Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

VII SEMESTER B.TECH (MECHANICAL ENGINEERING)

END SEMESTER MAKE UP EXAMINATION – DEC.2016/JAN. 2017

SUBJECT: MECHANICAL VIBRATIONS (MME 403)

REVISED CREDIT SYSTEM

Time: 3 Hour **Max. Marks: 50**

Note: (i) Answer **ANY FIVE FULL** questions
(ii) Missing data, if any, may be appropriately assumed
(iii) Draw the sketch as applicable
(iv) Assumptions made must be clearly mentioned

1A. Determine the natural frequency of pendulum system shown in figure Q1A. 04

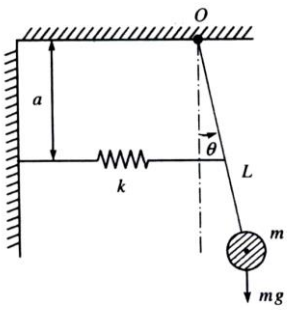

Fig. Q 1A

1B. Derive an expression to find the natural frequency of free vibrations of an un-damped spring (*k*)-mass (m*)* system taking into consideration the mass of the spring (m_s), given that 'ρ' is the mass per unit length of the spring. 04

1C Derive an expression for logarithmic decrement in terms of damping factor. 02

2A. Derive an expression for amplitude of an underdamped spring mass damper system and show that it decays exponentially with time. 03

2B. A mass of 1.2 kg is attached to a spring having stiffness of 4800 N/m. The mass slides on a horizontal surface. The coefficient of friction between the mass and surface being 0.15. Determine the frequency of vibration and amplitude after one cycle, if initial deflection is 5 mm. Also determine the final resting position. 03

2C What is force transmissibility ratio? Derive an expression for the same using usual notations. 04

3A. A single cylinder vertical petrol engine of total mass 360 kg is mounted upon a steel chassis and causes a vertical static deflection of 2.5 mm. The reciprocating parts of the engine have a mass of 25 kg and move through a vertical stroke of 150 mm with a simple harmonic motion. A dashpot attached to the system offers a resistance of 490 N at a velocity of 0.3m/s. Determine 05
i) Speed of the driving shaft at resonance
ii) Amplitude of steady state vibration at engine speed of 1000 rpm

3B. What is critical speed of a shaft? With usual notations derive an expression for the lateral displacement of the shaft in terms of eccentricity and the frequency ratio. Neglect the effect of damping. 04

3C Plot the frequency response curves of the following forced vibration systems: 01
i) Systems subjected to harmonic excitation of type $F(t) = F_o \sin(\omega t)$
ii) Systems subjected to rotating/reciprocating unbalance

4A. The springs of an automobile trailer are compressed 0.05 m under its own weight. Find the critical speed when the trailer is passing over a road with a profile of sine wave whose amplitude is 75 mm and the wavelength is 2 m. Find the amplitude of vibration at a speed of 50 km/hr. Assume a damping factor of 0.2 for the shock absorber of the trailer. 05

4B. What is a vibrometer and how it is different from an accelerometer? 04

4C Plot the frequency response curves of relative displacement ratio and absolute displacement ratio of a seismic instrument. 01

5A. For the pendulum system shown in figure Q5A, find the natural frequencies of the system. Neglect mass of the pendulum rods. 05

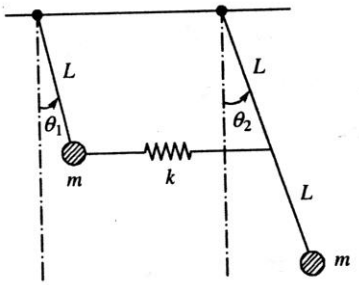

Fig. Q5A

5B. Differentiate between the Dunkerley's method and Rayleigh's method of finding the fundamental natural frequency of a multi-degree of freedom system. 05

6A. Explain with derivation how a centrifugal pendulum vibration absorber reduces the torsional disturbances in rotary systems. 05

6B. Find all the flexibility influence coefficients of the spring-mass system shown in figure Q6B and express them in matrix form. 05

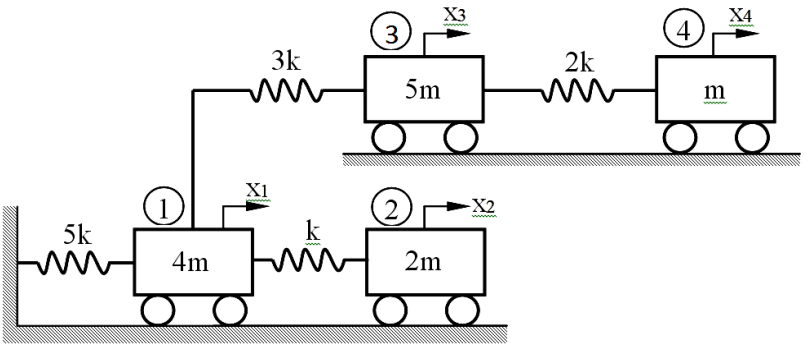

Fig. Q6B

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