Reg. No. :

Question Paper Code : X67641

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Third Semester
Mechanical Engineering
ME1202A – KINEMATICS OF MACHINERY
(Regulations 2008)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. What is meant by kinematic chain ?
2. Write down any two applications of indexing mechanisms.
3. Define number of instantaneous centre.
4. What is low degree of complexity ?
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. What is helix angle related to screws ?
8. State the various types of friction clutches.
9. State the functional difference between a clutch and a brake.
10. What are the advantages of wire ropes over fabric ropes ?

PART – B **(5×16=80 Marks)**

11. a) Explain the inversions of single slider crank chain with examples. **(16)**

(OR)

b) Explain the following with a neat sketch :

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

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

12. a) i) The crank AB of four bar mechanism shown in Figure 3. Rotates at 60 rpm clockwise. Determine the relative angular velocities of the coupler to the crank and the lever to the coupler. Find also the rubbing velocities all the surface of pins 25 mm radius and the joints B and C. **(8)**

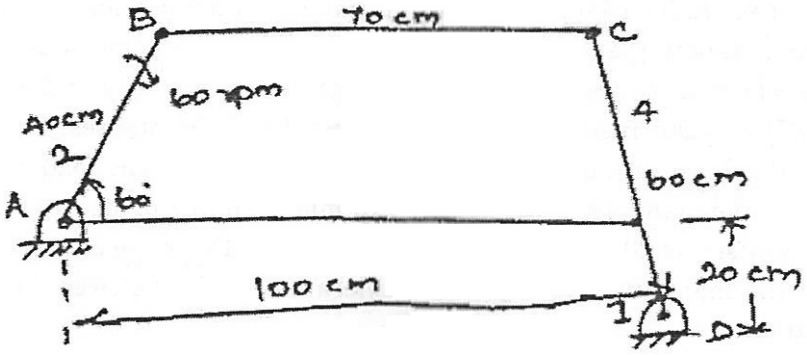

Fig. 3

ii) Locate the instantaneous centre's of the slider crank mechanism shown in Fig.4. Find the velocity of the slider . **(8)**

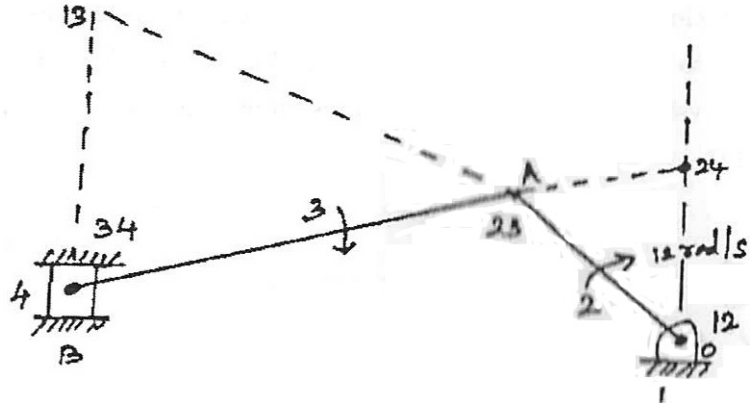

Fig. 4

(OR)

b) i) Fig. 5 shows the configuration of a whit worth quick return mechanism. The lengths of the fixed link OA and the crank OP are 200 mm and 300 mm respectively. Other lengths are AR = 200 mm and RS = 400 mm. Find the velocity of the ram using instantaneous centre method when the crank makes a single of 120° with the fixed link and rotates at 10 rad/s. **(10)**

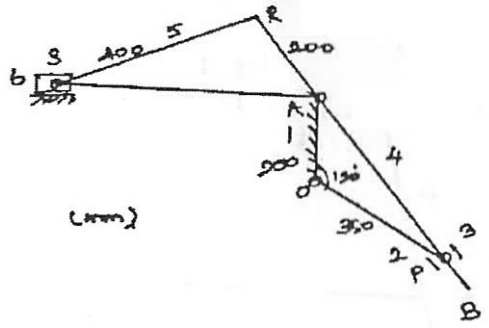

Fig. 5

ii) Differentiate low degree and high degree of complexity with suitable sketch. **(6)**

13. a) 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. Determine the flank radius and the maximum velocity, acceleration and retardation of the follower. If the mass of the follower and valve with which it is in contact is 4 kg, find the minimum force to be exerted by the spring to overcome inertia of the valve parts. **(16)**

(OR)

b) A cam rotating clockwise at a uniform speed of 200 r.p.m. is required to move an offset roller follower with a uniform and equal acceleration and retardation on both the outward and return strokes. The angle of ascent, the angle of dwell (between ascent and descent) and the angle of descent is 120°, 60° and 90° respectively. The follower dwells for the rest of cam rotation. The least radius of the cam is 50 mm, the lift of the follower is 25 mm and the diameter of the roller is 10 mm. The line of stroke of the follower is offset by 20 mm from the axis of the cam. Draw the cam profile and find the maximum velocity and acceleration of the follower during the outstroke. **(16)**

14. a) An epicyclic gear train consists of a sun wheel S, a stationary internal gear E and three identical planet wheels P carried on a star shaped planet carrier C. The size of different tooth wheels are such that the planet carrier C rotates at $1/5^{th}$ of the sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 Nm. Determine : i) No. of teeth on different wheels of the train and ii) Torque necessary to keep the internal gear stationary. **(16)**

(OR)

b) Two 20° binvolute spur gears have a module of 10 mm. The addendum is one module. The larger gear has 50 teeth and the pinion 13 teeth. Does the interference occur ? If it occurs, to what value should the pressure angle be changed to eliminate interference. **(16)**

15. a) i) The following data relate to screw jack, Pitch of the thread screw = 8 mm, Diameter of the thread screw = 40 mm, Coefficient of friction between screw and nut = 0.1, Load = 20 kN. Assuming that the load rotates with the screw, determine 1) the ratio of torque required to raise and lower the load 2) the efficiency of the machine. **(6)**

ii) A friction clutch is used to rotate a machine from a shaft rotating at a uniform speed of 250 rpm. The disc type clutch has both of its sides effective, the coefficient of friction being 0.3. The outer and the inner diameters of the friction plate are 200 mm and 120 mm respectively. Assuming uniform wear of the clutch, the intensity of pressure is not to be more than 100 kN/m^2. If the moment of inertia of the rotating parts of the machine is 60.5 kg/m^2, determine the time to attain the full speed by the machine and the energy lost in slipping of the clutch.

What will be the intensity of pressure, if the condition of uniform pressure of the clutch is considered ? Also, determine the ratio of power transmitted with uniform wear to that with uniform pressure. **(10)**

(OR)

b) 2.5 kW of powers is transmitted by an open-belt drive. The linear velocity, of the belt is 2.5 m/s. The angle of lap on the smaller pulley is 165°. The coefficient of friction is 0.3. Determine the effect on power transmission in the following cases :

i) Initial tension in the belt is increased by 8%.

ii) Initial tension in the belt is decreased by 8%.

iii) Angle of lap is increased by 8% by the use of an idler pulley, for the same speed and the tension on the tight side, and

iv) Coefficient of friction is increased by 8% by suitable dressing to the friction surface of the belt. **(16)**
