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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, M.Tech. - Civil Engineering (MCAD)

Semester End Examination; June-2022

Structural Dynamics Theory and Computation

Time: 3 hrs *Max. Marks: 100*

Course Outcome

The Students will be able to:
CO1: Understand the basic principles of dynamics.
CO2: Analyze lumped mass systems for their dynamic behaviour.
CO3: Evaluate the structural characteristics of continuous vibratory system.
CO4: Carry out dynamic analysis of beams using FEM.

Note: ***I)*** *Answer any* ***FIVE*** *full questions, selecting* ***ONE*** *full question from each unit.*
II) *Any* ***THREE*** *units will have internal choice and remaining* ***TWO*** *unit questions are compulsory.*
III) *Each unit carries 20 marks.* ***IV)*** *Missing data, if any, may suitably be assumed.*

Q. No.	Questions	Marks	BLs	COs	POs
	UNIT - I	**20**			
1 a.	Establish the equation of motion using dynamic equilibrium for a spring mass system.	10	L1	CO2	PO1,3,5
b.	What are the characteristics of dynamic loading? Briefly discuss. State; i) Dynamic Degrees of freedom ii) D'Alembert's Principle	10	L1	CO3	PO1,3,5
	OR				
1 c.	List the types of damped system and sketch the responses neatly. Also obtain the equation of motion for critically damped systems.	12	L2	CO3	PO1,3,5
d.	Unknown mass *m* is attached to the one end of the spring of stiffness *k* having the natural frequency of 12 Hz. When 1 kg of mass is attached with the *m* and the natural frequency of the system is lowered by 25%, determine the value of unknown mass *m* and stiffness *k*.	8	L1	CO3	PO1,3,5
	UNIT - II	**20**			
2 a.	With a neat sketch, discuss the features of frequency response curves for different damping ratios of SDOF system and evaluate the frequency ratio at which the response is maximum.	12	L2	CO3	PO1,3,5
b.	Derive Duhamel's integral used to evaluate the response of an undamped spring-mass system.	8	L2	CO3	PO1,3,5
	OR				
2 c.	A vibrating system having mass 5 kg is suspended by a spring of stiffness 1.2 N/mm is forced to vibrate by a harmonic force of 9 N. Assuming damping ratio of 0.1 N-s/mm. Determine;	12	L2	CO3	PO1,3,5

Contd… 2

i) Resonant frequency

ii) Amplitude at resonance

iii) Phase angle at resonance

iv) Frequency corresponding to peak amplitude

v) Peak amplitude

vi) Phase angle corresponding to peak amplitude

d. Derive the expression for the steady state response of a spring mass dashpot system, with main mass *M*, an eccentric mass *m*, eccentricity *e* and rotation of machine is ω rad/sec. — 8 | L2 | CO3 | PO1,3,5

UNIT - III — **20**

3 a. Evaluate the natural frequency and mode shapes for the system shown in Fig. Q3a. Draw mode shape diagram. — 20 | L2 | CO5 | PO1,3,5

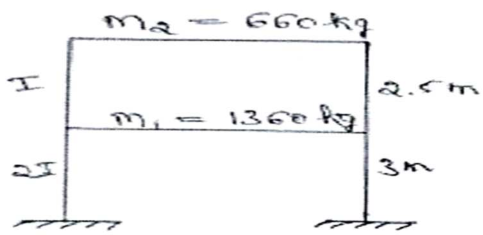

Fig.Q3a

OR

3 b. Obtain the matrix form of differential equation of motion. Also evaluate the natural frequencies and mode shapes for the MDOF system shown in Fig. Q3b. — 20 | L2 | CO5 | PO1,3,5

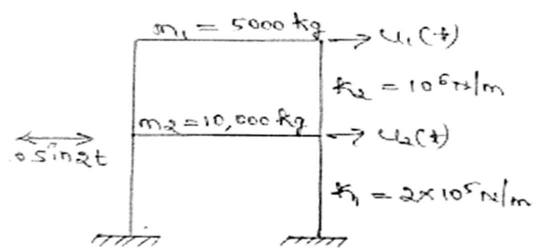

Fig. Q3b

UNIT - IV — **20**

4. Set up the differential equation of motion and obtain the characteristic equation for a simply supported beam subjected to free transverse vibration. Also obtain the expression for natural frequency. — 20 | L3 | CO3 | PO1,3,5

UNIT - V — **20**

5. Using the cubic Hermitian polynomials, derive the shape function for a two nodded Euler-Bernoulli element. Also derive mass coefficient M_{ij} for i = 1, j = 1, 2 and 3. — 20 | L4 | CO4 | PO1,3,5

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