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10ME54

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 equilibrium with respect to two force and three force members. **(04 Marks)**

b. A four bar mechanism shown in Fig.Q1(b) is acted upon by a force P = 100 N at 120° on link CD. The dimensions of various links are AB = 40 mm, BC = 60 mm, CD = 50 mm, AD = 30 mm, DE = 20 mm. Determine the input torque on link AB for static equilibrium. **(16 Marks)**

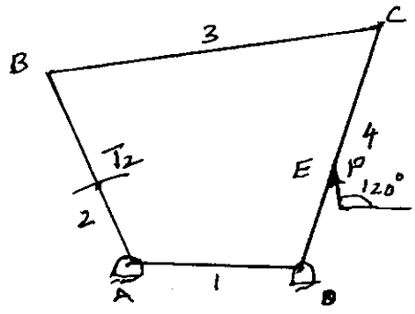

Fig.Q1(b)

2 a. Briefly discuss the following :
(i) D'Alembert's principle (ii) Dynamically equivalent system. **(06 Marks)**

b. The turning moment diagram for a four stroke engine may be assumed for simplicity to be represented by four isosceles triangles. The areas of the triangles are suction = – 0.5cm^2 ; Compression = – 2.1cm^2 ; Expansion = +8.1cm^2 and exhaust = – 0.8cm^2. 1 cm^2 area represents 1400 N-m of work. Determine the mass moment of inertia of the flywheel to keep the fluctuation of speed within 1% of mean speed, if the mean speed is 400 rpm. **(14 Marks)**

3 a. State the laws of dynamic friction. **(04 Marks)**

b. Derive an expression for frictional torque in a flat collar bearing assuming uniform pressure. **(06 Marks)**

c. A leather belt is required to transmit 7.5 kW from a pulley 1.2 m in diameter, running at 250 rpm, the angle of contact is 165° and $\mu = 0.3$. If the safe working stress for the leather belt is 1.5 MPa and density of leather is 1000 kg/m^3 and thickness of belt is 10 mm, determine the width of belt taking centrifugal tension into account. **(10 Marks)**

4 a. Briefly explain the static and dynamic balancing. **(04 Marks)**

b. A 3.6 m long shaft carries three pulleys, two at its two ends and the third at the midpoint. The two end pulleys have masses 79 kg and 40 kg with their radii 3 mm and 5 mm from axis of shaft respectively. The middle pulley has a mass of 50 kg with radius 8 mm. The pulley are so keyed to the shaft that the assembly is in static balance. The shaft rotates at 300 rpm in two bearings 2.4 m apart with equal overhangs on either side. Determine
(i) Relative angular positions of pulleys.
(ii) Dynamic reaction on the two bearings. **(16 Marks)**

PART – B

5 a. With usual notations, explain primary and secondary unbalanced forces of reciprocating masses. **(05 Marks)**

b. A five cylinder inline engine running at 500 rpm has successive cranks at 144° apart. The distance between the cylinder line is 300 mm. Piston stroke is 240 mm, length of connecting rod is 480 mm. Examine the engine for balance of primary and secondary forces and couples. Find the maximum value of these and position of central crank at which these maximum values occur. The reciprocating mass for each cylinder is 150 N. **(15 Marks)**

6 a. Define the following :
(i) Sensitiveness (ii) Hunting (iii) Governer power (iv) Stability
(v) Isochronous governer. **(10 Marks)**

b. A portor governer has all four arms 300 mm long, the upper arms are pivoted on axis of rotation and lower arms are attached to the sleeve at a distance 35 mm from the axis. The mass of each ball is 7 kg and the load on the sleeve is 540 N. Determine the equilibrium speed for two extreme radii of 200 mm and 260 mm of rotation of governer balls. **(10 Marks)**

7 a. With usual notations and diagram, derive an expression for the gyroscopic couple produced by a rotating disc. **(08 Marks)**

b. Each road wheel of motor cycle has a moment of inertia of 2 kg-m^2. The rotating parts of the engine of the motor cycle, has a M.I. of 0.2 kg-m^2. The speed of the engine is 5 times the speed of the wheel and is in the same sense. The mass of the motor cycle with rider is 200 kg and its C.G is 500 mm above ground level. The diameter of the wheel is 500 mm, the motor cycle is travelling at 15 m/s on a curve of 30 m radius. Determine
(i) Gyroscopic couple, centrifugal couple, over turning and balancing couple in terms of angle of heel.
(ii) Angle of heel. **(12 Marks)**

8 A straight sided cam has both sides tangential to the base circle, with a radius of 25 mm. The total angle of action is 120°, A lift of 10 mm is given to the roller 20 mm diameter, the centre of which moves along a straight line, passing through the axis of the cam. The crank shaft has a speed of 240 rpm. Determine
(i) The radius of the nose arc.
(ii) The velocity and acceleration of the roller centre when the roller in contact with the cam at the end of one of the straight flanks adjacent to the nose and
(iii) The acceleration of roller centre at peak. **(20 Marks)**

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