Reg. No. :

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B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020

Third/Fourth Semester

Mechanical Engineering

ME 2203/ 10122ME 404/080120010/ME 35 – KINEMATICS OF MACHINERY

(Regulations 2008/2010)

(Common to PTME 2203 – Kinematics of Machinery for B.E. (Part-Time) Third

Semester-Mechanical Engineering- Regulations 2009)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions.

PART – A   (10×2=20 Marks)

1. Sketch and define Transmission angle of a four-bar mechanism. What are the worst values of transmission angle ?

2. What is the condition for correct steering of an automobile ?

3. Write about rubbing velocity.

4. Write down the expression for finding the number of instantaneous centres in a mechanism.

5. Draw the displacement, velocity and acceleration diagrams for a follower when it moves with Cycloidal motion.

6. Which of the displacement diagrams in respect of follower motion should be chosen for better dynamic performance of a cam-follower mechanism ?

7. Define gear ratio.

8. Write short notes on differentials.

9. Why self locking screws have lesser efficiency ?

10. What is meant by a self-locking and a self-energised brake ?

PART – B **(5×16=80 Marks)**

11. a) Explain the inversions of Four bar chain with examples.

             (OR)

   b) Sketch and explain the following :

     i) Elliptical trammel. **(8)**

   ii) Scotch yoke mechanism. **(8)**

12. a) The dimensions of the mechanism, as shown in Fig. below, are as follows :
   AB = 0.45m; BD = 1.5 m; BC = CE = 0.9 m.
   The crank AB turns uniformly at 180 r.p.m. in the clockwise direction and
the blocks at D and E are working in frictionless guides. Draw the velocity
diagram for the mechanism and find the velocities of the sliders D and E in
their guides. Also determine the turning moment at A if a force of 500 N acts on
D in the direction of arrow X and a force of 750 N acts on E in the direction
of arrow Y. **(16)**
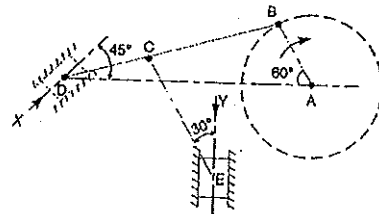
             (OR)

   b) A single cylinder rotary engine is shown below. OA is the fixed link, 200 mm
long. OB is the connecting rod and is 520 mm long. The line of stroke is along
AD and at the instant is inclined at 30 ° to the vertical. The body of the engine
consisting of cylinders rotates at a uniform speed of 400 rpm about fixed centre
A. Determine the acceleration of slider B and angular acceleration of
connecting rod. **(16)**
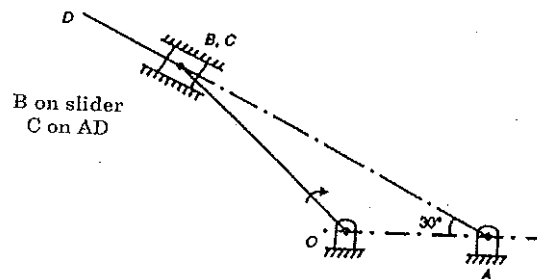
13. a) A cam is to be designed for a knife edged follower with the following data :

    i) Follower lift is 40 mm with SHM, during 90° of cam rotation.

    ii) Dwell for the next 30°.

    iii) Follower return to its original position with SHM, during next 60° of cam rotation.

    iv) Dwell for the remaining cam rotation.

    The line of stroke of the follower passes through the axis of the cam shaft. Radius of the base circle of the cam is 40 mm.

    1) Draw the displacement diagram. **(4)**

    2) Draw the profile of the cam. **(8)**

    3) Determine the maximum velocity and acceleration of the follower during forward and return strokes, if the cam rotates at 200 rpm in CW direction. **(4)**

    (OR)

    b) The following particulars relate to a symmetrical circular cam operating a flat faced follower : Least radius = 25 mm, Nose radius = 8 mm, Lift of the valve = 10 mm, Angle of action of cam = 120°, Cam shaft speed = 1000 r.p.m.

    i) Find the flank radius. **(4)**

    ii) Determine the maximum values of velocity, acceleration and retardation of the follower. **(3)**

    iii) Draw the profile of the cam. **(9)**

14. a) i) Explain the various pitches of helical gears with sketch. **(10)**

    ii) Two 15 mm module 20° pressure angle spur gears have addendum equal to one module. The pinion has 25 teeth and the gear 50 teeth. Determine whether interference will occur or not. If it occurs, to what valve should the pressure angle be changed to eliminate interference ?

    (6)

    (OR)

b) i) An epicyclic gear train consists of three gears 1, 2 and 3 as shown in fig. 6 the internal gear 1 has 72 teeth and gear 3 has 32 teeth. The gear 2 meshes with both gear 1 and gear 3 and is carried on an arm A. Which rotates about the centre O_2 at 20 rpm. If the gear 1 is fixed, determine the speed of gears 2 and 3. **(12)**
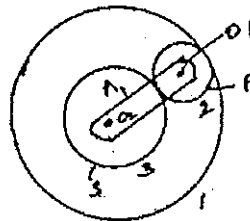

Fig. 6

ii) Write short notes on speed ratio of a planetary gear train. **(4)**

15. a) i) In a thrust bearing, the external and internal diameters of the contacting surfaces are 320 mm and 200 mm respectively. The total axial load is 80 kN and the intensity of pressure is 350 kN/m². The shaft rotates at 400 rpm. Taking the coefficient of friction as 0.06, calculate the power lost in overcoming the friction and the number of collars required. **(8)**

ii) A screw-jack has a square thread of mean diameter 60 mm and pitch 8 mm. The co-efficient of friction at the screw thread is 0.09. A load of 3 kN is to be lifted through 120 mm. Determine the torque required and the work done in lifting the load through 120 mm. Find also the efficiency of the jack. **(8)**

(OR)

b) i) Derive an expression for the centrifugal tension in a belt passing round a pulley rim. **(6)**

ii) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 rpm. The angle embraced is 165° and the coefficient, of friction between the belt and the pulley is 0.3. The safe working stress for the leather belt is 1.5 MPa; the density of leather is 1000 kg/m³ and thickness of belt is 10 mm. Determine the width of the belt taking centrifugal tension into account. **(10)**

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