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Question Paper Code: 34702

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Mechanical Engineering

01UME402 – KINEMATICS OF MACHINERY

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Differentiate between machine and structure.
2. Define kinematic pair and illustrate any two types of constrained pair.
3. What is transmission angle?
4. How will you determine the magnitude and direction of coriolis component of acceleration?
5. Define (a) pressure angle (b) pitch curve of radial cam.
6. Define the term trace point.
7. Define (i) Module and (ii) Pressure angle.
8. What are differences between simple, compound, and epicyclic gear trains?
9. What is centrifugal tension in a belt? How does it affect the power transmitted?
10. What is (i) Limiting friction and (ii) Angle of friction?

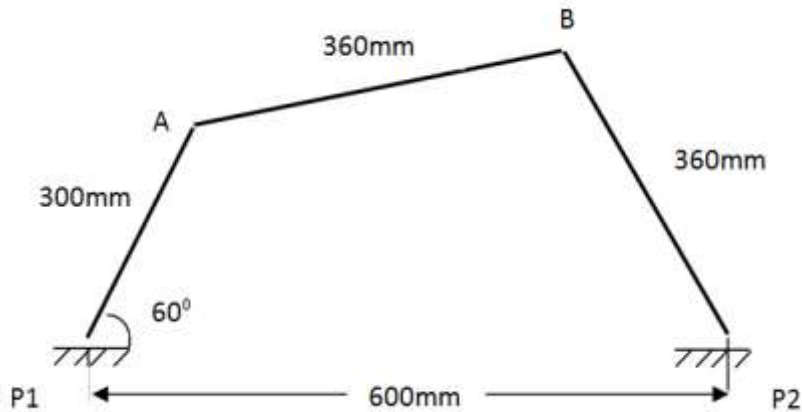
PART - B (5 x 16 = 80 Marks)

11. (a) Define transmission angle. Sketch a drag-link mechanism in maximum transmission angle and minimum transmission angle positions and explain. (16)

Or

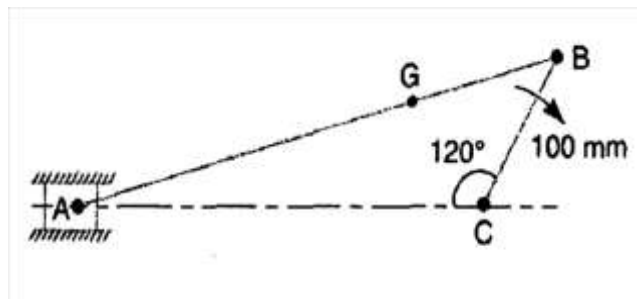
(b) Discuss about clamping and indexing mechanisms with neat sketches. (16)

12. (a) The dimensions and configuration of the four bar mechanism, as shown in the figure. The crank $P1A$ has an angular velocity of 10 rad/sec and an angular acceleration of 30 rad/sec^2 , both clockwise. Determine the angular velocities and angular accelerations of $P2B$ and AB and velocity and Acceleration of the joint B ? (16)



Or

- (b) An engine mechanism is shown in Fig. below. The crank $CB = 100 \text{ mm}$ and the connecting rod $BA = 300 \text{ mm}$ with centre of gravity G , 100 mm from B . In the position shown, the crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s^2 . Find: 1. Velocity of G and angular velocity of AB , and 2. Acceleration of G and angular acceleration of AB . (16)



13. (a) A cam rotating clockwise at a uniform speed of 1000 r.p.m. is required to give a roller follower the motion defined below:

- ◆ Follower to move outwards through 50 mm during 120° of cam rotation,
- ◆ Follower to dwell for next 60° of cam rotation,
- ◆ Follower to return to its starting position during next 90° of cam rotation,

- ◆ Follower to dwell for the rest of the cam rotation.

The minimum radius of the cam is 50 mm and the diameter of roller is 10 mm. The line of stroke of the follower is off-set by 20 mm from the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and retardation on both the outward and return strokes, draw profile of the cam and find the maximum velocity and acceleration during out stroke and return stroke. (16)

Or

- (b) A symmetrical circular cam operating a flat faced follower has the following particulars: minimum radius of the cam 30 mm; total lift 20 mm; angle of lift 75° ; Nose radius 5 mm; speed 600 rpm. Find the principal dimensions of the cam. (16)
14. (a) A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point 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. (16)

Or

- (b) Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m., find the speed of shaft B. (16)
15. (a) A load of 15 kN is raised by means of a screw jack. The mean diameter of the square threaded screw is 42 mm and the pitch is 10 mm. A force of 120 N is applied at the end of a lever to raise the load. Determine the length of the lever to be used and the mechanical advantage obtained. Is the screw self locking? Take $\mu = 0.12$. (16)

Or

- (b) (i) A single-plate clutch transmits 25 kW at 900 rpm . The maximum pressure intensity between the plates is 85 kN/m^2 . The outer diameter of the plate is 360 mm . Both the sides of the plate are effective and the coefficient of friction is 0.25 . Determine (i) The inner diameter of the plate (ii) The axial force to engage the clutch. (8)
- (ii) What is a clutch? Make a sketch of a single plate clutch and describe its working. (8)