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15AE44

**Fourth Semester B.E. Degree Examination, June/July 2017**  
**Mechanisms and Machine Theory**

Time: 3 hrs.

Max. Marks: 80

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

**Module-1**

- 1 a. Sketch and derive the length of stroke and ratio between time taken during the cutting and return stroke of a crank and slotted quick return motion mechanism. (08 Marks)
- b. Determine the number of degrees of freedom for the simple mechanisms shown in the Fig.Q1(b)(i), (ii) and (iii). (08 Marks)

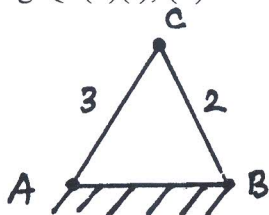


Fig.Q1(b)(i)

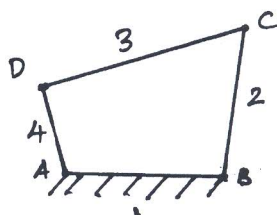


Fig.Q1(b)(ii)

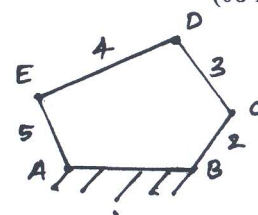


Fig.Q1(b)(iii)

OR

- 2 a. Sketch and explain the inversions of four bar mechanism. (08 Marks)
- b. Fig.Q2(b) shows the layout of a quick return mechanism of the oscillating link type, for a special purpose machine. The driving crank BC is 30 mm long and time ratio of the working stroke to the return stroke is to be 1.7. If the length of the working stroke of R is 120 mm, determine the dimensions of AC and AP.

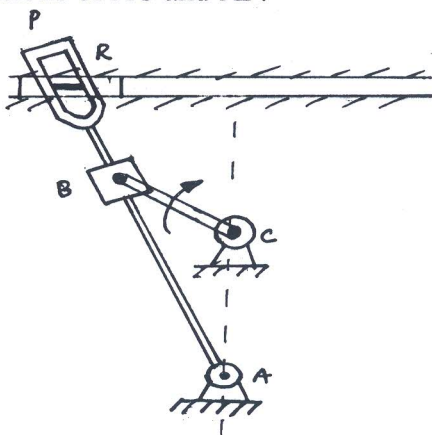


Fig.Q2(b)

(08 Marks)

**Module-2**

- 3 An engine mechanism is shown in Fig.Q3. The crank CB = 100 mm and the connecting rod BA = 300 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<sup>2</sup>. Find velocity of G and angular velocity of AB, and acceleration of G and angular acceleration of AB.

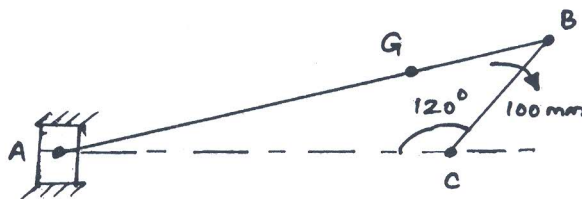


Fig.Q3

(16 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

- 4 a. A four-link mechanism with the following dimensions is acted upon by a force 80 N with an inclination of  $150^\circ$  on the link DC.  $AD = 500$  mm,  $AB = 400$  mm,  $BC = 1000$  mm,  $DC = 750$  mm,  $DE = 350$  mm. Determine the input torque  $T$  on the link AB for the static equilibrium of the mechanism for the given configuration. [Refer Fig.Q4(a)]

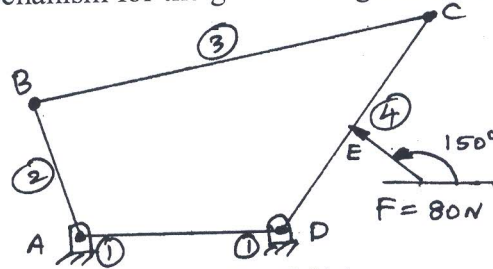


Fig.Q4(a)

(12 Marks)

- b. What are conditions for a body to be in equilibrium under the action of two forces, three forces and two forces and a torque? (04 Marks)

**Module-3**

- 5 a. A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with  $20^\circ$  pressure angle, 12 mm module and 10 mm addendum. Find the length of path of contact, arc of contact and the contact ratio. (10 Marks)
- b. Write short notes on undercutting in gears. (06 Marks)

OR

- 6 a. An epicyclic gear train is shown in Fig.Q6(a). The number of teeth on A and B are 80 and 200. Determine the speed of the arm a :
- If A rotates at 100 rpm clockwise and B at 50 rpm counter clockwise.
  - If A rotates at 100 rpm clockwise and B is stationary.

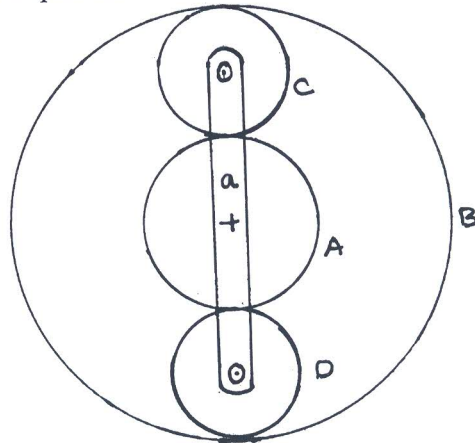


Fig.Q6(a)

(12 Marks)

- b. Briefly explain the types of gear trains. (04 Marks)

**Module-4**

- 7 A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B  $45^\circ$ , B to C  $70^\circ$ , C to D  $120^\circ$ . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitude and angular positions. (16 Marks)

OR

- 8 A five cylinder in-line engine running at 750 rpm has successive cranks  $144^\circ$  apart, the distance between the cylinder centre lines being 375 mm. The piston stroke is 225 mm and the ratio of the connecting rod to the crank is 4. Examine the engine for balance of primary and secondary forces and couples. Find the maximum values of these and the positions of the central crank at which these maximum values occur. The reciprocating mass of each cylinder is 15 kg. (16 Marks)

**Module-5**

- 9 a. In an open-arm type governor shown in Fig.Q9(a).  $AE = 400$  mm,  $EF = 50$  mm and angle,  $\theta = 35^\circ$ . Determine the percentage of change in speed when  $\theta$  decrease to  $30^\circ$ .

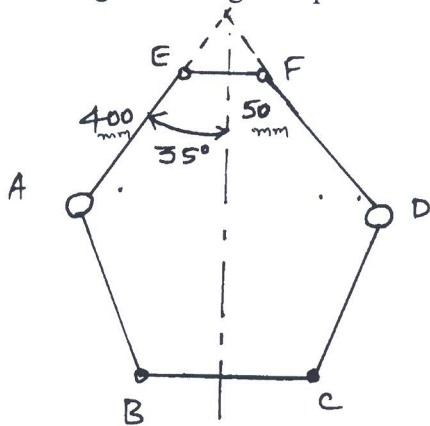


Fig.Q9(a)

(08 Marks)

- b. Each arm of a porter governor is 200 mm long and is pivoted on the axis of the governor. The radii of rotation of the balls at the minimum and the maximum speeds are 120 mm and 160 mm respectively. The mass of the sleeve is 24 kg and each ball is 4 kg. Find the range of speed of the governor. Also determine the range of speed if the friction at the sleeve is 18 N.

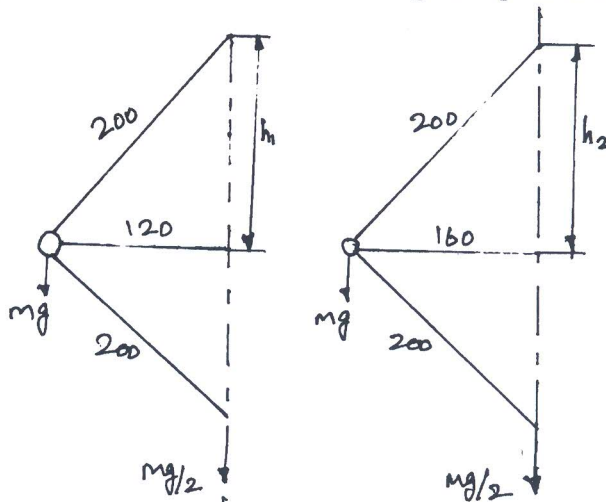


Fig.Q9(b)

(08 Marks)

OR

- 10 Explain in detail about the effect of gyroscopic couple on a Naval ship during:  
 i) Steering  
 ii) Pitching and  
 iii) Rolling. (16 Marks)

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