**Questions**

**Subject: Wave hydrodynamics**

1. What is meant by Fetch.?

2. What is meant by Fully developed Sea state?

3. Define swell

4. What is capillary wave ?

5. What is meant by Ultra gravity wave ?

6. What is meant by Gravity wave.?

7. What is Infra gravity wave ?

8. What is long period wave ?

9. What is Trans Tidal wave ?

10 What you mean by Progressive waves?

11. What you mean by Clapotis ?

12. What is meant by Oscillatory wave

13. Write a short note about solitary wave.

14. What you mean by shallow water wave

15. What you mean by deep water wave

16. Define relative water depth

17. Define steepness of wave

18. Define relative wave height

19. What you mean by Finite amplitude wave .?

20. Write a short note about small amplitude wave.

21. Define velocity potential or wave potential

22. What are the governing equations which we are used to derive wave potential?

23. What are the boundary conditions which we are used to derive wave potential?

24. Define Dynamic free surface boundary condition

25. What is Kinematic Bottom boundary condition ?

26. Define celerity of the wave?

27. What is meant by wave profile velocity?

28. Define wave number

29. Write down and explain Wave Dispersion relation

30. What is the relation between C ( celerity ) and C(deep water celerity) ?

31. What is the relation between L( wave length ) and L(deep water wave length) ?

32. Derive the expression for wave celerity in shallow water

33. Write down the expression for wave potential and explain the each term in it

34. Draw a neat sketch of water particle orbit in different water depth condition

35. How can we find the dynamic pressure under progressive wave ?

36. Define pressure response factor

37. Draw a neat sketch of pressure distribution under progressive wave

38. Write down the expression to find out the horizontal water particle velocity

39. A wave flume is filled with fresh water to a depth of 5m. A wave of height 1m and period, 4 sec. is generated. find deep water wave length

40. For a wave of height 2m and period 7 secs, plot the variation of orbital velocity and acceleration in the vertical and horizontal directions of a particle at a position 4m below SWL and 20 m above the sea bed. Calculate the maximum horizontal particle velocity

41. Define Diffraction coefficient K

42. What you mean by wave deformation?

43. Explain wave Refraction

44. Explain Wave Diffraction

45. What is meant by Wave shoaling?

46. Define shoaling coefficient

47. Define Refraction coefficient

48. Write down the governing equation for wave diffraction

49. State and explain Snell’s Law in wave refraction

50. What are the main reasons for the wave deformation?

51. What are the basic assumptions for the construction of refraction diagram?

52. Define refraction coefficient (K) and shoaling coefficient (K)

53. Explain the importance of the study of diffraction phenomenon

54. What are the main wave breaking conditions ?

55. Explain Spilling breaking with neat diagram.

56. Explain Plunging breaking with neat diagram

57. Explain Surging breaking with neat diagram

58. Define Ursell’s parameter

59. Describe Cnoidal wave theory and draw a typical cnoidal wave profile

60. Describe the wave theory which is used for shallow water shoaling computations

61. Define Spectral Density Function , how the amplitude of the component of the wave is related to Spectral Density Function

61. A wave height of 1 m and length 60m propagates in water depth of 6m.Which theory could be adopted for the evaluation of water particle kinematics. For the wave with the same frequency , for the range of wave heights in which stream function theory could be applied .Take care of breaking criteria

62. Classify wave theory according to Ursells number.

63. Describe solitary wave theory draw a typical solitary wave profile .

64. Describe a best theory which is very useful to study of very long wave like tsunami

65. Write down the expression for wave profile and celerity of solitary waves

66. Write down the expression for finding the total energy of solitary wave

67. Describe about Stokes wave theory

68. Write down the importance of the study of wave data .

69. Explain a method to measure the wave height of wave

70. Explain about the Spectral method of analysis of wave

71. Explain about the Statistical procedure of wave analysis

72. Define the Spectral width parameter (ɛ)

73. What is mean by wave spectrum?

74. Define significant wave height

75. Explain briefly about P-M ( Pierson- Moskowitz ) spectrum

76. Explain briefly about JONSWAP spectrum

77. State and explain Doppler Effect in wave current interaction

78. Explain how the current will be affecting wave propagation

79. What you mean by mass transport velocity?

**80**. A deep water of wave height 3.5m and period 10 sec is refracted so that the distance between the orthogonal is reduced by fifty percent at the depth of 10m and reduced by 20 % at 5m water depth. What will be the height of the wave here assuming no energy losses?

**81**. For a wave height with T=10 sec. , H=4m,evaluate the variation in the wave height when wave approaches shallow waters. Also determine the depth of water in which the wave would break theoretically

**82**. Given wave height (H)=1m,d=4m, wave period T= 8sec, Current velocity U=1 m/s.

Calculate the amplitude and the length of waves when currents are in the same direction & also in opposite direction .Also calculate the critical velocity at which would tend to break.

83.Write and explain about Morison equation

**86**. A wave flume is filled with fresh water to a depth of 5m. A wave of height 1m and period, 4 sec. is generated. Calculate the wave celerity, group celerity, energy and power.

**87**.) Oscillatory surface waves were observed in deep water and the wave period was found to be 6.7 sec.

(i) At what bottom depth would the phase velocity begin to be changed by the decreasing water depth?

(ii) What is the phase velocity at a bottom depth of 15.3 m and 3.06 m.

**88**. A wave flume is filled with fresh water to a depth of 5m. A deep-water wave height 2m and time period, 4 sec. is generated. For a given n=0.6689, calculate the wave celerity, group celerity, energy and power.

**89**. A wave of height 3m and period, 6 sec. is generated. Calculate the wave celerity, group celerity, energy and power in water depths, 2m

**90**. The semi major axis and semi minor axis are 1.1m and 1.0m at z = -2m. Calculate the water depth, time period, wave height corresponding to this, as well as deep water wave height when k = 0.14 and also find the displacement at z=-5 m, at sea bed and at free surface.

**91**. Consider a particle initially 5m below the SWL and 20 m above the sea bed. After the wave motion is established, what is the size and character of the orbit of the particle. Repeat the calculations for the particle at the surface and the other at the sea bed. L=33m and a=2 m

**92**. For a wave of height 2m and period 7 secs, plot the variation of orbital velocity and acceleration in the vertical and horizontal directions of a particle at a position 4m below SWL and 20 m above the sea bed. Estimate the maximum velocities at this position, at SWL and at the sea bed.

**93**. Determine the maximum orbital velocities and accelerations in the horizontal and vertical directions of the particle at a position (i) 3.06m below SWL and 12.24 above the sea floor (ii) at SWL and at the sea bed for H = 2.82 m and T = 6.7 sec.

**94**. A wave with a height, 5.5m and period, 8 secs propagates in a water depth of 15m. Determine the local horizontal and vertical velocities at a depth 3m below the SWL when phase angle is 60o

95. A wave of height 5.5m and wave length of 81.79m propagates in a water depth of 15m. Determine the local horizontal and vertical velocities at depth 3m below the SWL at a position one fifth ahead of the wave crest

**96**. A wave of height H = 3m and wave period T = 10s, propagates in a water depth of 12m, the corresponding deep-water wave height Ho = 3.5m. Estimate,

(a) The horizontal and vertical displacements from its mean position at z = 0 and

Z=-d.

(b) The maximum water particle displacements at a depth of 7.50m below SWL,

Where the wave is in deep water.

(c) Also, compare the water particle displacements in deep water conditions for the corresponding deep-water wave height, Ho = 3.5m and wave period T = 15s at z = -7.5m

**97**. Aerial photographs of a coastal line displayed the presence of two wave systems. One with crests 60m apart and another with crests at 12m spacing. Timing of major breaking on the beach in the same period indicated the wave period to be10 sec., for the longer wave. What was the depth of water in the zone of wave observation and what was the period of the minor wave system?

**98**. Ocean waves measure 90m from crest to crest when travelling at a point at a speed of 32 km/hr. Find the depth in the ocean at this point and the period of waves. If the waves were fully grown and their steepness, H/L = 1/23, what is the wave height?

99. If a pressure sensing instrument is set up at 4m below SWL in a water depth of 20m, determine the phase distribution of pressure head this instrument would record. Plot this pressure head against phase and compare this result to the phase variation of hydrostatic pressure. The wave height is 2m and period is 10 sec. and γ = 1020 kg/m3.

**100**. A subsurface pressure type recorder is installed at a depth of 6m at the point where water depth is 8m. The average maximum pressure and the period registered by the recorder are 3060 kg/m3 and 9.2 sec respectively. Compute η, γ = 1020 kg/m3

**101**. An average maximum pressure of 12500 kg/m2 is measured by a sub surface pressure recorder located at 0.6m above the sea bed in a water depth of 12m. The average wave frequency is 0.0666 cycles/sec. and γ = 1025 kg/m3. Determine the wave height.

**102**. Water depth, d =12m, Wave period, T=10sec and Wave height, H=1.0m.

(a) Calculate mass transport velocity, u(z) for z=0 to –d and find out the effect of z/d on u(z)

(b) d=12m, T=10sec and H=0.5 to 9m at 0.5m interval. Find the effect of H/L on u(z) at z=0.0

(c) d=12m, H=2.0m and T=5 to 15sec at every 1sec interval. Find the effect of d/L on u(z) at z=0.0

118. Explain about various Force Regimes

119. Explain how to calculate Diffraction force

120. What is mean by wave slamming ?

121. Explain the various methods to find out C( drag coefficient )and C

122. State and explain MacCamy and Fuch’s Linear Diffraction Theory

123. Define Keulegan Carpenter number (KC)

124. A pile of diameter 1.25mrests on the sea bed in a water depth of 14m and subjected to the action of waves of height 6m and period 10 sec. Determine (i) the phase variation of wave force, the distribution of maximum wave force along the depth , maximum total wave force and moment about the bottom. ii ) the maximum force and moment due to the wave with above characteristics in presence of a uniform current of 1 m/sec in the direction of wave propagation .

125. Derive an expression for wave potential and water particle kinematics

126.Show that the drag force due to wave on vertical cylinders in deep water will be more than the inertia force only if H/D >4π

127. Explain the regions of application of wave force formulas, with graph.

128. A single point mooring buoy 3m in diameter is anchored in 120m water depth. The SPM has a draft of 15m.If the significant wave height is 2.5m and the period is 12 sec. Calculate the maximum force acting on the buoy.

129. Compute the maximum drag , inertia and maximum total force for given data

D=1.0m, H=7m, d=100m, T=10sec, C=1.0, C=2.0

130. A pile of diameter, D of 0.75m is to be installed in a water depth, d of 100m.The wave height , H and period , T are 6m and 10 sec respectively. With C=1.0 , C= 2.0

131. Classify the loads on the offshore structure .

132. The precise evaluation of the force exerted upon a structure by an ocean wave is extremely complicated. Why?

133. What you mean by “Design wave approach ’’in wave force calculations ?

134. How can estimate the force on a fixed cylinder in a wave ?

135. What is meant by Current blockage factor .

136. What is meant by conductor shielding factor ?

137. Define Apparent wave period .

138. Define wave kinematic factor

139. What is meant by Random wave.

140. How the Morison equation will vary when wave associated with current?

141. Explain what the common statistical parameters of ocean waves are.

142. How the spectrum can be obtained

143. What are most common current categories of ocean currents?

144. In deep water in uniform current , how the wave number is related to wave frequency

145. What is Froude-Krylov force?

146. Explain how to estimate wave diffraction force on a structure

147. What is Haskind relation ?

148. What is meant by Wave Run-Up?

149. How can estimate wave breaking load?

150. What is meant by Wave Setup and Wave Set Down?

151. Explain the region of the application of wave theories with graph

152. Given H= 3.0m, T=8sec, d=12.0m find H/H

153. Classify the ocean wave

154. What are the boundary conditions used in Airy’s wave theory.

155. Derive expressions for water particle displacement under small amplitude progressive wave.

156. Derive expression for finding Kinetic energy of small amplitude progressive wave

157. Derive expression for finding Potential energy of small amplitude progressive wave

158. Derive expression for finding Energy flux( power ) of small amplitude progressive wave

159. Explain about wave deformation

160. Derive expressions to find out horizontal and vertical water particle acceleration of small amplitude waves

161. Write down the major assumptions used in Airy’s wave theory.

162. A wave of height 5.5m and wave length of 81.79m propagates in a water depth of 15m. Determine the local horizontal and vertical velocities at depth 3m below the SWL at a position one fifth ahead of the wave crest

163. A wave has 3m height and 7 seconds period in deep water. It travels towards shore over

Parallel bed contours. If its crest line makes and angle of 300 with the bed contour of 10m before refraction, calculate the wave height after crossing this contour line.

164. Confused sea waves are striking approximately normally against a semi- infinite breakwater in 6 m deep water with Hs = 2.5 m and Ts = 10 sec. What are the values of Hs and Ts at a location 400 m behind and 400 m on the lee of the breakwater?

165. A one m diameter jacket leg is subjected to an attack of waves which are 5m high,

80 m long and 10 seconds in period. Determine maximum Drag Force , maximum Inertia Force ,Total Force @ q = , at a location 10m below SWL . The water depth is 60m.

Take *C* =1; Cm=2; Use linear theory

**166.** Obtain variation of total horizontal force and moment at the sea bed with time for a circular vertical pile of diameter 1.22 m extending into a water depth of 22.9 m. The wave height is 10.67m and the wavelength is 114.3m. Take *C* =1 and *C* =2, ɤ =10.06 3KN/m³

What are the maximum force and moment values?

Use Linear Theory.

Consider two cases (a) Integration up to SWL.

(b) Integration up to Free surface.

**167.** What are the limitations of Morison equation ?

**168.** Derive the expression to find the total force( force due to wave induced pressure ) acting on a submerged horizontal cylinder with large diameter

**169**. Explain linear diffraction theory

170. Derive an expression for total velocity potential of wave diffraction

**171**. Deep water Hs = 3.315 m μ = 0.5

Ts = 9.8 sec ɤ=10.06 3KN/m³

d = 30.49 m , ʋ = 0.33 x 10 −5m²/sec

D = 1 m

θ = 0 Determine submerged weight of the pipe. Assume no refraction

**172**. What are the practical applications of wave spectrum?

174. Derive an expression for the pressure under sea surface

175. Prove that group celerity ( C ) = n ×C

Where C= wave celerity;

176. Describe various methods of ocean wave analysis

177. What are the important parameter to describe a wave ?

178. “Wave length continually decreases with decreasing depth for a constant wave period’’ - Prove this comment theoretically.

179. Prove the water particle trajectory under progressive wave is

+ =1

180. A wave of 2 m height in deep water approaches shore with straight and parallel contours at a 30" angle and has a wave period of 15 s. In water of 8 m, what is the direction of the wave, and what is its wave height?

181. Two pressure sensors are located as shown in the sketch. For an 8-s progressive wave, the dynamic pressure amplitudes at sensors 1 and 2 are 2.07 x 10⁴ N/m² and 2.56 x 10⁴ N/m², respectively. What are the water depth, wave height, and wave length?

h

Sensor 2

Sensor 1

7.62m

**182**. A wave with the following deep water characteristics is propagating toward the coast:

Ho= 1 m

T = 1 5 s

At a particular nearshore site (depth = 5 m) a refraction diagram indicates that the spacing between orthogonals is one-half the deep water spacing.

a) Find the wave height and wave length at the near shore site

(b) Assuming no wave refraction, but the same deep water information as in part (a), and that the wave will break when the ratio H/d reaches 0.8, in what depth does the wave break?

**183**. A wave with the following deep water characteristics is propagating toward the shore in an area where the bottom contours are all straight and parallel to the coastline:

Ho=3m

T= 10s

The bottom is composed of a sand of 0.1 mm diameter. If a water particle velocity of 30 cm/s is required to initiate sediment motion, what is the greatest depth in which sediment motion can occur?

184. Pile diameter , D=1.2m, water depths d=3m,5m, & 7m find the breaking wave force , Fand the moment about base , M

185. A wave flume is filled with fresh water to a depth of 15m. A wave of height 1m and period, 8 sec. is generated. Calculate the wave celerity, group celerity, energy and power.

186. Consider a particle initially 4.06m below the SWL and 13.24 m above the sea bed. After the wave motion is established, what is the size and character of the orbit of the particle. Repeat the calculations for the particle at the surface and the other at the sea bed. T = 6se c. and Ho = 4.06m.

187. The semi major axis and semi minor axis are 1.1m and 1.0m at z = -3m. Calculate the water depth, time period, wave height corresponding to this, as well as deep water wave height when k = 0.14 and also find the displacement at z=-5 m, at sea bed and at free surface

188. Consider a particle initially 6m below the SWL and 20 m above the sea bed. After the wave motion is established, what is the size and character of the orbit of the particle. Repeat the calculations for the particle at the surface and the other at the sea bed. L=30m and a=2 m

189. For a wave of height 2m and period 8 secs, plot the variation of orbital velocity and acceleration in the vertical and horizontal directions of a particle at a position 4m below SWL and 16 m above the sea bed. Estimate the maximum velocities at this position, at SWL and at the sea bed.

190. An average maximum pressure of 12500 kg/m2 is measured by a sub surface pressure recorder located at 0.6m above the sea bed in a water depth of 12m. The average wave frequency is 0.0666 cycles/sec. and γ = 1025 kg/m3. Determine the wave height

191. How C and C are varying with KC?

192. Classify waves according to the relative water depth

193. Draw the Schematic diagram of water particle Trajectories under different water depth

194. Draw the schematic diagram of pressure distribution under progressive wave at various phase position

195. Define mass transport velocity and Write down the expression to find out the mass transport velocity

196. Define Still water level (SWL)

197. Draw a neat sketch of ‘Wave Set-up’ on sloping beach

198. What is meant by Tsunamis?

199. Define Surf Similarity parameter (ξ) and write down the expression for ξ

200. Explain the phenomenon ‘Wave Reflection ’.

201. A wave has 3 m height and 7 seconds period in deep water. It travels towards shore over

Parallel bed contours. If its crest line makes and angle of 30° with the bed contour of 10m before refraction, calculate the wave height after crossing this contour line.

Data: d/L0 d/L n

0.1300 0.1655 0.7621

0.1310 0.1674 0.7606

**202.** Define the coefficient of reflection (K)

**203**. What are the factors which will be affecting the amount of reflection ?