The base circle diameter of the cam is 60 mm and the stroke of the follower is 20 mm. The line of movement of the follower passes through the cam centre. Draw the displacement diagram and the profile of the cam very neatly showing all constructional details. **10**

## Section C

**5.** (a) Define Slip in Belt drive. Derive a suitable expression for slip. **4**

(b) Power is transmitted using a V-belt drive. The included angle of V-groove is 30°. The belt is 20 mm deep and maximum width is 20 mm. If the mass of the belt is 0.40 kg per metre length and maximum allowable stress is 1.5 MPa, determine the maximum power transmitted when the angle of lap is 140°. $\mu = 0.15$. **6**

**6.** (a) What are the gear profile ? Explain each one with net sketch. **4**

(b) In the figure number of teeth are given with respective gears : (i) If arm makes 100 rpm clockwise and gear 5 is fixed, find speed of gear 2. (ii) If arm makes 200 rpm clockwise,



**Roll No.** ..... **Total Pages : 06**

# July-22-00295

## B. Tech. EXAMINATION, 2022

Semester V (CBCS)

KINEMATICS OF MACHINES (ME, AE)

ME-501

*Time : 3 Hours* *Maximum Marks : 60*

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note** : Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Q. No. 9 is compulsory. Drawing sheet/graph paper is required.

## Section A

**1.** (a) What is Kutchbach equation ? Explain with suitable expression. **4**

(b) Write inversion of single and double slider mechanism. **6**

2. (a) Explain the Kennedy Theorem of Three instantaneous centres. 4

(b) In a four-bar mechanism ABCD, the link lengths in mm are as follows :

Input AB = 25, coupler BC = 85, output CD = 50 and frame AD = 60. The angle between the frame and the input is 100° measured anti-clockwise. The velocity of point B is 1.25 m/sec in the clockwise direction. Sketch the mechanism and determine the velocity and acceleration of the mid-point of the link BC, using graphical method. Also, find the angular velocity and angular accelerations of the links BC and CD. 6

## Section B

3. (a) What are the cam with specified contours ? Explain with neat sketches. 4

(b) Cam rotating clockwise with a uniform speed is to give the roller follower of 20 mm diameter with the following motion :

(i) Follower to move outwards through a distance of 30 mm during 120° of cam rotation



(ii) Follower to dwell for 60° of cam rotation

(iii) Follower to return to its initial position during 90° of cam rotation

(iv) Follower to dwell for the remaining 90° of cam rotation.

The minimum radius of the cam is 45 mm and the line of stroke of the follower is offset 15 mm from the axis of the cam and the displacement of the follower is to take place with simple harmonic motion on both the outward and return strokes. Draw the cam profile. 6

4. A flat faced reciprocating follower has the following motion. The follower moves out for 80° of cam rotation with uniform acceleration and retardation, the :

(i) Acceleration being twice the retardation.

(ii) The follower dwells for the next 80° of cam rotation.

(iii) It moves in for the next 120° of cam rotation with uniform acceleration and retardation, the retardation being twice the acceleration.

(iv) The follower dwells for the remaining period.

displacement of the slider is proportional to the square of the crank rotation in the interval $45° \leq \theta \leq 135°$. Use three precision points with Chebyshev's spacing. **10**

**(Compulsory Question)**

9. (a) What do you understand by equivalent linkage ?

   (b) Write about pantograph.

   (c) What is the maximum velocity of follower moving in SHM in conjunction of cam, running with 10 rad/s with maximum displacement of 10 mm for 90 degree of cam rotation ?

   (d) Write advantages of V-belt.

   (e) Define backlash in gears.

   (f) Define helix angle in helical gear.

   (g) Write about reverted gear train.

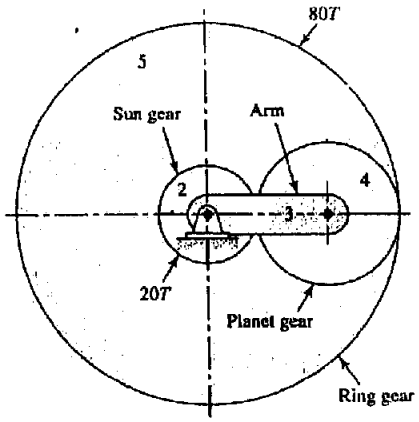
   (h) Define prime circle in cam profile.

   (i) What is number and dimensional synthesis ?

   (j) What is structural errors ? **10×2=20**



gear 5, 20 rpm anticlockwise, find speed of Gear 4. **6**




**Section D**

7. Synthesize a four-bar mechanism to generate a function $y = \sin x$ for $0 \leq x \leq 90°$. The range of the output crank may be chosen as 60° while that of input crank be 120°. Assume three precision points which are to be obtained from Chebyshev spacing. Assume fixed link to be 52.5 mm long and $\theta 1 = 105°$ and $\varphi 1 = 66°$. **10**

8. Synthesize a slider crank mechanism so that the