CBCS SCHEME

17AE/AS44

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
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: i) Kinematic pair   ii) Kinematic chain   iii) Mechanism   iv) Degree of freedom   v) Inversion.   **(10 Marks)**
    b.   Explain beam engine and parallel crank mechanism with neat sketches.   **(10 Marks)**

OR

2   a.   With a neat sketch, explain the working of crank and slotted lever mechanism. Express its stroke length interms of crank radius, fixed link length and length of the slotted bar.   **(10 Marks)**
    b.   Derive an expression for necessary condition for exact steering. Also explain Ackerman's steering gear mechanism.   **(10 Marks)**

Module-2

3   A four bar mechanism ABCD is made up of four links pin jointed at ends. AD is a fixed link which is 180mm long. The links AB, BC and CD are 90mm, 120mm and 120mm 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 100rpm clockwise. Determine:
         i)   Angular velocity of the links BC and CD
         ii) Angular acceleration of links CD and CB.   **(20 Marks)**

OR

4   a.   Explain the condition for the equilibrium of the following system:
         i)   Two force member
         ii) Three force member
         iii) Member with two force and a torque
         iv) Four force member.   **(08 Marks)**
    b.   A slider crank mechanism shown in Fig.Q.4(b). The force applied on to the piston is 1000N when the crank is at 60° from IDC. Calculate the driving torque T_2. AB = 100mm, BC = 300mm.   **(12 Marks)**
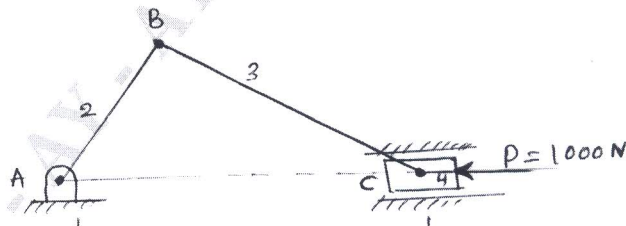

Fig.Q.4(b)

Module-3

5 a. Derive an expression for length of path of contact for a pair of involute gear in contact.
(10 Marks)

   b. State and prove law of gearing. (06 Marks)

   c. Write a short note on interference in involute gears. (04 Marks)

OR

6 a. With neat sketch, briefly explain different types of gear trains and state their applications.
(08 Marks)

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

Module-4

7 a. Explain the balancing of rotating mass, where both balancing masses are on one side of the shaft. (06 Marks)

   b. A, B, C and D are four masses carried by a rotating shaft at radius 100, 125, 200 and 150mm respectively. The plane in which masses revolve are spaced 600mm apart and the masses B, C and D are 10, 5, 4 kg respectively. Find the required mass A and relative angular position of the four masses to keep the shaft in balance. (14 Marks)

OR

8 a. Four masses M_1, M_2, M_3 and M_4 are 200kg, 300kg, 240kg and 260kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m 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 0.2m. (10 Marks)

   b. Briefly explain the balancing of multicylinder engine. (10 Marks)

Module-5

9 a. Derive an expression for height of an porter governor. (10 Marks)

   b. A Hartnell governor having a central steeve spring and two right angled bell crank levers moves between 290rpm and 310rpm for a sleeve lift of 15mm. The sleeve arms and the ball arms are 80mm and 120mm respectively. The levers are pivoted at 120mm from the axis of the governor axis and mass of each ball is 2.5kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine:
   i)   Loads on the spring at the lowest and highest equilibrium speeds
   ii)   Stiffness of the spring. (10 Marks)

OR

10 a. Explain the effect of gyroscopic couple on an airplane when propeller turns clockwise when viewed from the rear and aeroplane takes i) Left turn   ii) Right turn. (10 Marks)

   b. An aeroplane makes an complete half circle of 50m radius towards left when flying at 200km/hr. The mass of the rotary engine and propeller is 400kg with radius of gyration 300mm. Engine runs at 3000rpm moves in CCW when viewed from the rear. Determine gyroscopic couple and its effect on the airplane. (10 Marks)

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