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10AE53

Fifth Semester B.E. Degree Examination, June / July 2014
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain static force analysis of three force members and two force member with torque. **(06 Marks)**

b. A four bar mechanism under the action of external forces is shown in Fig. Q1 (b). Determine the torque T_2 and various forces on links for the equilibrium of the system. AB is 200 mm, AD = 215 mm, BC = 370 mm, DC = 350 mm, CE = 100 mm and F is 2000 N at 45° on CD. **(14 Marks)**

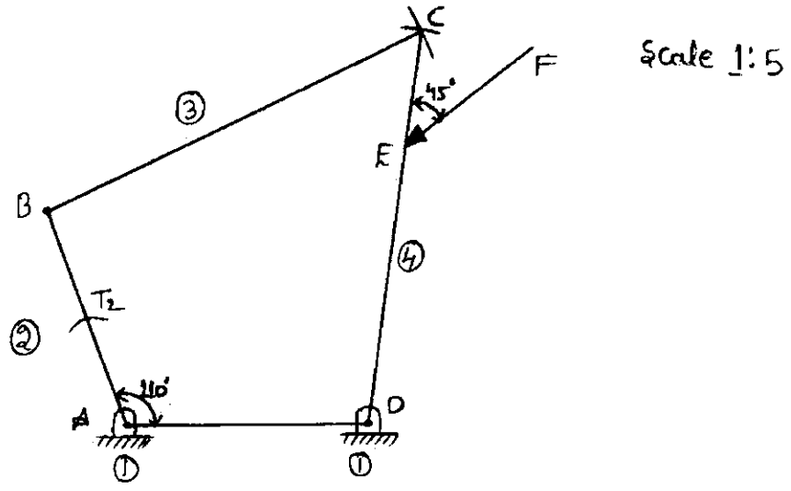

Fig. Q1 (b)

2 a. Explain turning moment diagrams of 4-stroke IC engine and multi cylinder engine. **(05 Marks)**

b. A punching press is required to punch 40 mm dia holes in a plate of 15 mm thick at the rate of 30 holes per minute. It requires 6 Nm of energy per mm^2 of sheared area. If the punching takes $\frac{1}{10}$ of second and the rpm of the flywheel varies from 160 rpm to 140 rpm, determine the mass of the fly wheel having radius of gyration of 1 meter. **(15 Marks)**

3 a. Derive an expression to determine the ratio of tension applicable to a flat belt drive. **(06 Marks)**

b. A leather belt is required to transmit 15 kW from a pulley of 1200 mm effective diameter running at 300 rpm. The angle of contact is spread over $\frac{5}{12}$ of circumference and co-efficient of friction between belt and pulley rim is 0.3. If the safe working stress for the belt material is 1.5 MPa and mass of leather is 1000 kg/m^3 (1 gm/cc or 10^{-6} kg/mm^3) and thickness of belt is 10 mm, determine the width of the belt taking centrifugal tension into account. **(14 Marks)**

4 a. Explain static balancing and dynamic balancing. **(04 Marks)**

b. Four masses M_1 = 100 kg, M_2 = 175 kg, M_3 = 200 kg and M_4 = 125 kg are fixed to the crank of 200 mm radius and revolve in planes 1, 2, 3 and 4 respectively. The angular position of the planes 2, 3 and 4 with respect to 1 are 75°, 135° and 240° taken in the same sense. Distances of the planes 2, 3 and 4 from 1 are 600 mm, 1800 mm and 2400 mm. Determine the magnitude and position of the balancing masses at radius 600 mm in planes L and M located in the middle of 1 and 2 and in the middle of 3 and 4 respectively. (Graphical method) **(16 Marks)**

PART – B

5 a. Explain the primary balancing of V-engine. **(06 Marks)**

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 stoke of each piston is 400 mm and the crank to compression ratio 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 forces and couples. **(14 Marks)**

6 a. Define i) Sensitivity ii) Stability iii) Effort iv) Power. **(06 Marks)**

b. The mass of each ball of spring controlled governor is 1.4 kg. The bell crank level has its vertical arm 90 mm and horizontal arm 40 mm. The distance of fulcrum from the axis of rotation is 45 mm. The sleeve has a mass of 7.5 kg. The sleeve begins to rise at 220 rpm. The rise of the sleeve for 6% rise in speed is 8 mm. Find the initial thrust on the spring and its stiffness. **(14 Marks)**

7 a. With usual notations and diagram, derive an expression for the gyroscopic couple, produced by a rotating disc. **(06 Marks)**

b. A rotor of the turbine of a ship has a mass of 2500 kg and rotates at a speed of 3200 rpm counter clockwise when viewed from stern. The rotor has radius of gyration of 0.4 m. Determine the gyroscopic couple and its effect,

(i) When the ship steers to the left in a curve of 80 m at a speed of 27,900 m/hr.

(ii) The ship pitches 5° above and 5° below the normal position and the bow is descending with the maximum velocity. The pitching motion is simple harmonic with a periodic time of 40 seconds.

(iii)The ship rolls and at the instant the angular velocity is 0.04 rad/sec clockwise when viewed from stern. **(14 Marks)**

8 a. Explain with sketch an under cutting in cams and define cam size. **(06 Marks)**

b. The following data relate to a symmetrical circular cam operating on a flat faced follower: Least radius = 25 mm, nose radius = 8 mm, lift of the valve = 10 mm, angle of action of cam = 120°. Cam shaft speed = 1000 rpm.

Determine (i) Flank radius (ii) Maximum velocity (iii) Maximum acceleration (iv) Maximum retardation.

If the mass of the follower and valve with which it is in contact is 4 kg, find the minimum force exerted by the spring to overcome the inertia of the moving parts. **(14 Marks)**

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