Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI (NEW).EXAMINATION – WINTER 2016

Subject Code: 2161901 Date: 27/10/2016

Subject Name: Dynamics of Machinery

Time: 10:30 AM to 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** The four masses m_1, m_2 m_3 and m_4 having their radii of rotation as 200 mm, 150 mm, 250 mm and 300 mm are 200 kg, 300 kg, 240 kg and 260 kg in magnitude respectively. The angles between the successive masses are 45˚, 75˚ and 135˚ respectively. Find the position and magnitude of the balance mass required, if its radius of rotation is 200 mm. Use analytical method. **07**

(b) The reciprocating mass per cylinder in a 60˚ V- twin engine is 1.5 kg. The stroke is 10 cm for each cylinder. If the engine runs at 1800 rpm, determine the maximum and minimum value of the primary forces and out the corresponding crank position. **07**

Q.2 **(a)** 1) If two springs of stiffness K_1 and K_2 are connected in series and mass m is attached to it. Find its natural frequency of the longitudinal vibration. **03**

2) A vertical spring mass system has a mass of 0.5 kg and an initial deflection of 0.2 cm. find the spring stiffness and the natural frequency of the system. **04**

(b) The mass 'm' is hanging from a chord attached to the circular homogeneous disc of mass 'M' and radius 'R' as shown in **Figure-1**. The disc is restrained from rotating by a spring attached at radius 'r' from the centre. If the mass is displaced downwards from rest position, determine the frequency of oscillations. **07**

OR

(b) Find the natural frequency of system shown in **Figure-2**. If m, K_1, K_2, L are fixed, find the value of 'b' for which the system will not vibrate. **07**

Q.3 **(a)** A vibrating system is defined by the following parameters: m=3 kg, k=100 N/m, C=3 N-sec/m. Determine (a) the damping factor (b) the natural frequency of damped vibration (c) logarithmic decrement (d) the ratio of two consecutive amplitudes (e) the number of cycles after which the original amplitude is reduced to 20 percent. **07**

(b) The equation of motion for a spring mass system is given by $m\ddot{x} + c\dot{x} + kx = F\sin\omega t$. Find steady state response of the system. **07**

OR

Q.3 **(a)** Derive equation of motion for the system shown in **Figure-3**. If m = 1.5 kg, k = 4900 N/m, a = 6 cm and b = 14 cm, determine the value of damping coefficient (C) for which the system is critically damped. **07**

(b) Derive an expression for logarithmic decrement. **07**

Q.4 **(a)** Two rotors A and B are attached to the end of a shaft 50 cm long. Weight of the rotor A is 300 N and its radius if gyration is 30 cm and the corresponding values of B are 500 N and 45 cm respectively. The shaft is 7 cm in diameter for the first 25 cm, 12 cm for the next 10 cm and 10 cm diameter for the remaining of its length. Modulus of rigidity for the shaft material is 8×10^{11} N/m^2. Find: **07**

(i) the position of the node

(ii) the frequency of torsional vibration.

(b) Write a short notes on : **07**

a) Frequency Response Curve

b) Vibration Isolation

OR

Q.4 **(a)** A vertical petrol engine 150 mm diameter and 200 mm stroke has a connecting rod 350 mm long. The mass of the piston is 1.6 kg and the engine speed is 1800 rpm. On the expansion stroke with crank angle 30˚ from the top dead centre, the gas pressure is 750×10^3 N / m^2. Determine the net thrust on the piston. **07**

(b) Derive an expression for critical speed of a shaft carrying rotor and without damping. **07**

Q.5 **(a)** Explain Jump phenomenon and cross over shock in case of cam and follower. **07**

(b) The vibration of a cantilever is given by $\mathbf{y = y_1\left(1 - \frac{\cos \pi x}{2L}\right)}$. Calculate the frequency with following data using Rayleigh's Method. E = 2×10^{11} N/m^2 , I = 0.02 m^4, mass m = 60000 kg and length L = 30 m. **07**

OR

Q.5 **(a)** What are various frequency measuring instruments? Explain any one in detail. **07**

(b) A shaft of negligible weight 6 cm diameter and 5 metres long is simply supported at ends and carries four weights 50 kg each at equal distance over the length of the shaft. Find the frequency of vibration by Dunkerley's method. Take E = 2×10^6 kg/cm^2 **07**

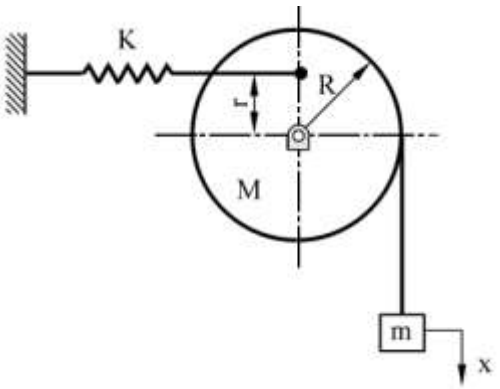

Figure-1

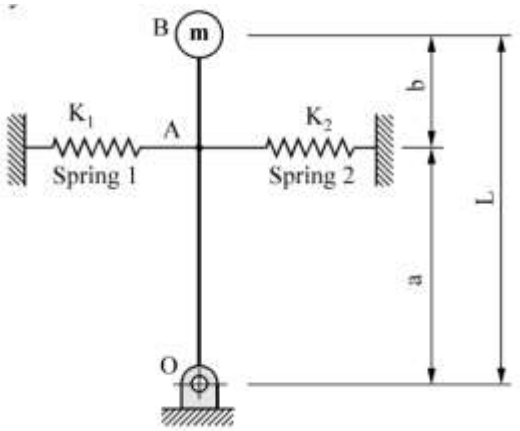

Figure-2

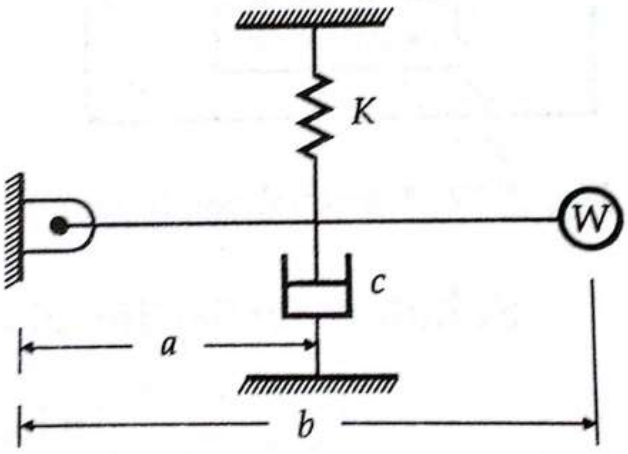

Figure-3

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