

CBCS SCHEME

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17AE44

Fourth Semester B.E. Degree Examination, June/July 2023 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. Explain any three inversions of double slider crank chain mechanisms in detail. (10 Marks)
- b. Define the following :
 - i) Kinematic chain and pair
 - ii) Mechanism
 - iii) Structure
 - iv) Inversions
 - v) Degree of freedom. (10 Marks)

OR

- 2 a. Write a neat sketch, explain the condition for correct steering for Ackermann's mechanism. (10 Marks)
- b. Explain the following mechanisms :
 - i) Peancellier's mechanism
 - ii) Genera wheel mechanisms. (10 Marks)

Module-2

- 3 a. A four bar line mechanism is acted upon by forces as shown in Fig.Q3(a). determine the torque T_2 to be applied on link 2 to keep the mechanisms in equilibrium $AD = 50\text{mm}$, $AB = 40\text{mm}$, $BC = 100\text{mm}$, $DC = 75\text{mm}$, $DE = 35\text{mm}$.

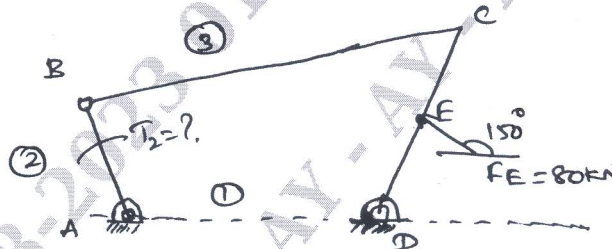


Fig.Q3(a)

- b. Describe angular velocity and relative velocity. (06 Marks)

OR

- 4 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 centre C. at the instant when the angle OCP is 120°. Find the velocity and acceleration of ram R. (20 Marks)

Module-3

- 5 a. Explain the Nameclature of spur gear. (10 Marks)
- b. Two 20° involute spur gear 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? (10 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

- 6 a. With a neat sketch, explain the following :
- Compound gear train
 - Epicyclic gear train.
- (04 Marks)
- b. In a epicyclic gear train, an arm carrier two gears A and B, having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anti clockwise direction 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 300 rpm in the clockwise direction, what will be the speed of gear B?

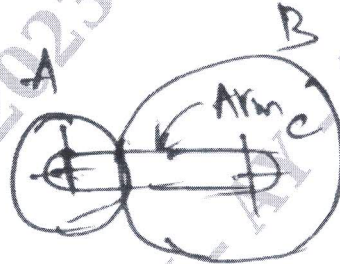


Fig.Q6(b)

(08 Marks)

- c. The gearing of a machine tool is shown in Fig.Q6(c) The motor shaft is connected to gear A and rotates at 975rpm. The gear wheels B, C, D and E are fixed to parallel shaft 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 :

Gear	A	B	C	D	E	F
Number of teeth	20	50	25	75	26	65

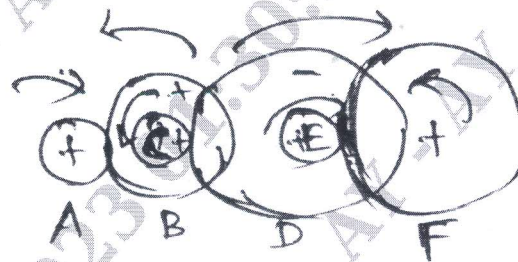


Fig.Q6(c)

(08 Marks)

Module-4

- 7 A shaft carries four masses A, B, C and D of magnitude 200kg, 300kg, and 200kg respectively and revolving at radii 80mm, 70mm, 60mm and 80mm in planes measures from 300mm, 400mm and 700mm. The angle 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 involve at a radius of 100mm, find their magnitudes and angular positions. (20 Marks)

OR

- 8 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 rank 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 in order that the engine may be in complete primary balance. (20 Marks)

Module-5

- 9 a. Explain the different types of governors. (05 Marks)
- b. In a Hartwell 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 lever from the governor axis is 140mm. Each governor ball has mass of 4kg. The governor runs at a mean speed of 300rpm 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
- iv) The spring stiffness if the governor is to be isochronous at 300 rpm. (15 Marks)

OR

- 10 a. An aeroplane flying at a speed of 300kmph takes right turn with a radius of 50m. The mass of engine and propeller is 500kg and radius of gyration is 400mm. If the engine runs at 1800rpm 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? (08 Marks)
- b. Describe the gyroscopic effect on airplane. (12 Marks)
