Model Question Paper

SECOND SEMESTER M. TECH. DEGREE EXAMINATION

(CIVIL - STRUCTURAL ENGG. & CONSTRUCTION MANAGEMENT)

CSD 2001: DESIGN OF OFFSHORE STRUCTURES

(2013 Scheme)

Time: 3 Hours Maximum: 60 Marks

(Answer any TWO full questions from each module)

Module-I

1. a) How are ocean waves classified? (3 marks)

   c) Differentiate between fixed and compliant offshore platforms. Cite examples of both. (3 marks)

   c) Describe the installation procedure for a Jacket Platform with the help of neat sketches (4 marks)

2. a) Derive the expression for fluid particle displacements for small amplitude wave theory. Also sketch the paths of the particles for deep water, shallow water and intermediate depth conditions (6 marks)

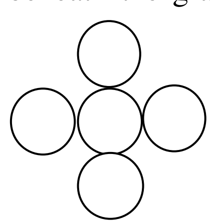
   b) Estimate the wave power in kW per metre length of the coast if wave height is 8 m and period is 12 s for deep and shallow water conditions. (4 marks)

3. a) Differentiate between wave refraction and wave diffraction. Use sketches. (6 marks)

   b) Estimate the wave power in kW per metre length of the coast if wave height is 8 m and period is 12 s for deep and shallow water conditions. (4 marks)

Module-II

4. Evaluate the soil pressures beneath the gravity platform with a base plan as shown in figure:



Total vertical load on gravity tower = 10,600 kN

Bending moment about base = 12,000 kNm

Diameter of the caissons = 5.0 m (10 marks)

5. Estimate the maximum wave force on a fixed vertical cylinder using Morison's equation for the data given below:

Diameter of cylinder	=	0.6m
Wave Height	=	6.0m
Water depth	=	40m
Wave period (T)	=	14 s, C_D=1.0, C_M=2.0

(10 marks)

6. The main leg of a Jacket platform is 1.4 m outer diameter and has 25 mm wall thickness. If the effective length of the member is 16.5 m and the yield stress is 325 MPa, (a) find the permissible load in the axial compression in the member (b) If the axial load is only 75% of that in (a), find the additional BM about one of the axes that can be resisted by the main leg member. (10 marks)

Module-III

7. a) Detail the Palmgren-Miner rule for cumulative damage ratio.

b) For an offshore structural component, the S-N curve is given by :

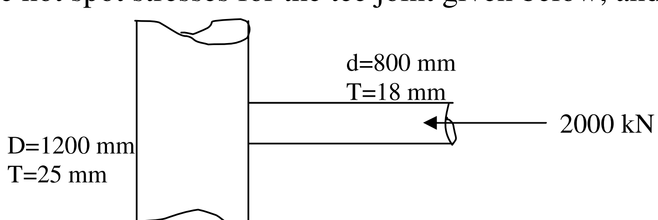
$\log N = -3.01 \log S + 15.03$, where S is stress in MPa.

The stress ranges in actual number of cycles that the component is subjected to are given in Table. Using Palmgren-Miner rule, check the safety of the component and estimate the life of the structure.

Stress level, MPa	1000	800	550	250	100
No. of cycles	0.10×10^6	0.75×10^6	1.25×10^6	10.5×10^6	12.10×10^6

(10 marks)

8. a) Discuss how stress concentration in tubular joints can be reduced.
b) Determine the hot spot stresses for the tee joint given below, and comment.



Effective length is 12 m, and allowable stress 360 MPa. (10 marks)

9. a) Discuss the applications of offshore pipelines. (4 marks)
b) Discuss the functions of a stinger beam in a lay barge. Use a neat sketch (6 marks)