Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2710908 **Date: 12-01-2015**

Subject Name: Vibration and Noise

Time: 02:30 pm - 05:00 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)** Derive the Duhamelôs integral for under-damped condition. **07**

(b) A press of mass m is mounted on an elastic foundation of stiffness K. During operation, the force applied to the press builds up to its final value F_0 in a time t_0 as shown in Fig.1. Determine the responses of the press for (i) $t < t_0$ and (ii) $t > t_0$ **07**

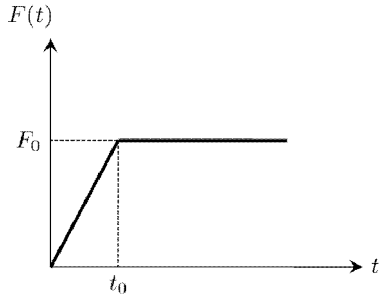

Fig. 1

Q.2 **(a)** Explain the concept of coordinate coupling with a suitable example **07**

(b) Consider the system shown in Fig. 1 in which the slender bar of mass m and mass moment of inertia $I = 1/12mL^2$ is attached to the spring of stiffness k at its left end and three quarters of the way across the bar. Derive the differential equation of the system using x and θ as generalized coordinates. (Fig. 2) **07**

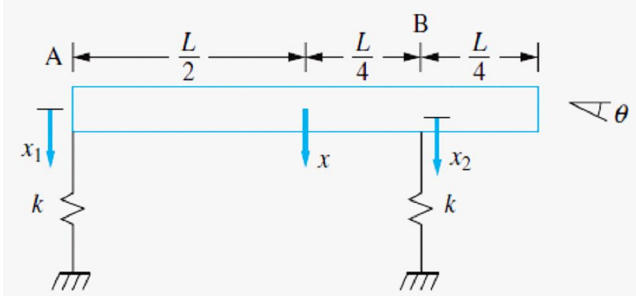

Fig. 2

OR

(b) Find the natural frequency for the following system. (Fig. 3) **07**

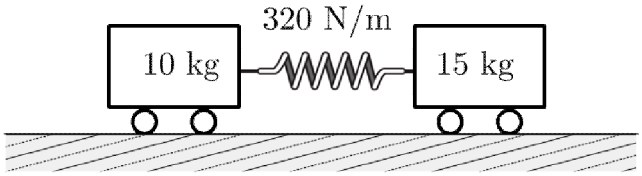

Fig. 3

Q.3 **(a)** Explain the torsional vibrations of a gear system. **07**

(b) Use Holzer method to find the natural frequencies of the system as shown in **07**

Fig. 4. Assume $I_1 = I_2 = I_3 = K_{t1} = K_{t2} = 1$.

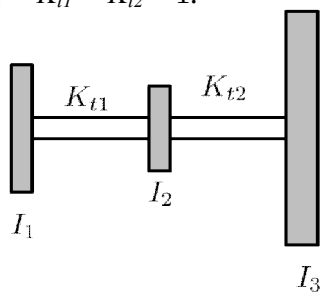

Fig. 4

OR

Q.3 **(a)** An accelerometer has a suspended mass of 0.01 kg with a damped natural frequency of vibration of 150 Hz. When mounted on an engine undergoing an acceleration of 1 g at an operating speed of 6000 rpm, the acceleration is recorded as 9.5 m/s^2 by the instrument. Find the damping constant and the spring stiffness of the accelerometer. **07**

(b) Derive the equation for the force transmissibility for the case of a vibration isolation system with a flexible foundation. **07**

Q.4 **(a)** Design a velometer if the maximum error is to be limited to 1% of the true velocity. The natural frequency of the velometer is to be 80 Hz and the suspended mass is to be 0.05 kg **07**

(b) Derive an equation of motion for an Euler-Bernoulli beam in the presence of the axial load. **07**

OR

Q.4 **(a)** Derive an equation of motion for a bar and discuss various boundary conditions. **07**

(b) A bar of uniform cross section having length l is fixed at both ends. The bar is subjected to longitudinal vibrations having a constant velocity V_0 at all points. Derive suitable mathematical expression of longitudinal vibration in the bar. **07**

Q.5 **(a)** Explain the Gaussian random process for vibration analysis.

(b) The power spectral density of a stationary random process is shown in Fig. 5. Find its autocorrelation function and the mean square value. **07** **07**

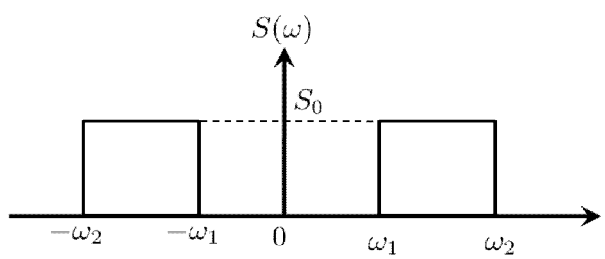

Fig. 5

OR

Q.5 **(a)** Discuss the sound intensity measurement methods in detail. **07**

(b) Discuss the design principles for noise reduction. **07**

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