

**INDIA METEOROLOGICAL
DEPARTMENT
QUESTION BANK
OF
ADVANCED METEOROLOGICAL
TRAINING COURSE (AMTC)
SEMESTER-I EXAMINATION
BASED ON 174-181 BATCHES
(2013-2021)
PAPER-II: PHYSICAL
OCEANOGRAPHY / MARINE
PART C**

INDIA METEOROLOGICAL DEPARTMENT
METEOROLOGICAL TRAINING INSTITUTE
MET. GR. II TRAINING COURSE
ADVANCED METEOROLOGICAL TRAINING COURSE
SEMESTER-I (PART-C)
PHYSICAL OCEANOGRAPHY / MARINE

Q.1 Choose the right answer from the given options

1. For irregular random waves the spectra is a _____ (Delta function/ broad band (spread over large frequencies). Draw a rough sketch of the spectra.
2. For winds blowing parallel to the west coast of India from the north, the surface water is transported to the _____(right/left). (right means out to sea. Left means towards land).
3. The phase speed depends on wavenumber (k) and therefore on frequency. Long waves therefore travel ----- (faster/slower) than short waves.
4. The mixed layer of the atmosphere reaches its maximum depth(i.e, height) by -----
----- (Early morning/ late afternoon).
5. Ocean water, with an average salinity of 35 psu freezes at _____ degrees Celsius.
6. Net Ekman transport is at an angle of _____ in the northern hemisphere.
7. ADCP is an example of _____ (eulerian/lagrangian) method of measuring ocean properties.
8. Deep water formation takes place in the _____.
9. Salinity of Arabian Sea is _____ (higher/lower) than that of Bay of Bengal.
10. The shallow water waves are _____(dispersive/non dispersive) in nature.
11. Net Ekman transport is at an angle of _____ in the southern hemisphere.
12. Tides have typical time periods of diurnal (24 hours), semi-diurnal (12 hours). Time period for swells are typically _____.
a . less than 1 sec b. 10-30 seconds c. 30 minutes
13. The phase speed of the water waves is given by $C_p = (g/\omega) \cdot * (_? _)$.
a. $\sinh(kd)$ b. $\tanh(kd)$ c. kd

Q.1 State whether the following are true or false

1. Albedo of the ocean surface affects the latent heat flux.
2. Albedo of the ocean surface affects the latent heat flux.
3. Eastern boundary current is strong compared to western.
4. Ekman theory is based on balance between pressure gradient and coriolis forcs.
5. Ekman theory is not applicable at the equator due to no Coriolis force.
6. Formation of gyre is due to curl of the wind stress.
7. Friction is important for geostrophic balance.
8. Inertial current is more at the equator compared to pole.
9. Internal waves formed due to the disturbances between two water masses of different density.
10. Molecular transport is important in Interfacial layer (0-1 cm) and no turbulence
11. Phase speed of Kelvin wave is eastward and group speed is westward.
12. Sea surface salinity increases as we move from equator to poles. Explain with diagram.
13. Sea surface temperatures increase as we move from equator to poles.
14. Sunlight can penetrate up to 500 meters in the upper open ocean waters.
15. The sea surface temperature in the east Pacific Ocean is higher than west Pacific Ocean during El-nino.
16. The sea surface temperature in the east Pacific Ocean is lower than west Pacific Ocean during El-nino.
17. Thermocline became deep during upwelling.
18. Tropics received more heat compared to high and mid latitude.
19. Tsunami are generated by gravitational potential of the moon and the sun
20. Tsunami is a shallow water wave.
21. Tsunamis are caused due to gravitational pull of moon and sun.
22. Oils-spill in sea occurs only when tanker-ship meets an accident

Q.2. Answer the following

1. Calculate inertial period at Mumbai (72.9E, 19.0N).
2. Write a short note on mixed layer depth of oceans Describe its importance in boundary layer studies. Does it have any seasonal dependence. What is the effect of winds and

- solar insolation on mixed layer depth (10-12 lines).
3. Define flux from a meteorological/oceanography perspective. What is conservation of mass and continuity equation. Describe heat budget and its important terms. Why is ocean heat budget different from that of land. (10-12 lines)
 4. Explain the forcing mechanism of the tides in the ocean?
 5. Write down the difference between shallow and deep water waves?
 6. Define Brunt-Vaisala frequency. Draw typical profiles (How they vary with depth) of potential temperature and salinity. (1 + 1/2 + 1/2)
 7. Make a brief note on sensitive components of marine ecosystems and various pollutants that can affect to them. (approx. 10-12 lines of short note)
 8. Draw a schematic diagram of wind vector along east and west coast of India for generation of coastal upwelling. Also explain the physics behind it.
 9. What is hydrostatic and Boussinesq approximation? Write down primitive equations for ocean and using scaling analysis show the importance of geostrophic circulation. Use interior deep sea condition for typical value of distance, velocity, depth, Coriolis parameter, gravity, density etc.
 10. Explain all possible types of dominant forcing for ocean dynamics. What is the role of Ekman theory for explaining coastal upwelling? What is Ekman pumping and explain its role on marine productivity?
 11. Kuroshio Current is warm current: True/False? and Why?
 12. Write the bulk formula for wind stress?
 13. Define Deep-water and Shallow water waves?
 14. What is marine debris and what are common types of marine debris found in the ocean?
 15. What is Marine pollution, what are types of pollution and what is point source or nonpoint source pollution?
 16. Define ocean mixed layer, Isothermal layer, Barrier Layer and thermocline depth with diagram?
 17. Write difference between boundary layer and free atmosphere?
 18. How long will a group of waves with frequency 0.07Hz and group velocity 15m/s take to cross Indian Ocean (40E-100E)
 19. El-nino Southern Oscillation (ENSO)(draw diagram)
 20. Ekman spiral, Coastal Upwelling, Open ocean upwelling. (With diagrams)

21. Compare and contrast the surface/marine boundary layer with the free atmosphere?
22. Write brief notes on Deep water waves and shallow water waves?
23. Explain important Transport processes in the marine surface layers
24. What are the various exchange coefficients. Write their usefulness (2)
25. Define Ocean mixed layer, isothermal layer and thermocline depth with diagram? (1)
26. What are the differences between swells and wind waves? (1)
27. Explain Monin-Obukhov Similarity theory.
28. Describe the temperature in the ocean beneath the thermocline?
29. Which color penetrates deeper into the ocean?
30. What is marine pollution and what are common types of marine debris found in the ocean?
31. El-nino Southern Oscillation (ENSO)(draw diagram). Also discuss the impacts of ENSO on the global monsoon systems.
32. What are inversions and write theirrole in pollution dispersion. (1 + 1 = 2 marks).