

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – December 2023
Programme Name: M Tech (NAOE)
Semester: 3
Subject Code: PG11E2302
Subject Name: ANALYSIS OF OFFSHORE STRUCTURES

Date: 06-12-2023

Max Marks: 60

Duration: 03 Hrs

Pass Marks: 30

General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.

Section A:

10 MCQs of 01 Mark Each = 10 Marks

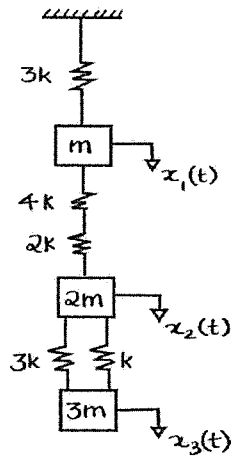
1. Gravity based structure fail due to
 - a) sliding and rocking
 - b) bearing capacity failure
 - c) Liquefaction.
 - d) All the above
2. Buoyancy chamber in articulate towers, ensures
 - a) Additional re centering capacity
 - b) Additional flexibility
 - c) Additional rigidity
 - d) Additional weight
3. Guy lines in Guyed towers are restrained in
 - a) Sway and Pitch motion
 - b) Surge and Heave motion
 - c) Surge and Sway motion
 - d) Heave and Roll motion
4. _____ spectrum is used for calculating seismic forces.
 - a) Pierson Moscowitz spectrum
 - b) Kanai-Tajimi spectrum
 - c) Johnswap spectrum
 - d) Response spectrum
5. Dunkerley proposed an approximate method for determining.
 - a) Higher mode frequencies of vibrating system
 - b) Fundamental frequency of vibrating system
 - c) Frequencies of all modes of vibrating system
 - d) All the above

6. In estimation of total response of multi degree of freedom system, higher modes
 - a) can be truncated
 - b) should be included
 - c) should be truncated
 - d) none of the above
7. Scouring and wave structure interaction problems are reduced by
 - a) Perforated cylinder structures
 - b) Vertical cylinder structures
 - c) Horizontal cylinder structures
 - d) none of the above
8. As per design philosophy of a TLP,
 - a) weight of structure exceeds buoyancy force
 - b) weight of is equal to buoyancy force
 - c) buoyancy force is proportional to weight of structure
 - d) buoyancy exceeds weight
9. The units of a_0 and a_1 in Rayleigh's damping equation are ____ and ____ respectively.
 - a) sec and sec^{-1}
 - b) sec and m/sec
 - c) sec^{-1} and sec
 - d) N/sec and sec
10. In stationary process, statistical properties of data are
 - a) same for all points in time
 - b) different for all points in time
 - c) are dependent on time step
 - d) none of the above

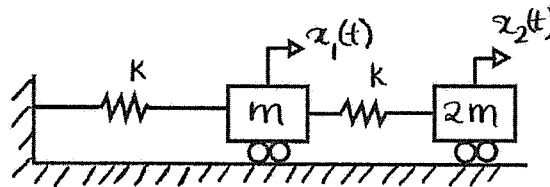
Section B:

5 out of 7 Questions of 8 Marks Each = 40 Marks

11.
 - a) What are the different wave theories and how appropriate wave theory is selected using wave selection chart? [4M]
 - b) List the spectrums used for determining wave forces and write the expressions of these spectrums. [4M]
12. What are the different types of compliant offshore structures? Explain in detail their structural action, advantages, and disadvantages.
13. Explain
 - a) principle of Mode superposition method and [4M]
 - b) Concept of mode truncation. [4M]
14. Determine the natural modal frequencies and mode shapes of MDOF shown in the figure using Influence Coefficient method. Take $m=1000$ kg and $k= 1200$ kN/m.



15. Write short notes on Fluid Structure interaction and explain how perforated members affect the hydrodynamic response of offshore structures.
16. Find damping matrix for MDOF shown in the figure using Rayleigh damping. Take $m=2500\text{kg}$, $K=1000\text{ kN/m}$ and damping ratio = 5%.

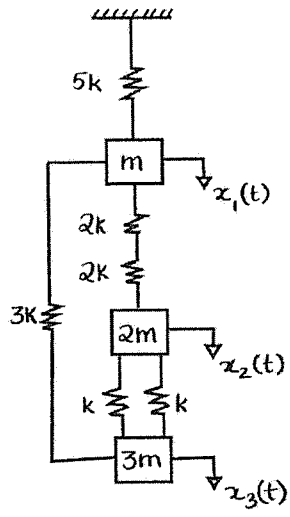


17. Explain spectral fatigue analysis briefly and deterministic fatigue analysis in detail.

Section C:

1 out of 3 Questions of 10 Marks Each = 10 Marks

18. Derive the stiffness matrix for a four-legged square TLP.
19. Derive the response of a damped forced SDOF vibration system. Explain dynamic magnification factor.
20. Determine the natural modal frequencies and mode shapes of MDOF shown in the figure using Eigen solver method. Take $m=1000\text{ kg}$ and $k=1200\text{ kN/m}$.



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