Code: 15A03502

R15

B.Tech III Year I Semester (R15) Regular Examinations November/December 2017

DYNAMICS OF MACHINERY

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

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

(a) Define angle of friction.
(b) Name the different types of mechanical brakes.
(c) What is active and reactive gyroscopic torque?
(d) What is coefficient of fluctuation of energy?
(e) What is meant by the term hunting of a governor?
(f) Define the terms power and effort of a governor.
(g) What is static and dynamic balancing?
(h) What is hammer blow in reciprocating engines?
(i) What is resonance?
(j) What is transmissibility and magnification factor?

PART – B

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

UNIT – I

2 (a) Derive an expression for frictional torque in a flat pivot bearing.

(b) In a thrust bearing the external and internal radii of the contact surface are 210 mm and 160 mm resp. The total axial load is 60 kN and coefficient of friction is 0.05. The shaft is rotating at 380 rpm. Intensity of pressure is not to exceed 350 kN/m^2. Calculate: (i) power lost in overcoming the friction. (ii) Number of collars required for the thrust bearing.

OR

3 The wheels of a bicycle are of diameter 800 mm. A rider on this bicycle is travelling at a speed of 16 km/hr on a level road. The total mass of rider and bicycle is 110 kg. A brake is applied to the rear wheel. The pressure applied on the brake is 100 N and coefficient of friction is 0.056. Before the cycle comes to rest, find: (i) Distance travelled by the bicycle. (ii) Number of turns of its wheel.

UNIT – II

4 A rear car has a total weight of 39240 N there are two axels, each of which together with wheels has moment of inertia of 30 kgm^2. The centre distance between the two wheels on an axle is 1.5 m and each of wheel is of 37.5 cm radius. Each axle is driven by a motor and its speed is 3 times the speed of wheel. Each motor has a moment of inertia of 15 kgm^2 and runs opposite to that of axle. The centre of gravity is 105cm above rails. Determine the limiting speed when it is negotiating a curve of 240 m radius such that no wheel leaves the rails.

OR

5 Turning moment curve for one revolution of a multi cylinder engine above and below the line of mean resisting torque are given by -0.5, +1.2, -0.95, +1.45, -0.85, +0.71, -1.06 cm^2. The vertical and horizontal scales are 1 cm = 7000 Nm and 1 cm = 30^0. The engine speed is 800 rpm and it is desired that the fluctuation from minimum to maximum speed should not be more than 2% of average speed. Determine the moment of inertia of the flywheel.

Contd. in page 2

UNIT – III

6 The arm of a porter governor are each 300 mm long and are hinged on the axis of rotation. The mass of each ball is 5 kg and mass of the sleeve is 15 kg. The radius of rotation of the ball is 200 mm, when the governor begins to lift and 250 mm, when the governor is at the maximum speed. Determine: (i) Range of speed neglecting the sleeve friction. (ii) Range of speed, if the frictional force at the sleeve is 30 N.

OR

7 The spring loaded governor of the Hartnell type has arms of equal lengths. The weights rotate in a circle of 13 cm diameter when the sleeve is in the mid position and the weight arms are vertical. The equilibrium speed for this position is 450 rpm, neglecting friction. The maximum sleeve movement is to be 205 cm and maximum variation of speed, taking friction into account is to be ± 5% of mid position equilibrium speed. The weight of sleeve is 39 N and the friction may be considered equivalent to 29 N at the sleeve. The power of the governor must be sufficient to overcome the friction by a ± 1% change of speed either way at mid position. Determine, neglecting obliquity effect. (i) Weight of each rotating arm. (ii) Spring stiffness in N/m. (iii) initial compression of spring.

UNIT – IV

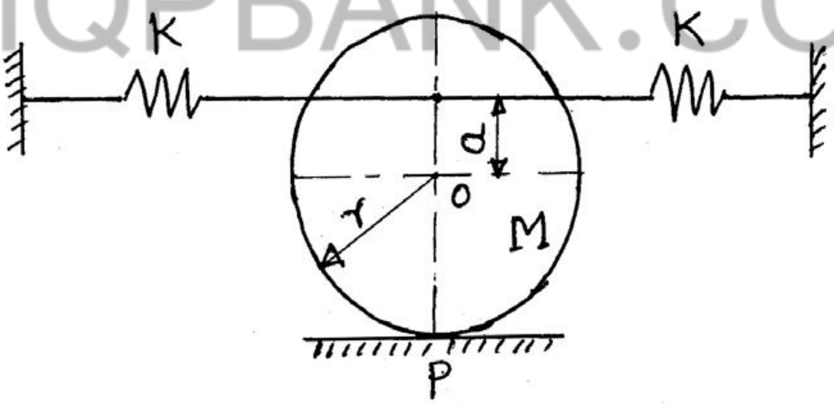
8 A shaft carries 4 masses in parallel planes A, B, C, D in this order along its length. The masses at B and C are 18 and 12.5 kg respectively and each has an eccentricity of 60 mm. Th masses at A and D have an eccentricity of 80 mm. The angle between the masses of B and C is 180^0 and that between masses at B and A is 190^0, both being measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, determine: (i) The magnitude of the masses at A and D. (ii) The distance between planes A and D. (iii) The angular position of the mass at D.

OR

9 A four crank engine has the two outer cranks set at 120^0 to each other, and their reciprocating masses are each 400 kg. The distance between the planes of rotation of adjacent cranks are 450 mm, 750 mm and 600 mm. If the engine is to be in complete primary balance, find the reciprocating mass and the relative angular position for each of the inner cranks.

UNIT – V

10 Find out the natural frequency of the system shown in figure below by using Energy method.



OR

11 A vibrating system having mass 1 kg is suspended by a spring of stiffness 1000 N/m and it is put to harmonic excitation of 10 N. Assuming viscous damping, determine: (i) Resonant frequency. (ii) The phase angle at resonance. (iii) The amplitude at resonance. (iv) The frequency corresponding to the peak amplitude. (v) Damped frequency. Take C = 40 N - S/m

*****