USN

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022
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.   Define the following : i) Mechanism   ii) Inversion   iii) Degree of freedom
iv) Structure   v) Kinematic chain and pair.   **(10 Marks)**
    b.   Explain Peaucellier's Mechanism.   **(06 Marks)**

OR

2   a.   Write the conditions for correct steering for Ackerman's mechanism with suitable sketches.
(08 Marks)
    b.   Explain the following Mechanism :
i) Geneva Wheel Mechanism   ii) Double Slider Crank Chain Mechanism (Inversion).
**(08 Marks)**

Module-2

3   In a crank and slotter lever quick return mechanism , the fixed centre 'O' and 'C' are at a distance 200mm. The length of driving crank CP is 100mm and it rotates at 60. The length of the link 'ON' is 400mm and the length of the link NR is 160mm. the line of stroke of ram 'R' is horizontal and 200mm above the fixed center C. At the instant when the angle OCP is 120°. Find the velocity and acceleration of ram R.   **(16 Marks)**

OR

4   a.   Define : i) Angular velocity   ii) Relative velocity.   **(04 Marks)**
    b.   A four bar link Mechanism is acted upon by forces as shown in Fig. Q4(b). Determine the torque T_2 to be applied on link 2 to keep the mechanism in equilibrium. **(12 Marks)**
AD = 50mm , AB = 40mm , BC = 100mm , DC = 75mm , DE = 35mm.

Fig. Q4(b)

FE = 80N
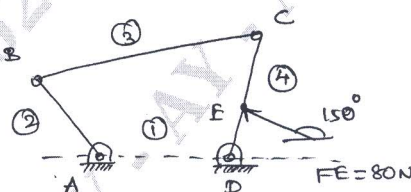
Module-3

5   a.   Two 20° involute spur gears have a module of 10mm. The addendum is equal to one module. The larger gear has 40 teeth while the pinion has 20 teeth. Will the gear interfere with the pinion?   **(06 Marks)**
    b.   Explain the Nomenclature of Spur Gear.   **(10 Marks)**

OR

6   a.   With neat sketches, explain the following :
i) Compound Gear Train   ii) Epicyclic Gear Train.   **(04 Marks)**

b. In a Epicyclic gear train, an arm carries two gear A and B, having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise directions about the centre of the gear A which is fixed. Determine the speed of gear B. If the gear A instead of being fixed, makes 300rpm in the clockwise direction, what will be speed of gear B? **(06 Marks)**

Fig. Q6(b)
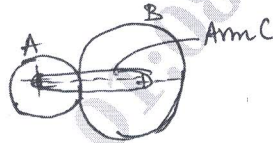
c. The gearing of a machine tool is shown in Fig. Q6(c). The motor shaft is connected to gear A and rotates at 950 rpm. The gear wheels B, C, D and E are fixed to parallel shafts rotating together. The final gear F is fixed on the output shaft. What is the speed of Gear F. The number of teeth on each gear are as given below. **(06 Marks)**

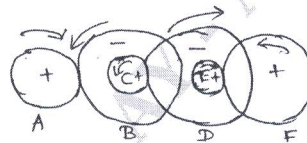| GEAR	A	B	C	D	E	F
NO OF TEETH	20	50	25	75	26	65

Fig. Q6(c)

Module-4

7 A Four Cylinder Vertical Engine has crank 150mm long. The planes of rotation of the first, second and fourth cranks are 400mm, 200mm and 200mm respectively from the third crank and their reciprocating masses are 50kg, 60kg and 50kg respectively. Find the mass of the reciprocating parts for the third cylinder and the relative angular positions of the cranks inorder that the engine may be in complete primary balance. **(16 Marks)**

OR

8 The shaft carries four masses A, B, C and D of magnitude 200kg, 300kg, 400kg and 200kg respectively at radii 80mm, 70mm, 60mm and 80mm in planes measures form 300mm, 400mm and 700mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100mm, between X and Y is 400mm and between Y and D is 200mm. If the balancing masses revolve at a radius of 100mm, find their Magnitudes and Angular Positions. **(16 Marks)**

Module-5

9 In a hartnell governor, the length of ball and sleeve arms of a bell crank lever are 120mm and 100mm respectively. The distance of the fulcrum of the bell crank level from the governor axis is 140mm. Each governor ball has a mass of 4kg. The governor runs at a mean speed of 300 Kpm with the ball arms vertical and sleeve arms horizontal. For an increase of speed of 4%, the sleeve moves 10mm upwards. Neglecting friction, find
i)   The minimum equilibrium speed if the total sleeve movement is limited to 20mm.
ii)   The spring stiffness.
iii) The sensitiveness of the governor and
iv) The spring stiffness if the governor is to be Isochronous at 300rpm. **(16 Marks)**

OR

10 a. Explain the gyroscopic effects on an Airplane. **(10 Marks)**

b. An Aeroplane flying at a speed of 300 kmph takes right turn with a radius of 50m. The mass of engine and propeller is 500kg ad radius of gyration is 400mm. If the engine runs at 1800 rpm in clockwise direction when viewed from tail end, determine the gyroscopic couple and state its effect on the Aeroplane. What will be the effect, if the Aeroplane turns to its left instead of right? **(06 Marks)**

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