Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Design of Floating Structures **Semester: 2**
Program: M.Tech. (Structural Engineering) **Time : 03 hrs.**
Course Code: CIVL 7020P **Max. Marks: 100**

Instructions: This is open book examination . Students are allowed to bring hard copy of notes, codes, books and other reference material and use them in examination. Any data required and not provided should be assumed suitably and clearly stated.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	In offshore structures, which zone of sea is considered to be most dangerous from corrosion point of view, and why.	**4**	**CO1**
Q 2	According to Airy linear wave theory, the velocity and acceleration of a linear wave do not achieve maximum values at the same instant of time. Do you agree with the statement. Give reason why.	**4**	**CO1**
Q 3	Explain, what is the effect on 'ringing' of offshore structures due to variations in density of sea water.	**4**	**CO1**
Q 4	Why are steel spirals provided on the body of spar offshore platforms .	**4**	**CO2**
Q 5	Which location today, is considered most suitable to place the turret in the FPSO. Give reason .	**4**	**CO3**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	An offshore structure is to be constructed in Indian Ocean at a distance of 150Km from Mumbai. The hull of structure is located 15m above the Mean Sea Level (MSL). The hull consists of three decks spaced vertically 10m above each other. Calculate the velocity of wind hitting on the different decks of offshore structure. Assume wind velocity at Mumbai as 44m/s.	**10**	**CO1**
Q 7	An offshore structure is to be designed for the sea state as shown below: Calculate the maximum wave height to be used for design of structure . If the structure is designed for operating condition, will the maximum wave height likely to be less or more. Give reason for your answer.	**10**	**CO1**

<table>
<tr><td></td><td>a. For extreme condition:
<table><tr><th>Height of waves (m)</th><th>Number of waves</th></tr><tr><td>18</td><td>14000</td></tr><tr><td>18.5</td><td>15200</td></tr><tr><td>19</td><td>16400</td></tr><tr><td>20</td><td>18000</td></tr><tr><td>21</td><td>19400</td></tr><tr><td>22</td><td>22000</td></tr><tr><td>22.5</td><td>24000</td></tr></table></td><td></td><td></td></tr>
<tr><td>Q 8</td><td>A spar platform is launched in a sea, that has tidal variations in sea as 1.3m above MSL and 1m below MSL, and design wave height as 10m in operating condition. Calculate the length of the central portion of long cylinder required for variable buoyancy and suggest a suitable length to be provided, Also give justification for length provided by you.</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 9</td><td>The leg of a tension leg platform has a diameter of 18m. The platform is to be launched in an ocean which is subjected to waves having design wave heights as 12m and 20m in operating condition and extreme condition respectively.
Assume the tidal variations from mean sea level as 2.m in high tides and 1.5m in low tides. Design suitable mooring system for the platform such that it is safe under operating conditions, using steel wires of 6mm diameter having UTS of 1800MPa. Take density of sea water as 1.2 t/m^3 .
Or
If the above platform can not be towed away during the extreme conditions, what will be the design of mooring lines.</td><td>10</td><td>CO3</td></tr>
<tr><td colspan="4">SECTION-C
(2Qx20M=40 Marks)</td></tr>
<tr><td>Q 10</td><td>A 35000 t weight four legged tension leg platform having diameter of leg as 15m is constructed in backwaters of an ocean where tidal variations are absent. The mean sea level is at a depth of 80m from sea bed. The design wave heights of waves present in ocean are 12 m and 20m in the operating and extreme condition respectively. Assume that the design wave heights in back waters are 50 % in magnitude and density of sea water as 1.1 t/m^3 . The platform has an air gap of 14m from the mean sea level. Assume the deck has a size of 55 x 55m. Determine the maximum and minimum buoyancy force for which the platform legs should be designed. Assume a suitable pontoon is present between the legs. .
Or</td><td>20</td><td>CO2</td></tr>
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	Do the above problem, assuming that no pontoon is present in between the legs.		
Q 11	A FPSO used for transport of crude oil has a weight of 70000 t and stores 12 lac barrels of oil. Suggest suitable dimensions of FPSO and design the oil storage compartments. Illustrate the details in a sketch and show most suitable position where turret can be placed . Assume density of seawater as 1.1 t/m^3 .	**20**	**CO3**