

# CBCS SCHEME

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17AE/AS44

## Fourth Semester B.E. Degree Examination, Jan./Feb.2021 Mechanism and Machine Theory

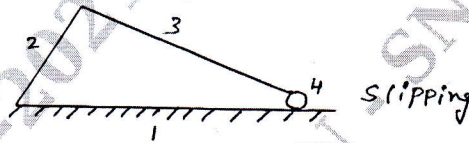
Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. Determine the mobility of the mechanism given below: (02 Marks)



- b. Give the classification of kinematic pairs (lower pairs) according to type of relative motion between links. Also indicate the degree of freedom associated with each pair. (06 Marks)
- c. Explain with neat sketches, three inversions of double slider crank chain. (12 Marks)

### OR

- 2 a. Prove that the Peaucellier's mechanism can be used to draw exact straight line motion. (10 Marks)
- b. Obtain the condition for correct steering for a four wheeled vehicle. (10 Marks)

### Module-2

- 3 A four bar chain ABCD has a fixed link  $AD = 1$  m. The driving crank  $AB = 0.3$  m. The follower link  $CD = 0.6$  m and the connecting link  $BC = 1.2$  m. Find the velocity and acceleration of Point 'P' midway between B and C, when the angle  $BAD = 135^\circ$  and AB rotates clockwise at a speed of 300 rpm with an angular acceleration of  $20 \text{ rad/sec}^2$  in C.C.W direction. (20 Marks)

### OR

- 4 For static equilibrium of the mechanism shown in Fig. Q4. Find the required input torque. The dimensions are  $AB = 150$  mm,  $BC = AD = 500$  mm,  $DC = 300$  mm,  $CE = 100$  mm and  $EF = 450$  mm. (20 Marks)

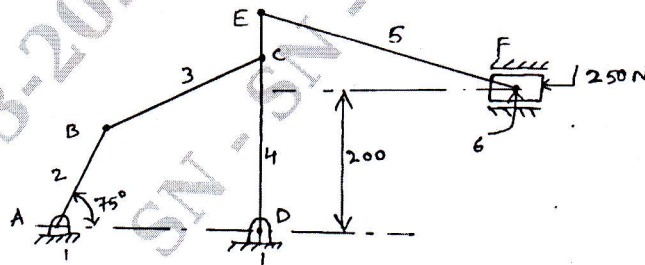


Fig. Q4

### Module-3

- 5 a. What is Involotometry. Derive an expression for finding the tooth thickness of a given point, if the tooth thickness of some other point is known. (10 Marks)
- b. A Pinion of 32 involute teeth and 4 mm module drives a rack. The pressure angle is  $20^\circ$ . The addendum of both Pinion and rack is the same. Determine the maximum permissible value of addendum to avoid interference. Also find the number of pairs of teeth in contact. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg.  $42+8 = 50$ , will be treated as malpractice.

OR

- 6 In an Epicyclic gear train of Sun and Planet type, the pitch circle diameter of the annular wheel A is 425 mm and the module is 5 mm. When the annular wheel is stationary, the spider which carries 3 planet gears P of equal size has to make one revolution for every 6 revolutions of the driving spindle carrying sun wheel S. Determine the number of teeth on all the wheels. (20 Marks)

**Module-4**

- 7 Four masses  $M_1 = 100$  kg;  $M_2 = 175$  kg;  $M_3 = 200$  kg and  $M_4 = 125$  kg are fixed to the crank of 200 mm radius and revolve in planes 1, 2, 3 and 4 respectively. The angular position of the planes 2, 3 and 4 with respect to 1 are  $75^\circ$ ,  $135^\circ$  and  $240^\circ$  taken in the same sense. Distance of the planes 2, 3 and 4 from 1 are 600 mm, 1800 mm and 2400 mm. Determine the magnitude and position of the balancing masses at radius 600 mm in plane L and M located in the middle of 1 and 2 and in the middle of 3 and 4 respectively. (20 Marks)

OR

- 8 The cranks and connecting rod of a 4 cylinder in line engine running at 1800 rpm are 50 mm, 250 mm each respectively and the cylinders are spaced 150 mm apart. If the cylinders are numbered 1 to 4 in sequence from one end and the cranks appear at intervals of  $90^\circ$  in an end view in the order 1 – 4 – 2 – 3. The reciprocating mass corresponding to each cylinder is 1.5 kg. Determine (i) Unbalanced primary and secondary forces if any (ii) Unbalanced primary and secondary couples with reference to central plane of engine. (20 Marks)

**Module-5**

- 9 a. Define : (i) Sensitiveness (ii) Governor effort (iii) Governor power (iv) Hunting. (08 Marks)  
b. In a spring controlled governor, the curve of controlling force is a straight line. When the balls are 0.4 m apart, the controlling force is 1500 N and when 0.25 m apart it is 750 N. At the what speed, the governor will run when the balls are 0.3 m apart. What initial tension will be required for isochronism and what would be then the speed. Mass of each ball 6 kg. (12 Marks)

OR

- 10 a. Derive an expression for the gyroscopic couple. (08 Marks)  
b. An aeroplane make a complete half circle of 40 m radius towards left when flying at 175 km/hr. The mass of the rotary engine and propeller is 400 kg with radius of gyration 300 mm. The engine runs at 2500 rpm clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft. What will be effect if the aeroplane turn towards right instead of left. (12 Marks)

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