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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fourth Semester, B.E. - Automobile Engineering

Semester End Examination; July / August - 2022

Theory of Machines

Time: 3 hrs *Max. Marks: 100*

Course Outcome

The Students will be able to:

CO1: Ability to identify various mechanisms, create inversions of planar four bar chain and calculate degrees of freedom of mechanisms.

CO2: Ability to analyze velocity of simple planar mechanisms using graphical methods.

CO3: Ability to design cam profiles for different follower motions and determine kinematic characteristics of the follower and explain working principle of Governors

CO4: Analyze graphically the static forces acting in different links of simple planar mechanisms.

CO5: Determine the magnitude and location of balancing masses for the rotating machines and Reciprocating machines.

Note: *i) **PART-A** is compulsory. One question from each unit for maximum of 2 marks.*
*ii) **PART-B** Answer any **TWO** sub questions (from a, b, c) from each unit for a Maximum of 18 marks.*

Q. No.	Questions	Marks
	I : PART - A	**10**
I a.	Define Machine.	2
b.	What is relative Velocity?	2
c.	What is the condition of Equilibrium when a member subjected with two forces.	2
d.	Why balancing is necessary.	2
e.	What is the function of Governor?	2
	II : PART - B	**90**
	UNIT - I	**18**
1 a.	Define, i) Kinematic Link ii) Kinematic Pair iii) Kinematic chain iv) Mechanism and Inversion.	9
b.	With neat Sketch explain i) Beam Engine ii) Coupling rod of locomotive	9
c.	With neat sketch Explain Crank and slotted lever Quick return motion mechanism.	9
	UNIT - II	**18**
2 a.	In a slider crank mechanism in Fig. 2a the crank OA = 300 mm and connecting rod AB = 1200 rpm. The crank OA is turned 30° from the Inner dead center. Locate all the instantaneous centres. If the crank rotates at 15 rad/sec clock wise find; i) Velocity of slider B ii) Angular velocity rod AB	12

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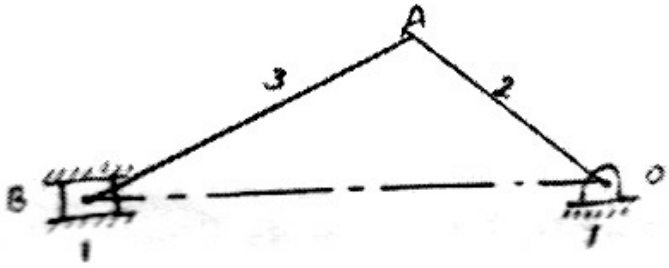

Fig. 2a

b. In a four bar chain ABCD AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 rpm. Clockwise, while the link CD=80mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD =60°. Do it in relative velocity method — 12

c. Explain different types of instantaneous — 6

UNIT - III — **18**

3 a. Draw the profile of a Cam operating a roller reciprocating follower with the following data: Minimum radius of Cam = 25 mm; Lift = 30 mm; Roller diameter = 15 mm; The Cam lift the follower for 120° with SHM followed by a dwell period of 30°. Then the follower lowers down during 150° of the Cam rotating with uniform acceleration and deceleration followed by a dwell period. If the Cam rotates at a uniform speed of 150 rpm. — 14

b. In an engine governor of the Porter type, the upper and lower arms are 200 mm and 250 mm respectively and pivoted on the axis of rotation. The mass of the central load is 15 kg, the mass of each ball is 2 kg and friction of the sleeve together with the resistance of the operating gear is equal to a load 25 N at the sleeve. If the limiting inclinations of the upper arms to the vertical are 30° and 40°. Find, taking friction into account, range of speed of the governor. — 14

c. Explain different types of followers. — 4

UNIT - IV — **18**

4 a. A Slider crank mechanism is shown in Fig. 4a the applied to the piston is 1000 N when the crank is at 60° from IDC. Calculate the driving torque T_2 AB = 100mm, BC = 300 mm. — 14

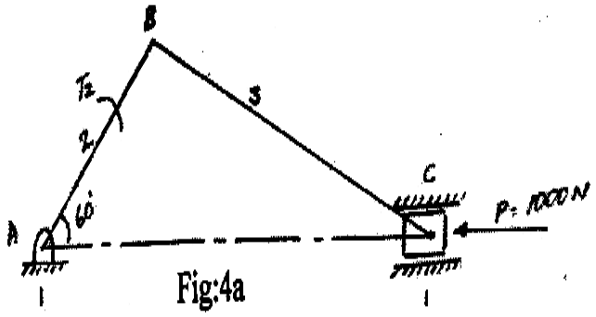

Fig:4a

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b. In the Fig. 4b, a four bar mechanism is shown. Calculate the required of T_2 and various forces on links for the equilibrium of the system. F = 2000 N, AD = 215 mm, AB = 200 mm, BC = 370 mm, DC = 350 mm, CE = 100 mm. 14

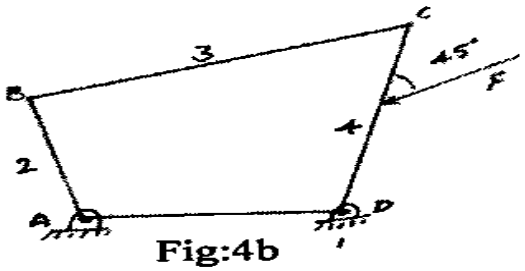

Fig:4b

c. Explain Law of superposition. 4

UNIT - V **18**

5 a. A shaft carries four masses M_1, M_2, M_3, and M_4 attached to it. They all revolve in the same plane. The magnitude of the masses is 6, 5, 9 and 7.5 kg respectively. The C, G of the masses is located at a radial distance 100, 125, 150 and 75mm from the axis of the shaft. The angular positions of the masses are 60°, 135° and 270° from M_1. Determine the position and magnitude of mass M_5 at 250 mm radius to balance the system. 16

b. A six cylinder two stroke single acting diesel engine with cylinder centre lines are spaced at 650 mm. In the end view the crank are 60° apart and in order 1-4-5-2-3-6. The stroke of each piston is 400mm and crank to C.R ration is 1:5. The mass of reciprocating part is 250 kg per cylinder and that of rotating part is 100 Kg per crank. The engine rotates at 240 rpm. Investigate the engine for out of balance primary and secondary force and coupling. 16

c. What is static and Dynamic balancing? 2

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