CBCS SCHEME

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18AE/AS44

Fourth Semester B.E. Degree Examination, June/July 2023
Mechanism 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. Define the following terms illustrating with sketches where possible, element, higher pair, lower pair, kinematic chain. **(06 Marks)**

b. Explain with neat sketch inversion of four bar chain mechanism. **(10 Marks)**

c. Determine mobility of the mechanism. Refer Fig. Q1 (c). **(04 Marks)**

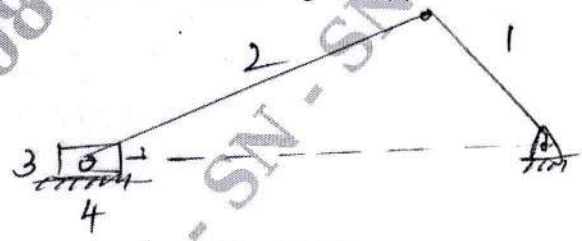

Fig.Q1 (c)

OR

2 a. Explain the following mechanism with suitable sketches :
(i) Drag link
(ii) Whitworth **(10 Marks)**

b. Obtain condition for correct steering for a four wheeled vehicle of Ackermann steering gear. **(10 Marks)**

Module-2

3 a. In a slider crank mechanism, the crank OB = 30 mm and the connecting rod BC = 120 mm the crank rotates at a uniform speed of 300 rpm clock wise, for a crank position in Fig. Q3 (a). Find (i) Velocity of position C and angular velocity of connecting rod BC (ii) Acceleration of piston C and angular acceleration of connecting rod BC.

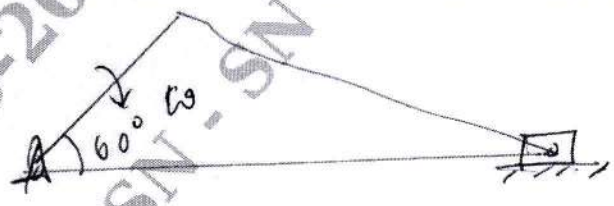

Fig. Q3 (a) **(10 Marks)**

b. The crank of a slider crank mechanism is 480 mm long and rotating at 20 rad/sec in the counter clockwise direction it has a connecting rod of 1600 mm long. Determine the following when the crank is at 60° for the inner dead centre,
(i) Velocity of slider.
(ii) Angular velocity of connecting rod.
(iii) The Piston and Velocity of a point P on the connecting rod having least absolute velocity. **(10 Marks)**

OR

4 a. Explain with neat sketch analysis of engine mechanism. **(10 Marks)**

b. In the four bar mechanism shown in Fig. Q4 (b) torque T_3 and T_4 have magnitude of 3000 Nm and 2000 Nm respectively. Take AD = 800 mm, AB = 300 mm, BC = 700 mm and CD = 400 mm. For static equilibrium of mechanism, find the required input torque on the crank.

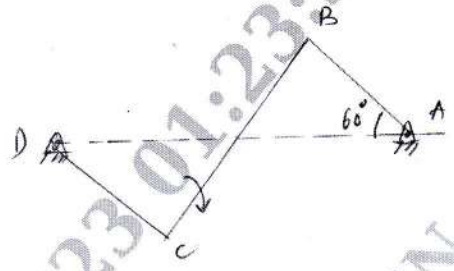

Fig. Q4 (c) **(10 Marks)**

Module-3

5 a. Explain interference in gears. Discuss the method of avoiding interference in gear drives. **(10 Marks)**

b. The number of teeth in the wheels are 20 and 31 with pressure angle 20°. Module = 2.5 mm, addendum = 1 m. Calculate (i) Length of path of contact and (ii) Angle turned through by pinion and gear wheel when any one pair is in contact. **(10 Marks)**

OR

6 a. Explain the sketches :
(i) Compound gear train (ii) Reverted gear train (iii) Epicyclic gear train. **(10 Marks)**

b. In an epicyclic gear train of sun and planet type. The pitch circle diameter of the annular wheel A is 425 mm and the module is 5 mm. When the annular wheel is stationary, the spider which carries 3 planet gears P of equal size has to make one revolution for every 6 revolutions of the driving spindle carrying sun wheel S. Determine number of teeth on all the wheels. **(10 Marks)**

Module-4

7 a. Explain balancing of several masses in different planes. **(10 Marks)**

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

OR

8 a. The pistons of a 4 cylinder vertical inline engine reach their upper most position at 90° interval in order of their axial position pitch of cylinder = 0.35 m. Crank radius = 0.12 m, length of C.R = 0.42 m. The engine runs at 600 rpm. If the reciprocating part of each engine has a mass of 2.5 kg find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. **(10 Marks)**

b. Following data refer to a 4-cylinder symmetrical engine which is in complete primary balance mass if reciprocating part attached to the intermediate cranks = 500 kg. Angle between intermediate cranks = 90°, distance between centre line of intermediate cranks = 50 cm, distance between centerlines of extreme cranks = 200 cm, length of each crank = 25 cm, C.R length = 100 cm. Estimate the reciprocating mass attached at extreme cranks and their relative angular position. If the engine runs at 300 rpm, what is the magnitude of secondary force and the couples about the centre line of system with the arrangement arrived for complete primary balance. **(10 Marks)**

Module-5

9 a. Explain the term height of the Governor and derive an expression for the height of porter governor. **(10 Marks)**

b. The length of upper arm and lower arms of a porter governor are 200 mm and 250 mm respectively both the arms are pivoted to the axis of rotation the central load is 150 N. The weight of each ball is 20 N and the friction of the sleev to gather with the resistance of the operating gear is equivalent to a force of 30 N at the sleev. If the limiting inclination of the upper arm to the vertical are 30° and 40° determine the range of speed of governor. **(10 Marks)**

OR

10 a. Describe the effect of the gyroscopic couple in an aeroplane. **(10 Marks)**

b. An aeroplane make a complete half circle of 40 m radius towards left when flying at 175 km/hr. The man of the rotating engine and the propeller is 400 kg with the radius of gyration 300 mm the engine runs at 2500 rpm clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft. What will be the effect if the aeroplane turn towards right instead of left. **(10 Marks)**

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