CBCS SCHEME

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18AU52

Fifth Semester B.E. Degree Examination, June/July 2024
Dynamics of Machines

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Draw the free body diagram of a slider crank mechanism subjected to gas pressure 'P' on the piston of area of cross-section A. **(06 Marks)**

b. A four bar mechanism under the action of two external forces is shown in Fig.Q1(b). Determine the torque to be applied on the link AB for static equilibrium. The dimensions of the links are AB = 50mm, BD = 66mm, CD = 56mm, CE = 25mm, CF = 30mm, BAD = 60° and AD = 100mm. Refer Fig.Q1(b).

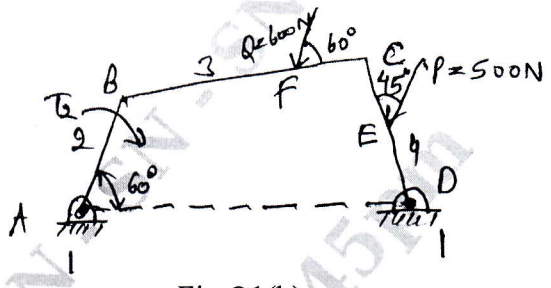

Fig.Q1(b) **(14 Marks)**

OR

2 a. Explain D'Alembert's principle. **(06 Marks)**

b. Explain inertia forces on a four bar mechanism. **(14 Marks)**

Module-2

3 a. What is the necessity of balancing of rotating masses? **(04 Marks)**

b. Explain static and dynamic balancing. **(04 Marks)**

c. Four masses A, B, C, D revolve at equal radii and are equally spaced along the shaft. The mass 'B' is 6kg and the radii of C and D make 90° and 240° with respect to B. Find the magnitude of the masses A, C and D and the angular position of A so that the system may be completely balanced. **(12 Marks)**

OR

4 a. Derive an expression for the residual unbalanced force at any instant in partial primary balancing. **(08 Marks)**

b. In a 4 cylinder in line engine the ranks are arranged such that $\phi_1 = 0$, $\phi_2 = 180°$, $\phi_3 = 180°$ and $\phi_4 = 0$. The distances from the plane of cylinder 1 are given by $a_1 = 150$, $a_3 = 300$ and $a_4 = 450$mm.

i) Are the shaking forces balanced

ii) Determine the magnitude of any resultant force on couple which may exist for crank position $\theta_1 = 330°$, crank length = 45mm, C.R length = 260mm, equivalent unbalanced mass of each piston = 3kg and crank shaft speed = 1600rpm

iii) Show how the unbalanced secondary forces may be balanced by a suitable gearing arrangement. **(12 Marks)**

Module-3

5 a. List the classification of governors. differentiate between flywheel and governor. **(10 Marks)**

b. The arms of a porter governor are each 30 cm long and are pivoted on the governor axis. Mass of each ball is 2kg. At the mean speed of 150 rpm, the arm makes 30° with the vertical. Determine the central load and the sensitivity of the governor if the sleeve moment is ±22.5cm. **(10 Marks)**

OR

6 a. Explain the following terms :
i) Sensitiveness
ii) Hunting
iii) Stability
iv) Unstable governor
v) Controlling force. **(10 Marks)**

b. With neat figure, explain Hartnell governor. **(10 Marks)**

Module-4

7 a. Derive an expression for total frictional torque in conical pivot bearing considering uniform pressure and uniform wear. **(10 Marks)**

b. Derive an expression for total frictional torque of flat collar bearing considering uniform pressure and uniform wear. **(10 Marks)**

OR

8 a. Derive an expression for length of belt for cross belt drive. **(10 Marks)**

b. The diameter of a pulley mounted on a shaft rotating at 250 rpm is 0.75m. A counter shaft is to be driven at 500 rpm by an open belt drive. The co-efficient of fiction is 0.3 and distance between centers = 2.5m. Determine the necessary belt width for transmit 12 KW, if safe – pull on the belt is not for exceed 25N/mm width of belt. **(10 Marks)**

Module-5

9 a. Derive an expression for gyroscopic couple considering a body rotating about axis. **(06 Marks)**

b. Explain the gyroscopic effect of steering of a ship moving in a sea. **(14 Marks)**

OR

10 Derive an expression for displacement, velocity and acceleration of the follower for the following two cases :
a. When the roller has contact with the straight flaks
b. When the roller has contact with the nose. **(20 Marks)**

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