# CBCS SCHEME

15MT45

## Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
## Theory of Machines

Time: 3 hrs.                                                                 Max. Marks: 80

**Note:** *Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

1 a. Define the following with sketch :
i) Link and types of link
ii) Kinematic chain
iii) Mechanism
iv) Structure.                                                         **(08 Marks)**

b. Find out the number of degrees of freedom or mobility as shown in following Fig.Q1(b)(i)(ii)(iii)(iv).



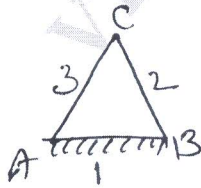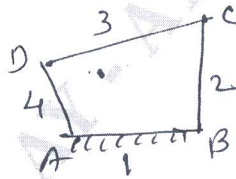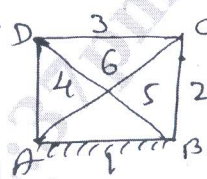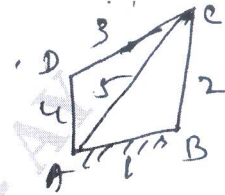Fig.Q1(b)(i)          Fig.Q1(b)(ii)          Fig.Q1(b)(iii)          Fig.Q1(b)(iv) **(04 Marks)**
                                                                                      **(04 Marks)**

c. Explain single slider crank chain with sketch.                       **(04 Marks)**

### OR

2 a. In a four bar mechanism (chain) AB CD, AD is fixed and 150mm long. The crank AB is 40mm long and rotates at 120rpm clockwise while the link CD = 80mm oscillates about D BC and AD are equal length find the angular velocity of link CD when angle $\angle BAD = 60°$.                                                                         **(08 Marks)**

b. In engine mechanism is shown in Fig.Q2(b). The crank CB = 100mm and the connecting rod BA = 300mm with center of gravity and 100mm from B. in the position shown. The crank shaft has a speed of 75rad/sec and an angular acceleration of 1200rad/s². Find :
velocity of G and angular velocity of AB.



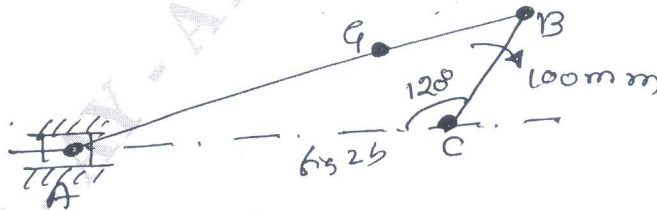Fig.Q2(b)                                                               **(08 Marks)**

### Module-2

3 a. Explain law of gearing with figure.                                **(06 Marks)**

b. Derive an expression for Arc and path of contact of spur gear.       **(10 Marks)**

**OR**

4  a. What is simple gear train explain the speed ratio with neat sketch. **(04 Marks)**

   b. In an epicylic gear train an arm carries two gears A and B having 36 and 45 teeth respectively. If the aram rotates at 150rpm in the anticlock wise direction about the center of the gear 'A' which is fixed. Determine speed of gear 'B'. If the gear 'A' instead of being fixed makes 300rpm in the clockwise direction what will be speed of gear B. **(12 Marks)**

## Module-3

5  a. What are the different types of follower explain any two with sketch. **(06 Marks)**

   b. Cam is to give the following motion in to a knife edge follower :
      i)   Outstroke during 60° of cam rotation
      ii)  Dwell for the next 30° of cam rotation
      iii) Return stroke during next 60° of cam rotation
      iv)  Dwell for the removing 210° of cam rotation.
      The stroke of the follower is 40mm and the minimum radius of the cam is 50mm. The follower moves with a uniform velocity during both outside and return stroke draw the profile of the cam when the axis of the follower passes through the axis of the cam. **(10 Marks)**

**OR**

6  a. Draw a neat sketch of displacement, velocity and acceleration diagram when the follower moves with simple harmonic motion. **(06 Marks)**

   b. Construct the profile of a cam to suit the following specification
      Cam shaft diameter      = 40mm
      Least radius of cam      = 25mm
      Diameter of roller       = 25mm
      Angle of lift            = 120°
      Angle of full            = 150°
      Lift of the follower     = 40mm
      Numbers of pauses are two of equal interval between motions. During the lift the motion is SHM. During the fall the motion is uniform acceleration and deceleration. The speed of the cam shaft is uniform. The line of stroke of the follower is offset 12.5 mm from the center of the cam. **(10 Marks)**

## Module-4

7  a. Explain balancing of single mars in a plane. **(04Marks)**

   b. A, B, C and D are four masses carried by a rotating shaft at radii 100, 125, 200 and 150mm respectively. The planes in which the masses revolve are speed 600mm apart and the mass of B, C and D are 10kg, 5kg and 4kg respectively. Find the required mass A and the relative angular setting of the four masses so that the shaft shall be in complete balance. **(12 Marks)**

**OR**

8  a. Derive an expression for ratio tension in belt drive. **(10 Marks)**

   b. Explain power transmitted by an open belt drive. **(06 Marks)**

## Module-5

9  a. Explain effect of gyroscopic couple on a ship during pitching. **(08 Marks)**

   b. Explain effect of gyroscopic couple on Aeroplane. **(08 Marks)**

**OR**

10 a. What are the requirements of a governor? **(08 Marks)**

   b. Derive an expression of speed and power of a Hartnell governor. **(08 Marks)**