ME (Mech) Sem - I CBCS first half May 2017
Sub: MV Date: 16/5/17

QP CODE : 845000

(03 Hours) [Total Marks: 80]

N.B. : *(1) Question No:01 is compulsory*
(2) Attempt any Three Questions from remaining Five Questions.
(3) Assume suitable data where ever is necessary and justify the same.
(4) Illustrate the answers with sketches wherever required.
(5) Answer to the questions should be grouped and written together.
(6) Assumptions made should be clearly stated.

Q.1 Answer any FIVE 4×5

i) *Define the flexibility and stiffness influence coefficients. What is the relation between them?* (20)
ii) *Write a short note on "Experimental Modal Analysis".*
iii) *Explain working of Digital Analyzer with block diagram.*
iv) *What are causes of non-linear vibrations?*
v) *Write a short note on basic signal attributes.*
vi) *Explain a jump phenomenon with a suitable example.*

Q.2

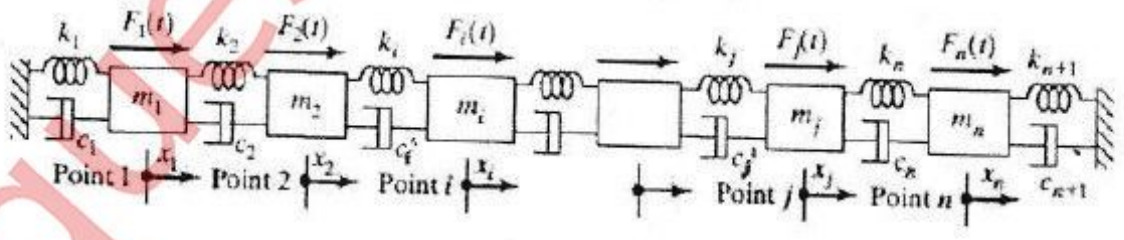
(A) *Write a note on Spectrum Analyzers and Band pass Filter.* (10)

(B) *Write a note on damage detection in structures using changes in modal frequency and mode shapes.* (10)

Q.3 *(A)*

Derive the equations of motion of the spring-mass-damper system as shown in the following figure: (10)

i) *Express the equation of motion in matrix form and write the mass, damping and stiffness matrices.*
ii) *Write the mass, damping and stiffness matrices in their most general form.*
iii) *Explain static and dynamic coupling*



(B) *Design a velometer if the maximum error is to be limited to 1 percent 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.* (10)

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(3)

Q.4

(A) *Write a note on Semi-Active and Active Vibration Control with practical applications and instrumentation involved in them.* (10)

(B) *Determine the Eigen values and Eigen vectors of a vibrating system for which* (10)

$$[m] = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and } [k] = \begin{bmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{bmatrix}$$

Q.5

(A) *Discuss the methodology of diagnosis of unbalance, misalignment and antifriction bearing defects.* (10)

(B) *Explain how Lindstedt's Perturbation Method is used to find the solution to a nonlinear vibration problem.* (10)

Q.6

(A) *What is the source of nonlinearity in Duffing's equation? What is the difference between hard spring and soft spring? Explain Jump Phenomenon.* (10)

(B) *A stereo turntable, of mass 1 kg, generates an excitation force at a frequency of 3 Hz. If it is supported on a base through a rubber mount, determine the stiffness of the rubber mount to reduce the vibration transmitted to the base by 80 percent.* (10)
