CBCS SCHEME

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15AE44

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019

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) Kinematic chain and pair ii) Mechanism iii) Structure
iv) Inversions v) Degree of freedom **(10 Marks)**

b. Explain any three inversions of double slider crank chain mechanisms. **(06 Marks)**

OR

2 a. Explain the following mechanisms:
i) Peaucellier's mechanism ii) Geneva wheel mechanisms **(08 Marks)**

b. With a neat sketch, explain the condition for correct steering for Ackelmann's mechanism. **(08 Marks)**

Module-2

3 a. A four bar link 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 mechanism in equilibrium.
AD = 50 mm, AB = 40 mm, BC = 100 mm, DC = 75 mm, DE = 35 mm.

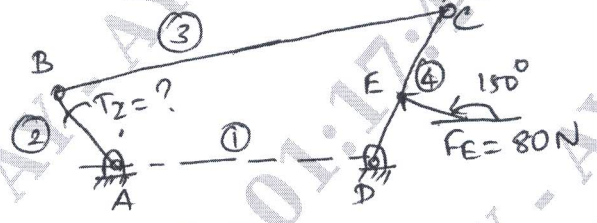

Fig.Q3(a) **(12 Marks)**

b. Describe angular velocity and relative velocity. **(04 Marks)**

OR

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

Module-3

5 a. Explain the Nomenclature of spur gear. **(10 Marks)**

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

OR

6 a. With neat sketches explain the following:
i) Compound gear train ii) Epicyclic gear train **(04 Marks)**

b. The gearing of a machine tool is shown in Fig.Q6(b). The motor shaft is connected to gear A and rotates at 975 rpm. 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
No. of Teeth	20	50	25	75	26	65

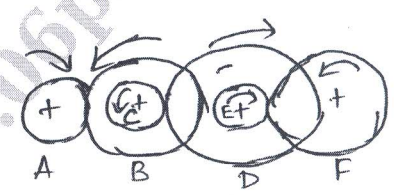

Fig.Q6(b) **(06 Marks)**

c. 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 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?

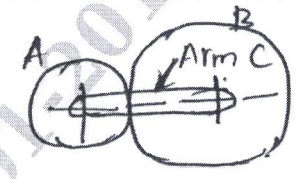

Fig.Q6(c) **(06 Marks)**

Module-4

7 A four cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg 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. **(16 Marks)**

OR

8 A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measures from 300 mm, 400 mm and 700 mm. 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 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm, find their magnitudes and angular positions. **(16 Marks)**

Module-5

9 a. Explain the types of governors. **(04 Marks)**

b. In a Hartnell governor, the length of ball and sleeve arms of a bell crank lever are 120 mm and 100 mm respectively. The distance of the fulcrum of the bell crank lever from the governor axis is 140 mm. Each governor ball has a mass of 4 kg. The governor runs at a mean speed of 300 rpm with the ball arms vertical and sleeve arms horizontal. For an increase of speed of 4%, the sleeve moves 10 mm upwards. Neglecting friction, find:

i) The minimum equilibrium speed if the total sleeve movement is limited to 20 mm.
ii) The spring stiffness
iii) The sensitiveness of the governor and
iv) The spring stiffness of the governor is to be isochronous at 300 rpm. **(12 Marks)**

OR

10 a. Describe the gyroscopic effect on airplane. **(10 Marks)**

b. An aeroplane flying at a speed of 300 kmph takes right turn with a radius of 50 m. The mass of engine and propeller is 500 kg and radius of gyration is 400 mm. 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)**