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10MA52

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Dynamics of Machinery

Time: 3 hrs.

Max. Marks:100

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

PART - A

- 1 a. State the conditions for the equilibrium of the following systems:
 (i) Two force member
 (ii) Three force member
 (iii) Member with two forces and a torque. (06 Marks)
- b. Determine the torque to be applied to the link AB of a four link mechanism shown in Fig. Q1 (b) to maintain static equilibrium at the given position. (14 Marks)

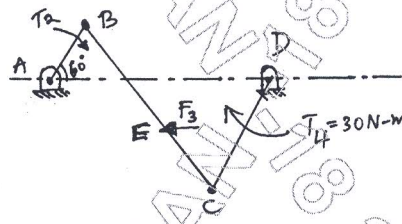


Fig. Q1 (b)

- 2 a. State the laws of dry friction. (04 Marks)
- b. An open belt drive is required to transmit 15 kW power from a motor running at 900 rpm. Diameter of the driving pulley is 300 mm. The speed of the driven pulley is 300 rpm. The belt is 9.75 mm thick and has a mass density of 0.001 g/mm³. Safe stress in the belt is not to exceed 2.5 N/mm². The two shafts are 3 m apart. The coefficient of friction is 0.3. Determine the width of the belt by neglecting the slip of the belt. (16 Marks)
- 3 a. Derive an equation to relate speed of flywheel and maximum fluctuation energy. (08 Marks)
- b. The vertical scale of the turning moment diagram for a multi-cylinder engine is 1 mm equal to 650 N-m of torque and horizontal scale 1 mm = 6°. The areas in mm² of the turning moment diagram above and below the mean resistance line starting from one end and taken in order are: -30, +382, -260, +310, -306, +248, -380, +265 and -229. The engine is running at a mean speed of 900 rpm and it is desired that the total fluctuation of speed is not to exceed ±1.8% of the mean speed. Determine the mass moment of inertia of the fly wheel. (12 Marks)
- 4 Three masses 10 kg, 12 kg and 8 kg are revolving at radii 6 cm, 7 cm and 8 cm in three parallel planes A, B and C respectively of a shaft. Planes B and C are at a distance of 0.5 m from A on either side of A (B is on left side). The three masses are placed in such a way that, they are statically balanced. Find the unbalanced couple in a plane midway between A and B if the shaft revolves at 1000 rpm. (20 Marks)

PART – B

- 5 The stroke of each piston of a six cylinder two stroke in line engine is 320 mm and the connecting rod is 800 mm long. The cylinder center lines are spaced at 500 mm. The cranks are at 60° apart and the firing order is 1–4–5–2–3–6. The reciprocating mass per cylinder is 100 kg and the rotating part is 50 kg per crank. Determine the out of balance forces and couples about the mid-plane if engine rotates at 200 rpm. (20 Marks)
- 6 a. Define the following terms: (i) Stability of a governor (ii) Isochronism of a governor (iii) Effort of a governor. (06 Marks)
- b. In a spring controlled Hartnell governor, the mass of each ball is 1.6 kg. Distance of fulcrum from the axis of rotation is 60 mm. The bell crank lever has a vertical arm 120 mm long and a horizontal arm 50 mm long. The mass of the sleeve is 6.5 kg. The sleeve begins to raise at 200 rpm and the raise of the sleeve for 5% increase is 9 mm. Determine the initial thrust in the spring and its stiffness. (14 Marks)
- 7 a. Derive an expression for heel angle of a motor cycle to avoid skidding. (10 Marks)
- b. A ship is propelled by a turbine rotor of mass 500 kg and has a speed of 2400 rpm. The rotor has a radius of gyration 0.5 m and rotates in clockwise direction when viewed from stern. Find the gyroscopic couple when,
- (i) The ship travels at a speed of 28 km/hr and steers to the left in a curve of 60 m radius.
- (ii) The ship rolls with angular velocity of 0.04 rad/sec. Clockwise when viewed from stern. (10 Marks)
- 8 For a symmetrical tangent cam operating a roller follower, the least radius of cam is 30 mm and roller radius is 15 mm. The angle of ascent is 60° , the total lift is 15 mm and the speed of the cam shaft is 300 rpm. Calculate
- i) Principle dimensions of cam, (that is the distance between the cam center and nose center, nose radius and angle of contact of cam with straight flank).
- ii) Acceleration of the follower at the beginning of the lift, where the roller just touches the nose and at the apex of circular nose. Assume that there is no dwell between ascent and descent. (20 Marks)
