Total No. of Questions : 12]

SEAT No. :

P2005

[Total No. of Pages :3

[4759] - 28
B.E. (Civil)
MECHANICS OF WAVES
(2008 Course) (Semester - II) (Open Elective)

Time : 3Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answer three questions from section I and three questions from section II.***
2) ***Answer to the two sections should be written in separate answer booklet.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Your answer will be valued as a whole.***
6) ***Use of electronic pocket calculator is allowed.***
7) ***Assume suitable data if necessary.***

SECTION - I

Q1) a) Discuss classification of waves. **[4]**

b) Discuss wave measurement in detail. **[6]**

c) For a wind of corrected speed 25 m/s remaining constant over a fetch of 40 km obtain Hs and Ts values using Hasselmann technique, if **[8]**

i) water is very deep

ii) water depth is 5 m

OR

Q2) a) Discuss the process of wave growth. **[4]**

b) Define wave. What are gravity waves and internal waves? Explain with examples. **[6]**

c) A slowly moving cyclone has a forward speed of 15 m/s passing over 30° latitude. The pressure at the hurricane centre is 700 mm of Hg. Maximum wind speed occurs at 60 km from the centre. What is the wave height and period at 300 km to the right of the centre. **[8]**

Q3) a) Derive equation for water particle displacement from mean position. **[8]**

b) A wave with a period 10 seconds is propagated shoreward over a uniformly sloping shelf from a depth of 300 m to 3m. Find individual wave velocity (C) and wavelength (L) corresponding to 300 m and 3m.**[8]**

OR

P.T.O.

Q4) a) Write short note on Stokes wave theory. **[4]**

b) What are the assumptions in linear wave theory. **[4]**

c) Derive expression for group wave velocity. Modify the formula for deep water and shallow conditions. **[8]**

Q5) a) What is long term wave height statistics? Name various distribution used to achieve the same while explaining Log-Normal distribution in detail. **[6]**

b) The annual maximum wave heights observed at Pondecherry in m are as follows; **[10]**

4, 5.23, 3.77, 5.88, 4.53, 4.59, 3.94, 3.12, 3.42, 6.96, 6.24, 4.43, 2.05, 5.23, 2.34, 1.25, 1.67, 3.45, 3.67, 2.35.

Find wave height of 50 year return period. For N = 20, $\overline{y_n}$ = 0.5236, S_n = 1.0628.

OR

Q6) a) Enlist various theoretical wave spectra. Explain any one of them in detail. **[6]**

b) Define stationary process, ergodic process, probability density function. **[5]**

c) Define probability density function, probability distribution function. **[5]**

SECTION - II

Q7) a) What is wave breaking? Discuss with respect to interaction with current and solitary theory. Discuss various ways of wave breaking. **[8]**

b) A beach having a 1 on 20 slope, a wave with deep water height of 3 m and a period 8 seconds travels shoreward. Assume that a refraction analysis gives refraction coefficient as $Kr = (b_o/b)^{0.5} = 1.05$ at the point where breaking is expected to occur. Find breaker height and depth at which breaking occurs. **[10]**

OR

Q8) a) Write short note on wave set up and set down. **[8]**

b) A wave of 2.8 m height and 8 second period strikes over a beach with a slope of 1 in 35. **[10]**

i) obtain the reflected wave height

ii) if the same wave strikes against the concrete wall having a slope of 1 in 8 what is reflected wave height?

Reflection coefficient for surf similarity of 0.7, 0.75 and 0.8 is equal to 0.05, 0.055 and 0.06 respectively.

Q9) a) Draw Minikin's wave pressure diagram. State formula for total breaking force on wall and total moment about toe. **[8]**

b) A wave of 1.5 m height attacks a smooth vertical wall of height 5.85 m. The depth at the structure of the toe is 3m. The net force and moment acting are 101.7 kN/m and 163.8 kNm/m respectively when wave is the crest and 17.1 kN/m and 11.8 kNm/m when wave at trough. The height of clapotis crest about bottom (y_c) is 5.5 m and height of clapotis trough (y_t) is 2.5 m. Calculate the reduced force and moment on the reduced wall of height 4.5 m. **[8]**

OR

Q10)a) Draw sketches for pressure distribution of non breaking wave forces when crest appears on the wall and trough appears on the wall. **[8]**

b) A vertical wall 4m high is sited in sea water with depth at tow (d_s) equal to 2.5 m. The wall is built on a bottom sloe of 1:20. The wave period is 8 sec. Find the maximum pressure, horizontal force and overturning moment about the toe of the wall for the given slope excluding the hydrostatic forces. The maximum breaker height (H_b) is 3m. **[8]**

Q11)a) A one meter jacket leg is subjected to an attack of waves which are 4 m high, 55 m long and 7 seconds in period. Determine the maximum drag force, maximum Inertia force, Total Force at $\theta = \pi / 4$ at a location 8 m below SWL. The water depth is 60 m. Take $C_D = 1$, $C_m = 2$, $\rho = 1030$ kg/m^3. Use linear theory. **[6]**

b) Write in brief about calculation of wave forces using Dean's theory. **[10]**

OR

Q12)a) Derive equation for Keulegan - Carpenter number. **[8]**

b) Discuss effect of roughness on C_D and C_M. **[4]**

c) Write short note on wave slam. **[4]**