

# CBCS SCHEME

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15AE44

## Fourth Semester B.E. Degree Examination, Aug./Sept.2020 Mechanisms and Machine Theory

Time: 3 hrs.

Max. Marks: 80

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

### Module-1

- 1 With neat sketch explain  
 (i) Geneva Wheel Mechanism  
 (ii) Ratchet and Pawl Mechanism  
 (iii) Ackerman Steering Mechanism  
 (iv) Scotch Yoke Mechanism. (16 Marks)

OR

- 2 Sketch and explain  
 (i) Whitworth quick return mechanism  
 (ii) Crank and slotted lever mechanism (16 Marks)

### Module-2

- 3 Fig.Q3 shows a four bar mechanism, crank  $O_2A$  rotates at 200 rpm and an angular acceleration of  $150 \text{ rad/sec}^2$  at the instant when the crank makes an angle of  $45^\circ$  to the horizontal. Find the acceleration of points B & C and angular velocities and angular acceleration of link 3 and 4.

- $O_2O_4 = 120 \text{ mm}$   
 $O_2A = 45 \text{ mm}$   
 $AB = 90 \text{ mm}$   
 $O_4B = 60 \text{ mm}, AC = 40 \text{ mm}$

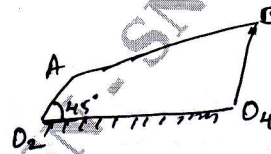


Fig.Q3

(16 Marks)

OR

- 4 Determine various forces and  $T_2$  for the mechanism shown in Fig.Q4.

- $AB = 300 \text{ mm}$   
 $BC = 600 \text{ mm}$   
 $BD = 200 \text{ mm}$   
 $AE = 200 \text{ mm}$

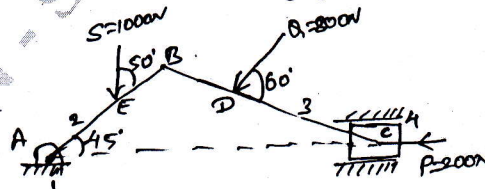


Fig.Q4

(16 Marks)

### Module-3

- 5 a. Derive an expression for length of arc of contact for spur gear. (10 Marks)  
 b. Find the minimum number of teeth to avoid undercutting when the addendum for teeth is 0.84 module. Gear ratio is 3:1. Also find the length of arc of contact in terms of module. Pressure angle =  $20^\circ$ . (06 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, the internal wheels A, B and the compound, wheel C and D rotate independently about the axis 'O'. The wheels E & F rotate on a pin fixed to the arm G. E gears with A & C, and F gears with B & D. Number of teeth on E & F are 18, C = 28, D = 26. Sketch the arrangement. Find number of teeth on A & B. If arm 'G' makes 150 rpm (CW) & A is fixed find  $N_B$ . If the arm 'G' makes, 50 rpm (CW) and  $N_A = 15$  rpm (CCW), Find  $N_B$ . (16 Marks)

**Module-4**

- 7 a. Explain the procedure for balancing several masses rotating in the same plane. (04 Marks)  
 b. A shaft carries four rotating masses A, B, C and D which are completely balanced. The masses B, C and D are 50kg, 80kg and 70 kg respectively. The masses C and D makes angles of  $90^\circ$  and  $195^\circ$  respectively with masses 'B' in same sense. The masses A, B, C and D are concentrated at radius 75mm, 100mm, 50mm and 90mm respectively. The plane of rotation of masses B and C are 250 mm apart. Determine mass A and its angular position, position of planes of A and D. (12 Marks)

OR

- 8 a. With usual notations, explain primary and secondary unbalanced forces of reciprocating masses. (04 Marks)  
 b. A 5 cylinder inline engine running at 500 rpm has successive cranks at  $144^\circ$  apart. The distance between the cylinder center line is 300 mm. Piston stroke = 240mm, length of CR = 480mm. Examine the engine for balance of primary and secondary forces and couples. Find the maximum value of these and position of central crank at which these maximum values occur. The reciprocating mass for each cylinder is 150 N. (12 Marks)

**Module-5**

- 9 a. Establish the relation between speed and height of porter Governor. (08 Marks)  
 b. The upper arms of porter governor are pivoted to axis of rotation. The length is 40cm. The lower arm pivoted on the sleeve at a distance of 2 cm from the axis, their length is 30cm. Mass of each ball is 5 kg the sleeve mass is 50 kg. Determine the equilibrium speed for the radius of rotation of 20 cm and also the effort and power of 1% speed change. (08 Marks)

OR

- 10 a. With usual notations and diagram, derive an expression for the gyroscopic couple produced by a rotating disc. (08 Marks)  
 b. With neat sketch explain gyroscopic effect on Aeroplane for all possibilities. (08 Marks)

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