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Fourth Semester B.E. Degree Examination, June/July 2019 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 a. Determine the degree of freedom of the mechanisms.

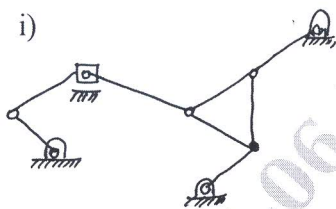


Fig Q1(a)(i)

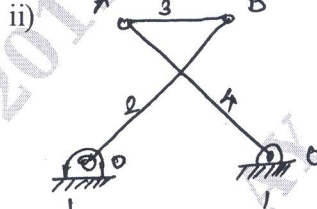


Fig Q1(a)(ii)

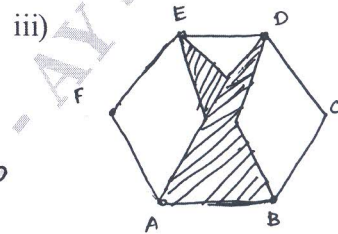


Fig Q1(a)(iii)

(08 Marks)

b. Differentiate between the following :

- i) Machine and Mechanism
- ii) Machine and Structure.

(08 Marks)

OR

- 2 a. Sketch and explain the any two inversions of four bar mechanism.
- b. Explain the Ackerman steering wheel mechanism.

(08 Marks)

(08 Marks)

Module-2

3 In a slider crank mechanism, the crank $OB = 30\text{mm}$ and the connecting rod $BC = 120\text{mm}$. The crank rotates at a uniform speed of 300rpm clockwise. For the crank position shown in Fig Q3. Find :

- i) Velocity of Piston C and angular velocity of connecting rod BC
- ii) Acceleration of Piston C and angular acceleration of connecting rod BC

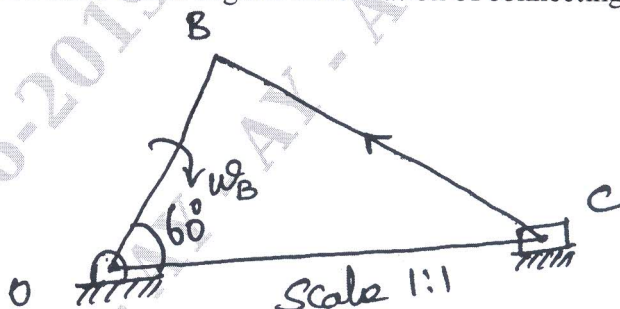


Fig Q3

(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. What are the conditions for a body to be in equilibrium under the action of two forces three forces and two forces and a torque? (06 Marks)
- b. An external force of 10N is acting horizontally on the rocker link, 30mm from the point D. Find the amount of torque to be applied to the crank AB to keep the mechanism in static equilibrium. (10 Marks)

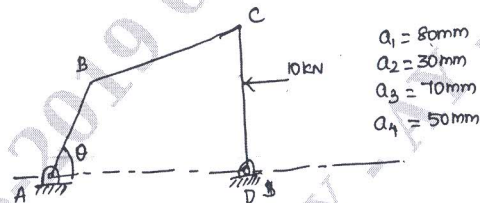


Fig Q4(b)

Module-3

- 5 a. Two equal spur gears of 20° involute teeth, module pitch 4mm and number of teeth 40 are in mesh. If the length of arc of contact is 1.75 times circular pitch. Find the addendum. (10 Marks)
- b. Define Interference and explain the methods to avoid interference. (06 Marks)

OR

- 6 a. Explain the types of gear trains. (04 Marks)
- b. An epicyclic gear train is shown in the figure 6(b). The number of teeth on A and B are 80 and 200. Determine the speed of the arm a :
 i) If A rotates at 100rpm clockwise and B at 50 rpm counter clockwise.
 ii) If A rotates at 100 rpm clockwise and B is stationary.

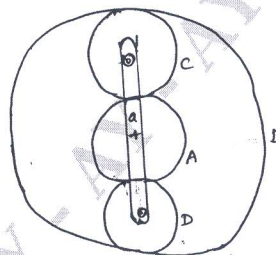
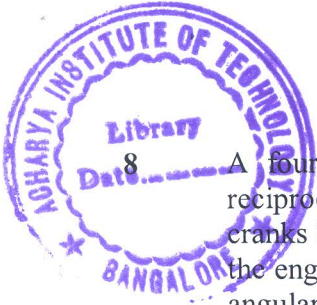


Fig Q6 (b)

(12 Marks)

Module-4

- 7 A shaft carries four masses A, B, C, D rotating at radii 100,125, 200 and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the mass of B, C and D are 10kg,5kg and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. (16 Marks)



OR

- 8 A four crank engine has the two outer cranks set at 120° to each other, and their reciprocating masses are each 400kg. The distance between the planes of rotation of adjacent cranks between the planes of rotation of adjacent cranks are 450mm, 750mm and 600mm. If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position of the inner cranks. If the length of each crank is 300mm, the length of each connecting rod is 1.2m and the speed of rotation is 240 rpm. What is the maximum secondary unbalanced force? (16 Marks)

Module-5

- 9 A loaded governor of the porter types has equal links 25cm long pivoted at the axis. The weight of each ball is 29.4N and the weight of the central load is 137.34N. The ball radius is 15cm when the governor begins to lift and 20cm at the maximum speed and the range of speed. If the friction at the sleeve is equivalent to 14.7N. Find the maximum and minimum speed and the range of speed. [Refer Fig.Q9] (16 Marks)

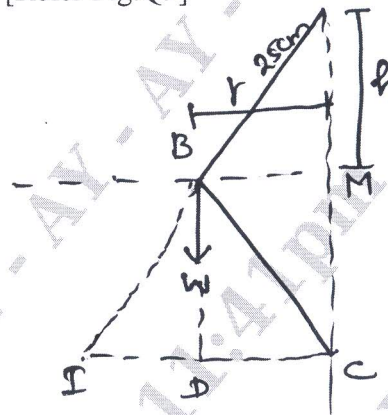


Fig Q9

OR

- 10 a. Explain in detail about the effect of gyroscopic couple in an aeroplane. (08 Marks)
b. An aircraft makes a half circle of 100m radius towards left when flying at 400km/hr. The engine and the propeller of the plane weighs 4.9kN having a radius of gyration of 50cm. The engine rotates at 3000 rpm. Clockwise when viewed from the rear. Find the gyroscopic couple and its effect on the aircraft. (08 Marks)
