Total No. of Questions : 12]

SEAT No. :

P1929

[Total No. of Pages : 3

[5254]-28

B.E. (Civil)

MECHANICS OF WAVES

(2008 Pattern) (Open Elective)

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

Instructions to the candidates:

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

SECTION - I

Q1) a) Discuss the phenomenon of wave growth considering the wave frequency and wave energy. **[4]**

b) Define wave length, wave period, wave steepness. **[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 (i) water is very deep (ii) water depth is 5 m. **[8]**

OR

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

b) Distinguish between Sea and Swell. **[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. **[10]**

Q3) a) Prove that in deep water $C_0 = \frac{gT}{2\pi}$ and in shallow water $C_s = \sqrt{gd}$ with usual notations. Start with linear dispersion relationship. How to obtain C (wave velocity) and L (wave length) in intermediate water? **[8]**

P.T.O.

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

OR

Q4) a) Write short note on choice of wave theories. **[4]**

b) Derive expression for water surface profile (η) starting with expression for velocity potential (ϕ). **[4]**

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

Q5) a) Define wave energy spectra. What are the methods of deriving wave spectra? Explain in brief. **[6]**

b) The annual maximum wave heights observed at Pondecherry in m are as follows; 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, $y_n = 0.5236$, $S_n = 1.0628$. **[10]**

OR

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

b) What is difference between short term and long term wave statistics? Give details of Rayleigh distribution for short term statistics. **[4]**

c) Define probability density function, probability distribution function. **[6]**

SECTION - II

Q7) a) What is wave reflection? Give equation of resultant wave profile. State variation of reflection with structure characteristics and wave properties. **[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) What is diffraction? Explain with neat sketch. What are the causes and effects of diffraction? Enlist the assumptions in the theory of diffraction. **[8]**

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

Q9) a) Draw pressure distribution diagram for non-breaking waves acting on vertical walls for crest and trough of clapotis on wall. What is the limitation of Sainflou's method? **[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 broken wave on wall seaward of still water level and wall landward of still water level. **[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) Discuss variation of CD and Cm with Kc (Keulegan-Carpenter number) and Reynolds number Re. **[6]**

b) Derive equation for wave force on entire member length. **[10]**

OR

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

b) Write short note on calculation of wave forces using Stokes' fifth order theory. **[4]**

c) What are limitations of Morrison's equation. **[4]**