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10ME54

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
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 principle of virtual work with an example. **(04 Marks)**

b. In the following Fig. Q1 (b) a 4-bar mechanism is shown. Calculate the required value of T_2 and various forces on links for the equilibrium of the system. **(16 Marks)**

AB = 50 mm, BC = 66 mm, CD = 55 mm, CE = 25 mm, CF = 30 mm, BAD = 60° and AD = 100 mm

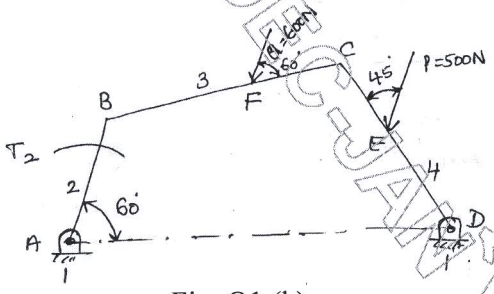

Fig. Q1 (b)

2 a. Explain the function of flywheel and show how its size and mass may be calculated by the aid of turning moment diagram. **(06 Marks)**

b. A punching press is required to punch 40 mm diameter holes in a plate of 15 mm thickness at the rate of 30 holes per minute. It requires 6 N-m of energy per mm^2 of sheared area. If the punching takes $\frac{1}{10}$ of a second and the rpm of the flywheel varies from 160 to 140. Determine the mass of the flywheel having radius of gyration of 1 metre. **(14 Marks)**

3 a. Derive an expression for frictional torque in a conical pivot bearing. Assume uniform pressure across the bearing surface. **(06 Marks)**

b. A belt drive is required to transmit 10 kW from a motor running at 600 rpm. The belt is 12 mm thick and has a mass density of 0.001 gm/mm^3. Safe stress in the belt is not to exceed 2.5 N/mm^2. Diameter of the driving pulley is 250 mm whereas the speed of the driven pulley is 220 rpm the two shafts are 1.25 m apart. The coefficient of friction is 0.25. Determine the width of the belt. **(14 Marks)**

4 a. Explain the procedure for balancing several masses rotating in the same plane by analytical method. **(04 Marks)**

b. A shaft carries four masses A, B, C and D of magnitude 200 kg, 300 kg, 400 kg and 200 kg respectively and revolving at radii 80 mm, 70 mm, 60 mm and 80 mm in planes measured from A at 300 mm, 400 mm and 700 mm. The angles between the cranks measured anticlockwise are A to B 45°, B to C 70°C and C to D 120°. The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100 mm, between X and Y is 400 mm and between Y and D is 200 mm. If the balancing masses revolve at a radius of 100 mm. Find their magnitudes and angular positions. **(16 Marks)**

PART – B

5 a. What are in-line engines and state how they are balanced? **(06 Marks)**

b. A four cylinder vertical engine has cranks 150 mm long. The planes of rotation of the first, second and fourth cranks are 400 mm, 200 mm and 200 mm respectively from the third crank and their reciprocating masses are 50 kg, 60 kg and 50 kg respectively. Find the mass of the reciprocating parts for the third cylinder and relative angular positions of the cranks in order that the engine may be in complete primary balance. **(14 Marks)**

6 a. Define height of the governor and derive an expression for the height of the Hartwell governor. **(06 Marks)**

b. The arms of a porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation. The lower arms are attached to a sleeve at a distance of 400 mm from the axis of rotation the mass of the load on the sleeve in 70 kg and the mass of each ball is 10 kg. Determine the equilibrium speed when the radius of rotation of the balls is 200 mm. If the friction is equivalent to a load of 20 N at the sleeve. What will be the range of speed for this position? **(14 Marks)**

7 a. Explain the effect of Gyroscopic couple on Navalship when it is steering and pitching. **(06 Marks)**

b. Each wheel of a four wheeled, rear engine automobile has a moment of inertia of 2.4 kgm^2 and an effective diameter of 660 mm. The rotating parts of the engine have a moment of inertia of 1.2 kgm^2. The gear ratio of engine of the back wheel is 3 to 1. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The mass of the vehicle is 2200 kg and the centre of the mass is 550 mm above the road level. The tack width of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around a curve with 80 m radius so that all the four wheels maintain contact with the road surface. **(14 Marks)**

8 The following particulars relate to symmetrical circular cam operating a flat faced follower least radius = 16 mm, nose radius = 3.2 mm, distance between cam shaft centre and nose centre = 25 mm, angle of action of cam = 150°, and cam shaft speed = 600 rpm. Assuming that there is no dwell between ascent and descent. Determine the lift of the value, the flank radius and acceleration and retardation of the follower at the beginning of lift and apex of the nose. **(20 Marks)**

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