Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 42840

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Third Semester

Mechanical Engineering

ME 2203 – KINEMATICS OF MACHINERY

(Regulations 2008)

(Common to PTME 2203 – Kinematics of Machinery for B.E. (Part-Time) Third Semester – Mechanical Engineering – Regulations 2009)

Time : Three Hours | Maximum : 100 Marks

A3 drawing sheet is to be supplied to the students.

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Differentiate a mechanism from a machine.
2. What is mechanical advantage ?
3. Why do we need to do acceleration analysis ? Give two practical engineering applications.
4. Identify the direction of Coriolis component for the given link (velocity vector qVp) that rotates at an angular velocity ω (Fig. 1(a) and Fig. 1(b)).

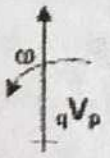

Fig. 1 (a)

Fig. 1 (b)

5. 'Roller follower is preferred to that of a knife edged follower' – Justify.
6. Define : pressure angle of a cam.
7. State the law of gearing.
8. Two 20° involute spur gears mesh externally and give a velocity ratio of 3. Module is 3 mm and addendum is equal to 1 module. Determine the minimum number of teeth on each wheel to avoid interference.
9. List the two types of dry friction and give an example for each type.
10. The brake drum of a single block brake of diameter 300 mm is rotating at 400 rpm. If the angle of contact is 90°, co-efficient of friction between the drum and brake block is 0.3, determine the equivalent co-efficient of friction.

PART – B (5×16=80 Marks)

11. a) i) With a neat sketch, explain any two inversions of a slider crank chain. (8)

ii) Write short notes on (i) toggle mechanism (ii) ratchets and escapements. (8)

(OR)

b) i) Determine the degree of freedom of the following mechanisms (Fig. 2 (a) to Fig. 2(d)). (8)

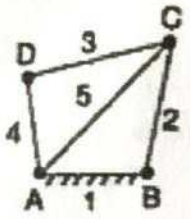

Fig. 2 (a)

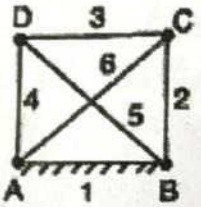

Fig. 2 (b)

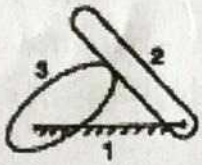

Fig. 2 (c)

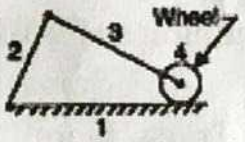

Fig. 2 (d)

ii) With neat sketches, explain the Peaucellier and Watt mechanisms of straight line generation. (8)

12. a) Crank 2 of the push-link mechanism shown in Fig. 3 is driven at $\omega_2 = 60$ rad/s clockwise. Find the velocities of points B and C and the angular velocities of links 3 and 4.

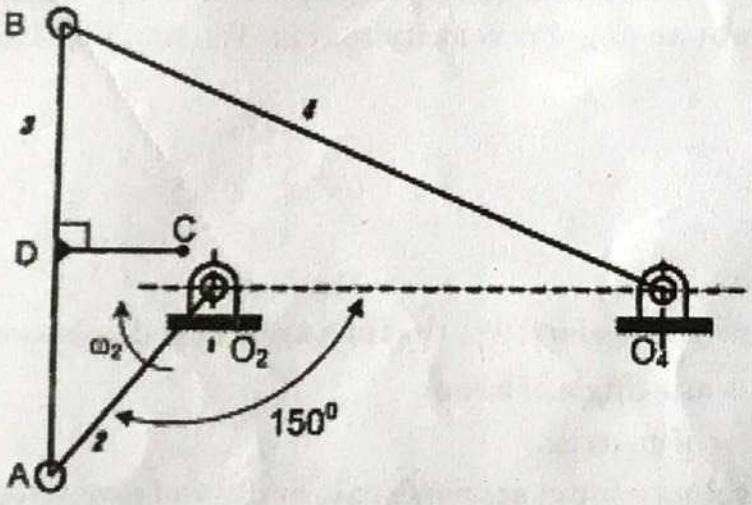

Fig. 3

The lengths of various links are as follows :

$O_2A = 150$ mm; $AB = 300$ mm; $O_2O_4 = 75$ mm; $O_4B = 300$ mm; $AD = 150$ mm; $CD = 100$ mm.

(OR)

b) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine (i) linear velocity and acceleration of the midpoint of the connecting rod (ii) angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from the inner dead centre position.

13. a) A radial cam drives a flat reciprocating follower in the following manner :

During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

(OR)

b) A symmetrical circular cam operating a flat-faced follower has the following particulars :

Minimum radius of cam = 30 mm; Total lift = 20 mm; Angle of lift = 75°; Nose radius = 5 mm ; Speed = 600 rpm; Find (i) the principal dimensions of the cam (ii) the acceleration of the follower at the beginning of the lift, at the end of contact with the circular flank, at the beginning of contact with nose and at the apex of the nose.

14. a) A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 rpm. Determine the velocity of sliding between the gear teeth faces at the beginning of engagement, at the pitch point, and at the end of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact.

(OR)

b) An epicyclic train of gears is arranged as shown in Fig. 4. How many revolutions does the arm, to which the pinions B and C are attached, make :

i) When A makes one revolution clockwise and D makes half a revolution anticlockwise, and

ii) When A makes one revolution clockwise and D is stationary

The number of teeth on the gears A and D are 40 and 90 respectively.

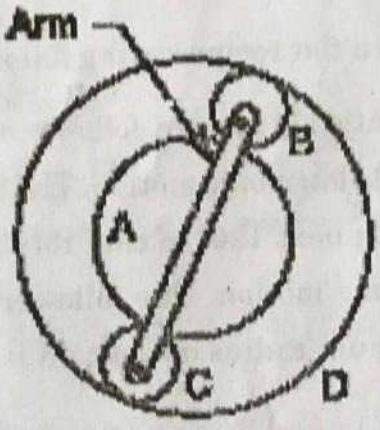

Fig. 4 Epicyclic gear train

15. a) i) The mean diameter of a square threaded screw-jack is 50 mm. The pitch of the thread is 10 mm. The coefficient of friction is 0.15. Determine the force that must be applied at the end of a 0.7 m long lever, which is perpendicular to the longitudinal axis of the screw to raise a load of 20 kN and lower it. (8)

ii) The external and internal radii of a friction plate of a single clutch are 120 mm and 60 mm respectively. The total axial thrust with which the friction surfaces are held together is 1500 N. For uniform wear, determine the maximum, minimum and average pressure on the contact surfaces. (8)

(OR)

b) i) A conical pivot with an angle of cone as 120°, supports a vertical shaft of diameter 300 mm. It is subjected to a load of 20 kN. The co-efficient of friction is 0.05 and the speed of the shaft is 210 rpm. Calculate the power lost in friction assuming (a) uniform pressure (b) uniform wear. (8)

ii) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. Determine the power transmitted by the belt when the larger pulley rotates at 200 revolutions per minute, maximum permissible tension in the belt is 1 kN and the coefficient of friction between the belt and pulley is 0.25. (8)
