Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)
END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: MECHANICAL VIBRATIONS [MME 469]

REVISED CREDIT SYSTEM
(06/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.

1A. Determine the equivalent stiffness for the system shown in ***fig. Q1A***. **04**

1B. State and prove Maxwell Reciprocal Theorem. **03**

1C. A spring mass system with viscous damping is displaced from the equilibrium position and released. If the amplitude diminished by 5% each cycle, what fraction of the critical damping does the system have? **03**

2A. Define logarithmic decrement and derive an expression for the same in terms of damping ratio. **04**

2B. Find out the frequency equation and the two natural frequencies for the system shown in the ***fig. Q2B*** and determine the principle modes of vibration. **06**

3A. A vibrating system consists of a mass of 50 kg, a spring of stiffness 30 kN/m and a damper. The damping provided is only 20 % of the critical value. Determine the following: **04**

i) Damping factor
ii) Critical damping coefficient
iii) Natural frequency of damped vibrations
iv) Logarithmic decrement
v) Ratio of two consecutive amplitudes

3B. Calculate all the influence coefficients for the system shown in ***fig. Q3B***. **06**

4A. Derive an expression for the natural frequency and time period of a spring mass system taking mass of the spring into consideration. **04**

4B. Using the matrix iteration method, determine the lowest natural frequency of the system shown in the ***fig. Q4B***. **06**

5A. A gun barrel of mass 600 kg has a recoil spring of stiffness 294,000N/m. If the barrel recoils 1.3 m on firing, determine the following: **05**

i) Initial velocity of the barrel
ii) Critical damping coefficient of the dashpot which is engaged at the end of the recoil stroke.
iii) Time required for the barrel to return to a position 0.05 m from the initial position.

5B. What is magnification factor? Derive an expression for the same. Sketch and discuss its variation with frequency ratio. **05**

6A. The cylinder of mass ***'m'*** and radius ***'r'*** rolls without slipping on a circular surface of radius ***'R'*** as shown in the ***fig. Q6A***. Derive an expression for the natural frequency of the system using energy method. **05**

6B. In the spring-mass-damper system shown in ***fig. Q6B***, it is given that ***m = 1 kg; k = 20 N/m; l = 0.5 m; a = 0.4 m and b = 0.25 m.*** Determine the critical value of the viscous damping coefficient ***C***. If the value of ***C*** is now reduced to half its critical value, what is the frequency at which the system undergoes free vibration? **05**

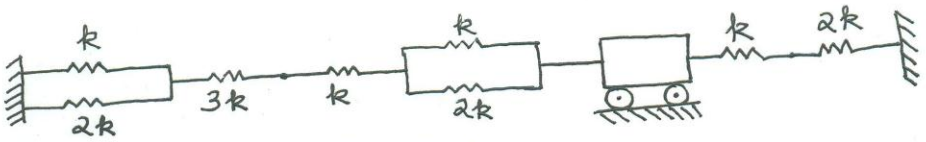

FIG Q1A

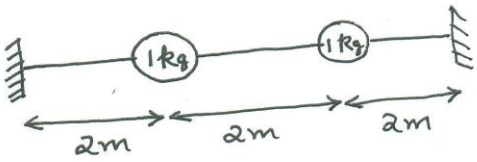

FIG Q2B

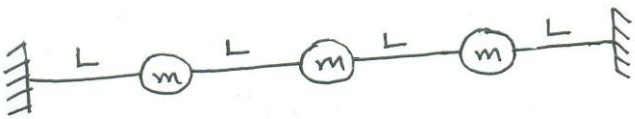

FIG Q3B

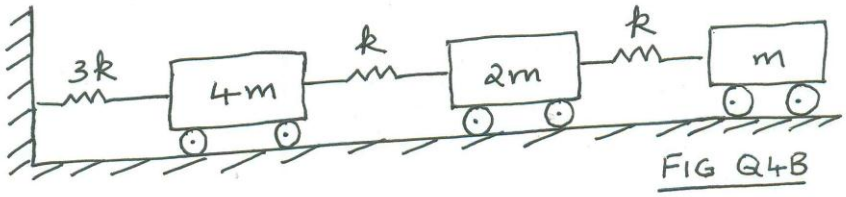

FIG Q4B

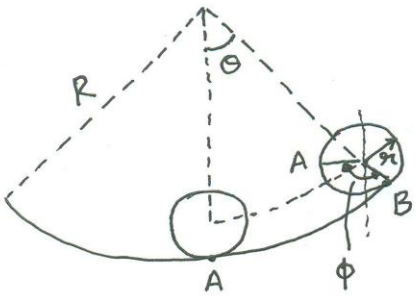

FIG Q6A

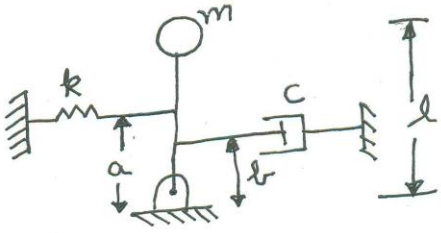

FIG Q6B