Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER B. TECH (MECHANICAL ENGINEERING)

END SEMESTER EXAMINATIONS (MAKEUP), DECEMBER 2018

SUBJECT: MECHANICAL VIBRATIONS I [MME 4101]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data if any, may be suitably assumed.

1A	Show that the un-damped natural frequency of a spring mass system is obtained by adding 1/3rd of the mass of the spring to the mass suspended when the mass of the spring is considered.	**05**
1B.	Define logarithmic decrement. Derive an expression for logarithmic decrement in terms of damping factor.	**05**
2A.	What is force transmissibility ratio? Derive an expression for force transmissibility ratio of a forced vibration system.	**05**
2B.	A single cylinder reciprocating air compressor 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 compressor 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 (a.) The speed of the driving shaft at resonance and. (b.) The amplitude of steady state vibration when the driving shaft of the engine rotates at 1000 rpm.	**05**
3A.	Derive an expression fir the relative displacement amplitude ratio of a seismic instrument and plot the frequency response curve	**05**
3B.	A rotor having a mass of 5 kg is mounted midway on a 1 cm diameter shaft supported at the ends by two bearings. The bearing span is 40 cm. Because of certain manufacturing inaccuracies, the C.G. of the disc is 0.02 mm away from the geometric centres of the rotor. If the system rotates at 3000 rpm, find the amplitude of steady state vibrations and the dynamic force transmitted to the bearings. Neglect damping and take E = 1.96 x10^{11} N/m^2.	**05**

4A. Determine the two natural frequencies and corresponding mode shapes for the system shown in figure Q4A. **05**

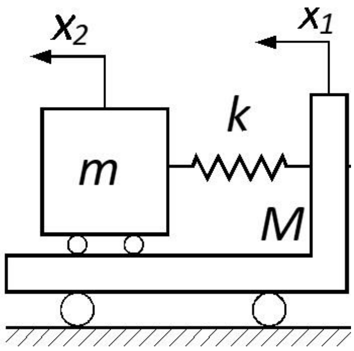

Fig. Q4A

4B. Derive and show how the resonance condition is avoided using a centrifugal pendulum vibration absorber. **05**

5A. Using Holzar's method, determine the stiffness K of the spring shown in the figure Q5A. The fundamental natural frequency of the system is 4.58 radians/ second. **05**

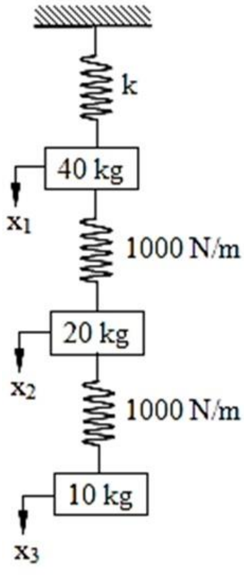

Fig.Q5A

5B. Derive and explain the Dunkerley's method of finding the fundamental natural frequency of a multi degree vibrtion system. **05**