INDIA METEOROLOGICAL DEPARTMENT

QUESTION BANK

OF

FORECASTERS TRAINING COURSE (FTC)

FINAL EXAMINATION

BASED ON 176-191 BATCHES

(2013-2021)

PAPER-II: PHYSICAL OCEANOGRAPHY

PART B

INDIA METEOROLOGICAL DEPARTMENT
METEOROLOGICAL TRAINING INSTITUTE
FORECASTER TRAINING COURSE: FINAL EXAMINATION
PAPER II – PHYSICAL OCEANOGRAPHY (PART-B)

Q.1 Fill up the blanks

1. _____ is a source of water pollution in coastal areas. (Give any one example) 8. Temperature of the ocean water …… with depth.
2. _____ color penetrates the deepest in open Ocean?
3.
4. _____ pollution occurs when there is a single, identifiable, and localized source of the pollution.
5. A warmer temperature above cooler temperatures usually is a sign of _____.
6. An increase in chemical nutrients in an ecosystem resulting an increase in the primary productivity and further effects including lack of oxygen and severe reductions in water quality, fish, etc is called _____.
7. Argo Floats are used to measure _____.
8. Coriolis force is towards the _____ of the motion in the Southern Hemisphere.
9. CTD records _____, _____ and _____ of the seawater.
10. CTD sensors are used to measure _____ in the ocean.
11. Depth of mixed layer is approximately _____.
12. Drifter is an instrument designed to measure _____ .
13. Echo-sounders are used to measure the _____ of the ocean.
14. For the study of the water masses, it is convenient to make use of the …… diagram.
15. Human induced climate change is mainly due to the increased concentration of _____ gases.
16. Instrument used to measure the temperature, salinity and depth of sea water is _____
17. Inversing thermometers are used to measure _____.
18. Mass of salt per unit mass of sea water is termed as _____
19. Most of Earth's water is located in the _____ layer of the ocean.
20. Nansen and niskin bottles are used to measure _____
21. Non-Point source pollution is due to _____.

22. Oceanic layer where rapid change of density with depth is called _____ ?
23. Oceanic layer where rapid change of density with depth is called _____ ?
24. Oceanic layer where rapid change of salinity with depth is called _____ ?
25. Oceanic layer where rapid change of temperature with depth is called _____ ?
26. Point source pollution is due to _____.
27. Pressure in the ocean _____ with depth. (increases/decreases)
28. Sea level rise can be measured using _____.
29. Sea Surface temperature difference between equator and poles is due to _____.
30. Temperature rise of ocean water associated with _____ increases the Sea Level.
31. The oceans contain approximately _____% of all the Earth's water?
32. The pressure at 4000m is approximately _____ bar.
33. Upwelling leads to _____ productivity. (high/low)
34. Water has _____ (high/low) heat capacity.
35. Water molecule has a _____ structure.
36. What is percentage of pollutants Entering into the Ocean due to Sewage? _____
37. Sea Surface temperature difference between equator and poles is due to _____.
38. Thermohaline circulation is driven by differences _____

Q.2 State whether the following are true or false

1. Atlantic Ocean is the most saline ocean basin.
2. Average movement of seawater under influence of wind is 90° to left of wind in Northern hemisphere
3. Climatology of SST indicates a warmer SST over southeast Pacific Ocean than that of equatorial West Pacific.
4. Density of moist air is less than dry air at the same temperature. If yes, why so?
5. Directly discharging sewage and industrial waste into the ocean is an example of point source pollution.
6. Eutrophication has created enormous dead zones in several parts of the world.
7. Garbage patches accumulates at the polar region
8. Global warming induces more river runoff and more nutrients supply to Ocean.
9. Heat capacity of ocean is high compared to land
10. In a T-S diagram, constant density lines are parallel to the X-axis.

11. Ocean appears violet in color.
12. Oil pollution in the Ocean is mostly due to Industrial wastes
13. Salinity in the ocean ranges from 2 to 50 psu.
14. Salinity is high in the Pacific as compared to the Atlantic Ocean.
15. Salinity is less over equator and in sub-tropics and high in extra-tropics.
16. Salinity is measured using CTD.
17. Sea ice melting leads to an increase in ocean surface salinity.
18. Sea surface salinity increases as we move from equator to poles. Explain with diagram.
19. Sea Surface temperature warmest in the sub-tropics and coldest in high latitude.
20. Sea-level rise (SLR) drives changes in the distribution of sea grass and coral reefs.
21. SOFAR channel is important because the sound waves propagate upto larger distances in that zone.
22. Submarine faults, Volcanic eruptions and Submarine landslides causes Tsunami waves?
23. The average current in the Ekman layer is at an angle of 90 degrees to the right of the wind in Northern Hemisphere.
24. The biggest culprit for eutrophication in the oceans is rivers that empty into the ocean.
25. The heating due to ultraviolet and visible light can penetrate much deeper than infrared radiations.
26. The increasing levels of carbon dioxide is acidifying the oceans.
27. The interaction of sunlight is different in the open ocean and the coastal ocean.
28. The mixed layer is roughly 10-200 m thick over most of the tropical and mid-latitude belts?
29. The oceans are becoming more acidic due to increased atmospheric CO2.
30. The polar snow cover has been reduced due to global warming.
31. The pollution in the oceans are only due to direct discharge of waste into the oceans.
32. The speed of a group of waves all traveling at the same speed in the same direction is less than the speed of the waves within the group
33. The strong summer monsoon winds lead to upwelling along the Somali coast in the Indian Ocean. If true, explain how.
34. The unit of salinity is parts per thousands.
35. Tides are generated by the gravitational potential of the moon and the sun.
36. Currents along the Peru coast are cold currents.

Q.3 Answer the following

1. Define (a) Ekman pumping, (b) Ekman layer, (c) Ekman current
2. Define coastal upwelling.
3. Define Ekman current.
4. Define Ekman spiral, Ekman depth, Ekman current and Ekman pumping.
5. Define Ekman spiral.
6. Define El Nino Southern Oscillation.
7. Define El Nino.
8. Define ENSO.
9. Define Indian Ocean Dipole
10. Define IOD and explain its regional impacts.
11. Define mixed layer.
12. Define the heat budget of the upper ocean? And explain the different components of heat budge.
13. Define thermohaline circulation.
14. Define western boundary intensification.
15. Describe briefly the different types of Marine pollution.
16. Explain Ekman transport, Ekman spiral, western boundary intensification?
17. Explain how increasing heavy rainfall events affect marine life.
18. Explain Southern Oscillation and El Nino?
19. Explain the different processes responsible for the SST cooling during cyclone.
20. Explain the distribution of density and temperature along latitudes and depth. Explain with suitable diagrams?
21. Explain the heat budget of the ocean mixed layer with the help of the heat budget equation.
22. Explain the heat budget of the ocean mixed layer.
23. Explain the impact of global warming on coastal population.
24. Explain the major subtropical gyres with diagrams.
25. Explain the oceanic heat budget along with the curve.
26. Explain the types of marine sediments found in the ocean.
27. Explain the working principle of ARGO floats?
28. Explain thermostatic effects of water?

29. Give one example each for a warm current and cold current.
30. How can seawater's density be altered?
31. How does equatorial upwelling take place?
32. How does global warming affect coastal population?
33. How does ocean force atmospheric motion?
34. How does salinity vary generally with latitude? With depth?
35. How does sea level rise affect coastal ecosystem?
36. Name a few methods to measure ocean temperature and salinity?
37. Name any four ocean currents.
38. Name any instrument to measure sea surface temperature.
39. Name at least four regions that effected by El Nino or La Nina?
40. Name two warm currents and cold currents.
41. Show by an example that Rossby waves propagate westward.
42. State a difference between latent heat of evaporation and latent heat of condensation.
43. State a positive air sea feedback mechanism associated with El Nino.
44. State any four techniques to measure sea surface temperature?
45. State any one difference between latent heat of evaporation and latent heat of condensation.
46. State any one satellite measurement technique for SST observation.
47. State any two methods widely used to observe SST.
48. State the mechanism responsible for coastal upwelling.
49. State two conditions under which ocean mixed layer will deepen.
50. State two factors affecting latent heat flux.
51. State two factors which can affect latent heat flux over ocean.
52. State two factors which influence the short wave radiative flux over a region?
53. State two processes which will deepen the mixed layer.
54. State whether the air sea interaction is intense over the tropics or mid latitudes.
55. State whether the mixed layer depth is more during day time or night time under ideal conditions.
56. What are differences between Arabian Sea and Bay of Bengal?
57. What are major consequences of sea-air interaction processes?
58. What are Mixed Layer, Isothermal Layer and Barrier Layer? Explain with diagram.
59. What are passive and active sensors?
60. What are subtropical anticyclones?

61. What are the different sources for marine pollution?
62. What are the different types of boundary currents? State their characteristics.
63. What are the factors influencing latent heat flux?
64. What are the implications if the thermohaline circulation slows down?
65. What causes waves and give example of Ocean waves?
66. What is ARGO?
67. What is Barrier Layer depth?
68. What is Ekman spiral?
69. What is ENSO?
70. What is flow and Ekman spiral? Write in detail.
71. What is Indian Ocean Dipole?
72. What is marine pollution?
73. What is the difference between skin temperature and bulk temperature?
74. What is the name for a zone where temperature rapidly changes with depth?
75. What is the relationship between Indian summer monsoon and El Nino?
76. What is thermohaline circulation?
77. What is upwelling and Downwelling?
78. What is Walker circulation? Give a brief description on its association with El Nino.
79. Write a brief note on any one tidal power generating mechanism.
80. Write a note on ARGO floats and Moored Buoys.
81. Write a short note on El Nino Southern Oscillation (ENSO).
82. Write any three differences between El Nino and La Nina?
83. Write Ekman equations?
84. Write equation for wind stress?
85. Write heat budget equation and explain Ekman Spiral?
86. Write major regions of upwelling and downwelling over tropical Oceans?
87. Write Ocean heat budget equation and explain different terms?
88. Write working principle of ARGO float, XBT and CTD.

Q.4 Write Short notes

1. Describe the vertical profile of temperature in the ocean with diagram?
2. Explain the working principle of ARGO floats?
3. Explain thermostatic effects of water?

4. Name the instruments used to measure ocean currents and ocean temperature?
5. What causes sea level rise and how does it affect environment?
6. What is T-S diagram and explain importance?
7. Write a note on Eutrophication and Acidification? 2) Explain T-S diagram?
8. Write a note on Oil pollution and Bioaccumulation?