Code: 13A03503

R13

B.Tech III Year I Semester (R13) Supplementary Examinations June 2016

DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Name the different laws of friction.

(b) Explain the working principle of plate clutch.

(c) With neat sketches, explain the effect of gyroscopic couple on pitching of a ship.

(d) Derive an expression for the maximum fluctuation of energy of a flywheel in terms of mean kinetic energy and coefficient of fluctuation of speed.

(e) Write note on stability and isochronisms of a governor.

(f) What is the function of governor?

(g) What to do you mean by static balancing and dynamic balancing?

(h) What do you mean by Primary and Secondary forces with respect to balancing of reciprocating masses?

(i) What do you mean by vibration isolation?

(j) What is logarithmic decrement; write its expression in terms of damping factor?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Explain briefly the uniform pressure theory and uniform wear theory as applicable to friction clutches and brakes.

OR

3 A simple band brake of drum diameter 600 mm has a band passing over it with an angle of contact of 225^0, while one end is connected to the fulcrum, the other end is connected to the brake lever at a distance of 300 mm from the fulcrum. The brake lever is 1 meter long. The brake is to absorb a power of 45 kW at 500 r.p.m. Determine the tangential force and tensions at both sides.

UNIT – II

4 A rear engine automobile is travelling along a track of 100 m mean radius. Each of the four wheels has a moment of inertia of 2 kg.m^2 and an effective diameter of 0.6 m. The rotating parts of the engine have a moment of inertia of 1.00 kg.m^2. The engine axis is parallel to rear axle and the crank shaft rotate in the same direction as the wheels. The gear ratio of engine to back axle is 3:1. The automobile mass is 1500 kg and centre of gravity is 0.5 m above the road level. The width of track of the vehicle is 1.5 m. Determine the limiting speed of the vehicle around the curve for all four wheel to maintain contact with the road surface if it is not banked.

OR

5 The Turning-Moment diagram for a multi cylinder engine has been drawn to a scale of 1 mm^2 = 5654.87 N-m and the intercepted areas with the mean torque line taken in order are +0.36, -0.81, +0.75, -0.64, +0.92, -0.58 mm^2. Mean speed of fly wheel is 150 rev/m and fluctuation of speed 2% of mean speed and density of fly wheel material 7260 kg/m^3 and mean peripheral speed is 1000 m/min. Determine the diameter and the cross section of the rim.

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UNIT – III

6 The mass of each ball of a Hartnell type governor is 1.5 kg. The length of ball arm of the bell crank lever is 125 mm whereas the length of arm towards sleeve is 75 mm. The distance of the fulcrum of bell crank lever from the axis of rotation is 90 mm. The extreme radii of rotation of the balls are 75 mm and 115 mm. The maximum equilibrium speed is 6% greater than the minimum equilibrium speed which is 300 rev/min. Determine: (i) Stiffness of the spring. (ii) Equilibrium speed when radius of rotation of the ball is 90 mm. Neglect the obliquity of the arms.

OR

7 In a Porter governor all the arms are 300 mm long. Upper and lower arms are pivoted on the axis of rotation. Central mass is 15 kg. Mass of each ball is 5 kg. Force of friction is 30 N and the extreme radii of rotation are 200 mm and 250 mm. Determine the range of speed: (i) Without considering friction. (ii) Considering friction.

UNIT – IV

8 A shaft carries four rotating masses A, B, C, D which are completely balanced. The masses B and C are 40kg, 28kg and both are at 160 mm radius. While the masses A and D are at 200 mm radius. Angle between B and C 100^0, B and A is 190^0, both angles being measured in the same sense. The planes A and B are 250 mm apart, B and C 500 mm apart. Determine: (i) The mass A and D and angular position of D. (ii) Distance between planes C and D.

OR

9 A four cylinder vertical engine has cranks 300 mm long. The planes of rotation of the first, third and fourth cranks are 750 mm, 1050 mm and 1650 mm respectively from that of the second crank and their reciprocating masses are 150 kg, 400 kg, 250 kg respectively. Find the mass of the reciprocating parts of the second cylinder and relative angular positions of the crank in order that the engine may be in complete primary balance. If each connecting rod of all four cylinders is 1.35 m long and the speed is 300 rev/min, find the maximum unbalanced secondary force and couple.

UNIT – V

10 A machine of total mass 68 kg mounted on springs of stiffness k = 1100 kN/m, with an assumed damping factor = 0.2. A piston within the machine has a mass of 2 kg has a reciprocating motion with stroke of 75 mm and a speed of 3000 rev/min. Assuming the motion to be S.H.M determine: (i) Amplitude of vibration. (ii) Transmissibility ratio. (iii) Force transmitted to the foundation.

OR

11 A rotor of mass 12 kg is mounted in the middle of 20 mm diameter shaft supported between two bearings placed at 900 mm from each other. The rotor is having 0.02 mm eccentricity. If the system rotates at 3000 rev/min, determine the amplitude of steady state vibration and the dynamic force transmitted to the bearing. Neglect the weight of the shaft. Take E = 2 x 10^5 N/mm^2.

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