/2004/2008)

ME232 / ME281 / ME9203 – 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. Explain the mobility of a mechanism.
2. Explain Kennedy Theorem?
3. State Grashoff's condition for planar linkages.
4. Classify Kinematic pairs according to the type of contact between the elements?
5. What are the different types of motion with which a follower can move?
6. Define the following in cams : i. pitch curve ii. Pressure angle
7. With a simple sketch, indicate the following in the meshing of two spur gear tooth
i. path of approach ii. Path of recess iii. Arc of contact
8. What are the advantages and limitations of worm gear trains ?
9. In calculating friction power loss in collar bearings, under what situation, uniform wear condition can be used ? Justify your answer.
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. Construct the profile of a cam to suit the following specifications

Cam shaft diameter=40mm, least radius of cam=25mm, diameter of roller=25mm, Angle of lift=120°, Angle of fall=150°; lift of the follower=40mm, Number of pauses are two of equal interval between motions. During the lift the motion is SHM. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is off-set 12.5mm from the center of cam.

12. a. Explain the following :

- i. lower and higher pairs with examples
- ii. Explain Kinematic Inversion with examples
- iii. Find the mobility of each mechanism shown in the fig 1 and 2

OR

Contd..2

b. i Fig 3 shown below is a Whitworth quick return motion mechanism. The various dimensions in the mechanism are as follows

OQ=100mm; OA=200mm; QC=150mm; and CD=500mm.

The crank OA makes an angle of 60° with the vertical and rotates at 120rpm in the clockwise direction.

Locate all the instantaneous centers and find the velocity of ram D.

13. a. Derive from the first principles an expression for the friction moment of a conical pivot bearing assuming (i) Uniform pressure and (ii) Uniform wear. (16 marks)

OR

b. (i) Explain the theory of lubrication?

(ii) A shaft has a number of collars integral with it. The external diameter of the collars is 400mm and the shaft diameter is 250mm. If the intensity of pressure is 0.35N/mm^2 (uniform) and the coefficient of friction is 0.05, estimate : 1. Power absorbed when the shaft runs at 105 rpm carrying a load of 150kN and 2. number of collars required.

14. A (i) A pair of spur gears with involute teeth is to give a gear ratio of 4 : 1. The module is 4 mm and arc of approach is not to be less than the circular pitch and the smaller wheel is driving gear. The pressure angle is $14\frac{1}{2}^\circ$. Find least number of teeth in each gear and addendum of the wheel. (10 marks)

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

OR

B (i) What is meant by controlling force curve of a governor? Sketch the controlling force curve of a gravity controlled governor. (4 mark)

(ii) A Porter governor has all the four arms of 30cm each and are pivoted on the axis of the of rotation. The mass of the each governor ball is 1kg and the mass of the sleeve is 20kg. Find the speed of the governor when the balls rotate at a radius of 15cm. If the friction is equivalent to 12 N. Find the coefficient of insensitivity at this speed (12 mark)

15. (A) A shaft rotating at 250 rpm is driven by another shaft at 500 rpm and transmits 5 kW through a belt drive. The belt is 100 mm wide and 10 mm thick and mass of the belt is 1000 kg / m^3 . The distance between the shaft is 3 m and diameter of the smaller pulley is 300 mm. Calculate the maximum stress in the belt for Cross belt drive. Take coefficient of friction as 0.3. (16 marks)

OR

B. The contact surfaces in cone clutch have an effective diameter of 75 mm. The semi-cone angle is 15° and coefficient of friction is 0.3. An axial force of 180 N is employed and this clutch is used to connect an electric motor running uniformly at 1000 rpm with a flywheel which is initially at rest. The flywheel has a mass of 13.5 kg and radius of gyration of 150 mm. Calculate i. torque required to produce slipping ii. Time taken by the flywheel to attain full speed iii. Energy lost during slipping. (16 marks)

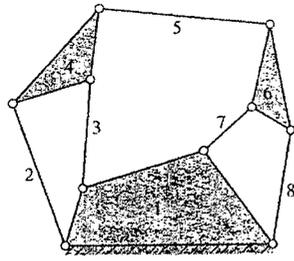


Fig 1

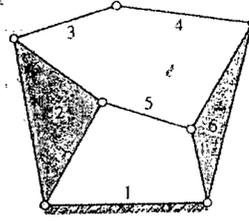


Fig 2

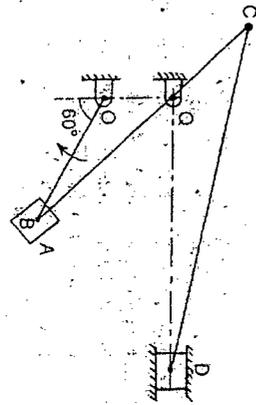


Fig 3