M.E DEGREE EXAMINATIONS: JUNE 2017

(Regulation 2015)

Second Semester

STRUCTURAL ENGINEERING

P15SET204: Aseismic Design of Structures

COURSE OUTCOMES

CO1: Explain behavior of structures subjected to earthquake

CO2: Utilize various IS codal provisions for seismic design

CO3: Design RC shear walls frame system

CO4: Perform Retrofitting and Rehabilitation for existing damaged buildings

CO5: Design buildings for seismic forces using various software packages

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. The ratio of two successive values of displacement in free vibration is called   CO1   [K$_2$]

   a)   Damping ratio   b)   Frequency ratio

   c)   Resonance   d)   Logarithmic decrement

2. Modified Mercalli scale is used to measure   CO1   [K$_1$]

   a)   Magnitude   b)   Intensity

   c)   Acceleration   d)   Frequency

3. **Assertion (A):** The Modal participation factor depends on the scaling used for mode   CO1   [K$_1$]

   shapes.

   Reason (R): The amplitudes of 95% mode shapes can be scaled arbitrarily to

   determine modal participation factor.

   a)   Both A and R are Individually true and   b)   Both A and R are Individually true but
        R is the correct explanation of A   R is not the correct explanation of A

   c)   A is true but R is false   d)   A is false but R is true

4. The percentage of live load to be considered for floors if the given live load is 5 kN/m^2 CO2   [K$_2$]

   is

   a)   10%   b)   25%

   c)   50%   d)   100%

5. Consider the following statements: CO2 [K2]

    1. For an MDOF system, the eigen values corresponds to natural frequencies.

    2. As per IS 13920-1993, the width-to-depth ratio shall be more than 0.3 for flexural members.

    3. Improving earthquake resistance of Low strength masonry buildings guidelines is given in IS 13827-1993.

    4. According IS 4326-1993, roof band shall be provided for RC roofs.

Which of these statements are correct?

a)	1,3	b)	1,4
c)	1,2	d)	2,3

6. Which of the following is a nonlinear static analysis? CO3 [K1]

a)	Equivalent static analysis	b)	Pushover analysis
c)	Response spectrum analysis	d)	Time history analysis

7. For capacity building of structures, the method adopted is CO3 [K2]

a)	Strong beam weak column concept	b)	Strong column strong beam concept
c)	Strong column weak beam concept	d)	All the above

8. Consider the following steps in repairing cracks in a RC column. CO4 [K2]

    1. Application of Epoxy injection under pressure in each hole.

    2. Crack at surface is sealed between the holes with rapid curing resin.

    3. The injected hole is sealed off and the next hole is treated.

    4. Drilling injection holes at intervals.

The correct sequence of the repair technique is

a)	2-1-4-3	b)	1-3-2-4
c)	3-4-2-1	d)	4-1-2-3

9. Matching type item with multiple choice code: CO4 [K2]

List I	**List II**
A. Vibration absorber	i. Viscous damper
B. Passive control	ii. Rollers at base
C. Silicone based fluid	iii. Tuned mass damper
D. Hypothetical building	iv. Base isolation

	A	B	C	D
a)	ii	i	iii	iv
b)	iii	iv	i	ii
c)	ii	iv	iii	i
d)	iii	ii	i	iv

| 10. | Which of the following software packages are available for design of steel and RC structural elements as per IS code of practice? | CO5 | [K$_1$] |

    a) STAAD.Pro   b) ETABS

    c) ABAQUS   d) All the above

PART B (10 x 2 = 20 Marks)

11.	What is Duhamel's integral? Write the expression for the same.	CO1	[K$_2$]
12.	Compare free and forced vibration systems.	CO1	[K$_2$]
13.	What is dynamic degree of freedom?	CO1	[K$_2$]
14.	Define zero period acceleration.	CO2	[K$_2$]
15.	Define displacement ductility.	CO2	[K$_2$]
16.	Explain the importance of mathematical modeling of buildings.	CO3	[K$_2$]
17.	Sketch the reinforcement details of a beam-column joint as per IS 13920.	CO3	[K$_2$]
18.	What is capacity design?	CO4	[K$_2$]
19.	List the advantages of base isolation system.	CO4	[K$_2$]
20.	List the advantages of using software packages for analysis and design of structures.	CO5	[K$_2$]

PART C (10 x 5 = 50 Marks)

21.	Explain the working of a seismograph with a neat sketch.	CO1	[K$_2$]
22.	Explain damped and undamped systems with examples.	CO1	[K$_2$]
23.	What is response spectrum? Explain the factors influencing response spectrum.	CO1	[K$_3$]
24.	Discuss about the earthquake response to inelastic buildings.	CO1	[K$_2$]
25.	Explain the cyclic behaviour of RCC and PCC elements	CO2	[K$_2$]
26.	What is special confining reinforcement? Under what situations it is provided?	CO2	[K$_2$]
27.	List and explain the types of shear wall with neat sketches.	CO3	[K$_2$]
28.	Explain the various methods to reduce liquefaction of soil.	CO3	[K$_2$]
29.	Explain the types of seismic dampers with a neat sketch.	CO4	[K$_2$]
30.	Explain the advantages of using software for analysis and design of buildings for earthquake loads.	CO5	[K$_2$]

PART D (2 x 10 = 20 Marks)

31. Explain the types and properties of seismic waves with neat sketches. CO1 [K₃]

32. Explain with neat sketches how to introduce ductility into RC structures as per IS 13920-1993. CO2 [K₃]

33. Design a shear wall of length 4.16 m and thickness 250 mm subject to the forces shown in Table. Assume f_{ck} = 25 MPa and f_y = 415 MPa. Sketch the reinforcement details. CO3 [K₃]

Loading	Axial force (kN)	Moment (kNm)	Shear (kN)
DL + LL	1950	600	20
Seismic load	250	4800	700

****