

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2026 Mechanisms 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. Briefly, explain the following :

- Kinematic pair
- Kinematic chain
- Mechanism
- Degree of freedom
- Inversion

(10 Marks)

b. With a neat sketch, explain Beam Engine Mechanism.

(04 Marks)

c. Determine the degree of freedom for the following :

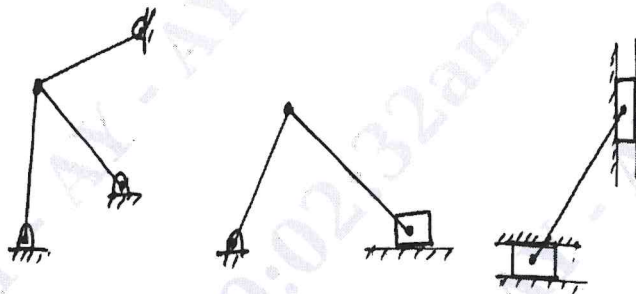


Fig Q1(c)

(06 Marks)

OR

2 a. Derive an expression for necessary condition for exact steering. Also explain Ackerman's steering gear mechanism.

(10 Marks)

b. With a neat sketch, explain the working of crank and slotted lever mechanism. Express its stroke length in terms of crank radius, fixed link length and length of the slotted bar.

(10 Marks)

Module-2

3 A four bar mechanism ABCD is made up of four links pin joined at ends. AD is a fixed link which is 180 mm long. The links AB, BC and CD are 90 mm, 120 mm and 120 mm long respectively. At certain instant the link AB makes an angle of 60° with the link AD. If the link AB rotates at a uniform speed of 100 rpm clockwise. Determine :

- Angular velocity of the links BC and CD
- Angular acceleration of links CD and CB

(20 Marks)

OR

- 4 a. Explain the condition for the equilibrium for
- Two force member
 - Three force member
 - Four force member
 - Member with two force and a torque

(08 Marks)

- b. A slider crank mechanism shown in Fig Q 4(b), the force applied to the piston is 1000 N when the crank is at 60° from IDC. Calculate the driving torque T_2 take $AB = 100$ mm, $BC = 300$ mm.

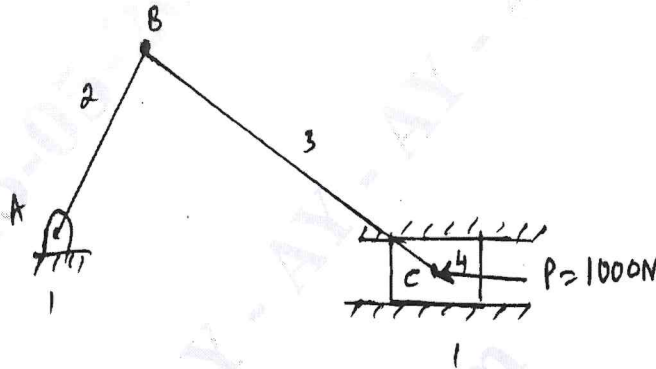


Fig Q4(b)

(12 Marks)

Module-3

- 5 a. With neat sketches briefly, explain different types of gear trains and state their applications. (08 Marks)
- b. Derive an expression for length of path of contact for a pair of involute gear in contact. (08 Marks)
- c. Write a short note on interference in involute gears, explain the methods to avoid interference. (04 Marks)

OR

- 6 a. State and prove the law of gearing. (08 Marks)
- b. In an epicyclic gear train, the internal wheels A and B and the compound wheel, C and D rotates independently about axis O. The wheels E and F rotate on pins fixed to arm G. Wheel E gear with A and C wheel F gears with B and D. All the wheels have same module. Take $Z_C = 28$, $Z_D = 26$, $Z_E = Z_F = 18$
- Sketch the arrangement
 - Find the number of teeth on A and B
 - If the arm G makes 100 rpm clockwise and gear A is fixed, find the speed of Gear B.

(12 Marks)

Module-4

- 7 a. Briefly, explain static and dynamic balancing with relevant equations with respect rotating marks. (04 Marks)
- b. A, B, C and D are four masses carried by a rotating shaft at radius 100, 125, 200 and 150 mm respectively. The planes in which masses revolve are spaced 600 mm apart. Find the required mass A and relative angular positions of the four masses to keep the shaft in balance. (16 Marks)

OR

- 8 a. Four masses M_1 , M_2 , M_3 and M_4 are 200 Kg, 300 Kg, 240 Kg and 260 Kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 respectively, and the angles between successive masses are 45° , 75° and 135° . Find the position and magnitude of the balance mass required if its radius of rotation is 0.2 m. (10 Marks)
- b. Explain the balancing of Multicylinder Engine. (10 Marks)

Module-5

- 9 a. Derive an expression for height of an porter governor. (08 Marks)
- b. A Hartnell governor having a central sleeve spring and two right angled bell crank levers moves between 290 rpm and 310 rpm for a sleeve lift of 15 mm. The sleeve arms and the ball arms are 80 mm and 120 mm respectively. The levers are pivoted at 120 mm from the axis of the governor and mass of each ball is 2.5 Kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine :
- Loads on the spring at the lowest and highest equilibrium speeds
 - Stiffness of the spring.
- (12 Marks)

OR

- 10 a. Explain the effect of gyroscopic couple on an airplane when propeller turns clockwise when viewed from rear and aeroplane takes :
i) Left turn ii) Right turn. (10 Marks)
- b. An Aeroplane makes an complete half circle of 50 m radius towards left when flying at 200 Km/hr. The mass of the rotating engine and propeller is 400 Kg with radius of gyration 300 mm. Engine runs at 3000 rpm moves in CCW when viewed from rear. Determine the gyroscopic couple and its effects on the airplane. (10 Marks)

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