POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
Results and Many more…

CE8020 STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

IMPORTANT QUESTIONS AND QUESTION BANK

UNIT-I SINGLE DEGREE OF FREEDOM SYSTEM

2-Marks

1. What is meant by theory of vibration?
2. Define logarithmic decrement method.
3. Name critical damping.
4. List out the methods to derive the equation of motion.
5. What do you understand by deterministic analysis?
6. What is meant by frequency response curve for damped system?
7. Outline D-Alembert's principle of dynamic equilibrium.
8. Classify the types of vibration.
9. List the types of damping.
10. Explain frequency ratio.
11. Distinguish between static and dynamic degrees of freedom?
12. Demonstrate about dynamic load factor.
13. Differentiate over damped and under damped system.
14. Identify the consequences of vibration.
15. Examine degrees of freedom and list the types.
16. Examine resonance and natural frequency.
17. Analyse about free vibration response and transient response.
18. Compare static and dynamic loading.
19. Create short note on amplitude.
20. Formulate simple harmonic motion.

13-Marks

1. A mass 1kg is suspended by a spring having a stiffness of 600 N/m. the mass is displaced downward from its equilibrium position by a distance of 0.01m. find.
   a) Equation of motion of the system
   b) Natural frequency of the system
   c) The response of the system as a function of time.
   d) Total energy of the system.
2. A harmonic motion has a maximum velocity of 6m/s and it has a frequency of 12cps. Determine its amplitude, its period and its maximum acceleration.
3. A damper offers resistance 0.08 N at a constant velocity 0.06m/s. the damper is used with a spring of stiffness equal to 12N/m. determine the damping ratio and frequency of the system when the mass of the system is 0.3 kg.

4. A single degree of freedom system having a mass of 2.5 m is set into motion with a viscous damping and allowed to oscillate freely. The frequency of oscillation is found to be 20Hz, and measure of the amplitude of vibration shows two successive amplitudes to be 6mm and 5.5mm. estimate the viscous damping co-efficient.

5. A vibrating system consists of a mass of 5kg, spring of stiffness 120N/m and a damper with a damping co-efficient of 5 N-s/m. examine damping factor, natural frequency of the system, logarithmic decrement, the ratio of two successive amplitude, the number of cycles after which the initial amplitude reduces to 25%.

6. A vibrating system consists of a mass of 20kg, spring of stiffness 20KN/m and a damper. The damping provided is only 30% of the critical value determine:
   a) The damping factors
   b) The critical damping coefficient
   c) The natural frequency of damped vibrations.
   d) The logarithmic decrement and
   e) The ratio of the consecutive amplitudes.

7. Derive the equation of motion for SDOF system free vibration and find the solution for:
   1.Undamped system
   2.damped system.

8. Solve the equation of motion of SDOF for free vibration to find out the natural frequency and angular frequency.

9. Define and discuss the following:
   1.Critical damping
   2.Coulomb damping
   3.Damped circular frequency.

10. A mass of 1kg is suspended by a spring having a stiffness of 600N/m. the mass is displaced downward from its equilibrium position by a distance of 0.01m. find.
    1.Equation of motion of the system
    2.Natural frequency of the system
    3.The response of the system as a function of time
    4.Total energy of the system.

11. A cantilever beam 3m long supports a mass of 500kg at its upper end. Find the natural period and natural frequency. $E=2.1 \times 10^6$ kg/cm^2 and $I=1300$cm^4.

12. A vertical cable 3m long has a cross sectional area of 4cm^2 supports a weight of 50 KN. What will be the natural period and natural frequency of the system? $E=2.1 \times 10^6$ kg/cm^2.

13. A body of mass of 50kg is suspended by an elastic structure of stiffness 10 KN/m. the motion of the body is controlled by a dashpot such that the amplitude

POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
Results and Many more…

of vibration decrease to one-tenth of its original value after two complete vibrations determine:

1. The damping ratio
2. The damping force at 1m/s and
3. The natural frequency of vibration.

14. A cantilever beam AB of length L is attached to a spring K and a mass M as shown in figure 2.12. (a) From the equation of motion; and (b) Find an expression for the frequency of motion.
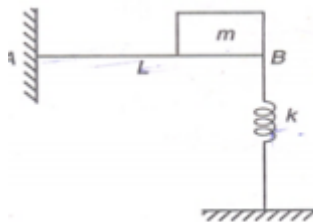
15. Consider the system shown in figure if k1=2000N/m, K2= 1500N/m, k3=3000N/m, k4 =k5=500N/m. find the mass if the system has a natural frequency of 10Hz.
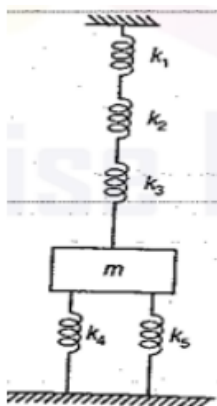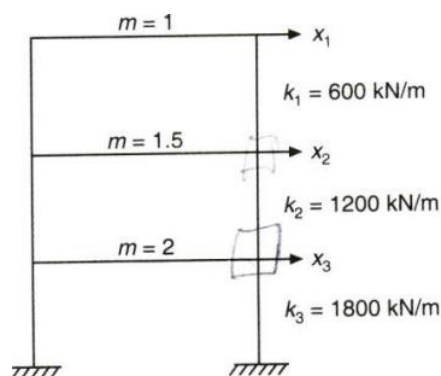

UNIT-II MULTI DEGREE OF FREEDOM SYSTEM

2-Marks

1. What is fundamental frequency and fundamental mode shape?
2. List out the assumptions made in the concept of shear building.
3. Compare orthogonality and normality principles.
4. Formulate the equation of motion for a damped two degrees of freedom system.
5. Define Eigen vectors and Eigen values.
6. What is meant by coupled and decoupling of equation?
7. Explain modal super position method.
8. How frequency is affected in the free vibration of a shear frame?
9. Define Dun Kerley's method.
10. Identify resonant frequency.
11. Examine impulsive force?

POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
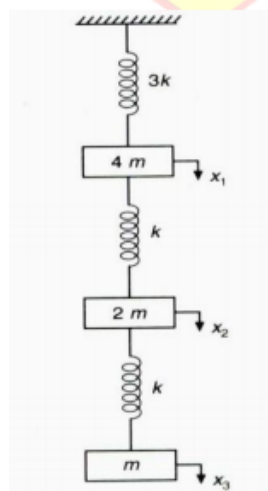*Results and Many more…*

12. Simplify mode shape?
13. Analyse transitional ground motion.
14. Enumerate dynamic equilibrium?
15. Select a note on free vibration analysis.
16. Outline Rayleigh's method.
17. Illustrate model analysis?
18. Explain static condensation approach.
19. Illustrate normal modes of vibration?
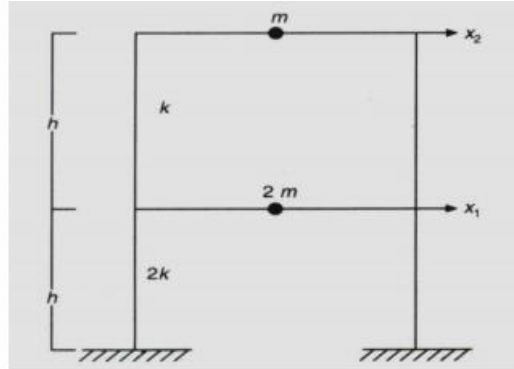20. What is mass matrix?

13-Marks

1. Determine the natural frequency and mode shape of given MDOF system. $EI=4.5\times10^6$N-m^2 for all coloumns.m_1=5000kg, m_2=4000kg and m_3=3000kg and the height of each story is 3m.

2. Determine the natural frequency and draw the mode shape for the shear building.

3. Select the equation motion of a two degree of freedom system for free vibration.

4. Analyse the natural frequency and mode of the system.

POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
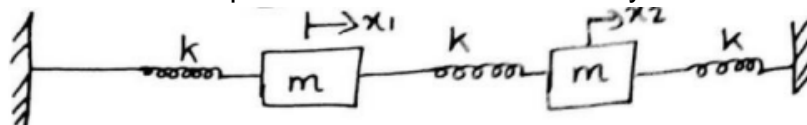*Results and Many more…*

5. Solve the natural frequency and mode of vibration of the system.

6. Determine the natural frequency and mode shapes of the following: the storey masses are m_1=1360kg, m_2=660kg, h_1=3m and h_{2}=2.5m moment of inertia is 21. Take I=5×10⁵mm⁴ and E=2.5×10⁴N/mm².

7. Determine the natural frequency and mode shapes of the following: the storey masses are M1=2, M2=1.5, M3=1 and storey stiffness are K1=900 N/m k2=600 N\m k3=300 N/m.

8. Define the natural frequency and mode of vibration of the give system.
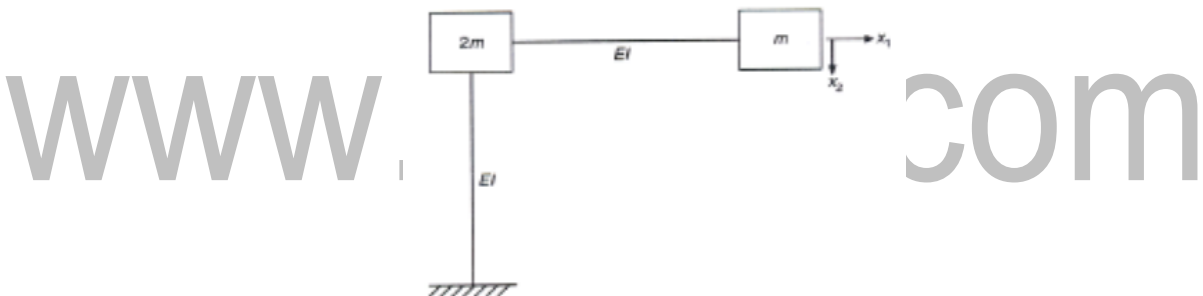
9. Obtain the natural frequency and mode shape for a single bay two storey shear frame with combined stiffness of ground and first floor columns as K=2000 KN/m respectively. Mass of each floor is 2000 kg.

10. Show the expression for the free vibration of a damped two degree of freedom system.

11. Explain the concept of shear building and modal superposition method.

12. A three-storey building has seismic weights of 200 KN, 300KN and 420 KN at I, II and III stores' respectively: the corresponding stiffness's are 20000 KN/m, 25000 KN/m and 30000 KN/m. 1) Examine the model frequencies. 2)Sketch the mode shapes.

13. Determine the natural frequencies and modes of the system shown in figure.

14. State and prove the orthogonality property of mode shapes.

POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
Results and Many more…

15. Obtain the three natural frequencies and the corresponding mode shapes for the three degrees of freedom.

UNIT-III INTRODUCTION TO EARTHQUAKE ENGINEERING

2-Marks

1. Identify the reason for the occurrence of faults.
2. Explain modified Mercalli intensity scale.
3. Define focus and epicentre.
4. Differentiate between P-waves and S-waves.
5. Distinguish between Epicentre and hypocentre.
6. Distinguish between seismograph and seismogram.
7. Identify the causes of earthquake.
8. What is meant by hypocentre?
9. Define focal depth and Epicentral distance.
10. Compare: magnitude and intensity of an earthquake.
11. Discuss the classification of seismic zones in India.
12. Classify the types of earthquakes.
13. Define fault and list its types.
14. Identify the factors influencing ground motion.
15. How will you develop am Isoseismal map?
16. Summarize the characteristic of earthquake
17. Define normal fault.
18. What is meant by Richter scale?
19. What are the commonly used intensity scales?
20. How the earthquakes are classified?

13-Marks

1. Find the natural causes of earthquake and explain it briefly.
2. 1.Explain the seismic waves with neat sketch.
   2.Explain about the elastic rebound theory.
3. Explain in detail about the plate tectonic theory and lithospheric plates.
4. Classify the types of geological faults and explain it briefly.
5. Explain about the classification of earthquake.
6. 1.Differntiate magnitude and intensity
   2.How will you measure magnitude and intensity. Explain the methods briefly.
7. Write down the characteristic of strong ground motion with neat graph.
8. How will you estimate the measurement of earthquakes using?
   1) Seismograph
   2) seismogram. With neat sketches.
9. What are the major plates that causes seismicity? List out the causes of earthquake occurred by manmade sources and explain it briefly.

POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
Results and Many more…

10. List out some of the recent earthquakes occurred and give information on some disastrous earthquakes.

11. On what is the assignment of an earthquake magnitude based? Is magnitude the same as intensity? Explain.

12. Define focus and epicentre of an earthquake. Name the kinds of body waves and explain it with neat sketch.

13. Analyse how the intensity is measured using MMI scale as per codal provisions.

14. Write short notes on

    1. Tsunami

    2. Spectral acceleration.

15. Discuss about the internal structure of the earth.

UNIT-IV EARTHQUAKE EFFECTS ON STRUCTURES

2-Marks

1. Define soil liquefaction.
2. Define peak acceleration and response spectrum.
3. What is meant by re-entrant corners of irregular buildings?
4. Define the term base shear & storey drift.
5. List out the methods of dynamic analysis.
6. Classify the types of irregularities found on RC buildings during earthquake.
7. What are the different direct and indirect effects of earthquake?
8. Identify the major damages occur in the RC structures during earthquake.
9. Summarize about peak ground acceleration (PGA).
10. Explain the term response reduction factors.
11. What is soft storey failure.
12. Discuss about P-Delta effect.
13. Compare mass irregularities from plane irregularities.
14. Analyse the concept of floating column.
15. Brief short column damages in RC buildings.
16. Explain some of the exterior wall changes during earthquake.
17. Discuss about the pounding effect in buildings.
18. Explain zero period acceleration.
19. Identity the different effects of liquefaction
20. Evaluate the damage due to seismic effects.

13-Marks

.

1. Explain briefly the effect of earthquake on different types of structures.

2. Illustrate about the vertical irregularities that affect the performance of RC buildings during earthquake.

3. What is the concept of peak acceleration and design spectrum describe it with neat sketches?

POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
Results and Many more…

4. Write the step-by-step dynamics analysis procedure of RC framed structure as per IS 1893:2002 with suitable assumed data of your choice.

5. Elaborate the planning and architectural considerations in RC buildings and also discuss the potential deficiencies.

6. List out the effects and methods to reduce soil liquefaction in brief.

7. Explain in detail about the methods of seismic analysis

8. Define response spectra. Explain the concept and types of response spectra with neat sketch.

9. List out the step-by-step procedure to analyse a frame by equivalent static lateral load method.

10. Identify the seismic damages in RC buildings during Bhuj earthquake.

11. Explain any one code-based procedure for seismic analysis.

12. Analyse the factors affecting response spectra.

13. With a help of a case study, explain briefly the lesson learnt from a recent earthquake happened in India after the year 2004.

14. Solve the design lateral forces at each floor level for a two storey RC shear frame of a hospital building for the following data. Use response spectrum method of per IS 1893-2002.
   Seismic weight of each floor=50KN
   Spacing between columns= 3m c/c
   Height of each floor =3m
   Type of structure =SMRF
   Location of the building =Coimbatore
   Type of soil=Rock
   Combined stiffness of ground floor columns=2000KN/m
   Combined stiffness of first floor columns=1000KN/m

15. A three storeyed symmetrical RC school building situated at Bhuj with following data:
   Plan dimension: 7m
   Storey height: 3.5m
   Total weight of beams in a storey: 130KN
   Total weight of slab in a storey: 250KN
   Total weight of columns in a storey: 50KN
   Total weight of walls in a storey: 530KN
   Live load: 130kN
   Weight of terrace floor: 655KN

The structure is resting on hand rock. Determine the total base shear and lateral loads at each floor level for 5% of damping using seismic coefficient method.

UNIT-V CONCEPTS OF EARTHQUAKE RESISTANT DESIGN

2-Marks

1. Define the following terms
   1. Rotational ductility
   2. Curvature ductility.
2. Define the terms DBE, MCE and MMI.
3. Define diaphragm discontinuity.
4. List out the factors affecting ductility.
5. Define ductility ratio.
6. Identify the methods of improving element level ductility.
7. Explain structural plan density.
8. Explain two cases of design horizontal earthquake load.
9. Identify the importance of ductility in RC structures.
10. Examine the design considerations made in masonry structures.
11. Write short note special confining reinforcement.
12. What are the methods available for lateral load analysis of rigidly joined frames?
13. Distinguish between weak storey and soft storey.
14. List the planning consideration made as per IS 4326:1993 for masonry building.
15. What do you mean by lateral load analysis?
16. Discuss about the strong column-weak beam design concept.
17. What do you know about displacement ductility?
18. Analyse the reason for high casualty during earthquake
19. Evaluate the causes of damages due to earthquake.
20. Formulate the steps to improve global level ductility.

13- Marks

1. List out the codal provisions for architectural considerations and structural design consideration as per IS 4326:1993.
2. Elaborate the design principles involved in design of masonry structure.
3. Explain the methods to improve local and global level ductility.
4. Explain the principles and practice of earthquake resistant design of R.C.C buildings.
5. Classify the damages and non-damages occurred in masonry buildings during an earthquake with examples.
6. Identify the different methods adopted in introducing ductility into RC structures.
7. List the design steps involved in equivalent static force analysis (lateral load analysis).

POLYTECHNIC, B.E/B.TECH, M.E/M.TECH, MBA, MCA & SCHOOLS

Notes   *Available @*
Syllabus
Question Papers   www.binils.com
Results and Many more…

8. What is the effect of ignoring the contribution of masonry infill in the lateral load analysis of a multi-storey frame?

9. Compare and contrast earthquake design of masonry and RC structures.

10. Explain the factors affecting ductility.

11. Describe the importance of ductility in earthquake resistant design.

12. Analyse the causes of damages occurred in RC building during earthquake.

13. List out the design principles of earthquake resistant structure as per IS 1893-2002.

14. Explain the concept of base isolation techniques.

15. Write a short note on type of damper with neat sketch?

www.binils.com