Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – December 2023

Programme Name: B.Tech (NASB)

Semester: 1 semester

Subject Code: UG13T1102

Subject Name: Engineering Physics

Date: 18.12.2023	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. What is the specific heat capacity of water?
A) 0.1 J/g°C
B) 1 J/g°C
C) 4.18 J/g°C
D) 10 J/g°C

2. When a gas expands in an adiabatic process, what happens to its entropy?
A) It increases
B) It decreases
C) It remains constant
D) It depends on the initial conditions

3. What is the term for the point where parallel rays of light either converge or appear to diverge after passing through a lens or reflecting surface?
A) Focus
B) Aperture
C) Diffraction
D) Aberration

4. Two coherent sources of light emit waves with a phase difference of 180 degrees. What type of interference will occur when these waves overlap?
A) Constructive interference
B) Destructive interference
C) No interference
D) Diffraction

5. What is the principle of superposition in wave behavior?
A) It refers to the reflection of waves off surfaces.
B) It describes how waves combine when they overlap.
C) It explains the phenomenon of wave interference.
D) It refers to the bending of waves around obstacles.

6. What does the Doppler effect describe?
A) The change in wave frequency due to motion
B) The reflection of waves off a boundary
C) The interference of waves
D) The diffraction of waves

7. Which effect is responsible for the generation of a voltage across a thermoelectric material when there is a temperature difference between its two ends?
A) Photoelectric effect
B) Peltier effect
C) Hall effect
D) Seebeck effect

8. In which units is the pointing vector typically expressed?
A) Watts per square meter (W/m^2)
B) Newtons per square meter (N/m^2)
C) Volts per meter (V/m)
D) Amps per meter (A/m)

9. What is the coordination number of an atom in a simple cubic lattice?
A) 4
B) 6
C) 8
D) 12

10. What is the energy bandgap of a semiconductor?
A) The energy difference between the valence band and the conduction band
B) The energy required to move a charge carrier through the crystal lattice
C) The energy level of the Fermi energy
D) The energy level of the doping atoms

Section B

Five Questions of 02 Marks each

11. Describe the term internal energy of a system and explain how the change in internal energy contribute to the work done by the system.

12. List out and explain various types of interference of electromagnetic radiation.

13. Explain the concept of beats in wave phenomena. Provide an example and discuss the factors that determine the beat frequency.

14. Explain the concept of thermoelectric EMF in thermocouples and how it relates to temperature measurement.

15. Describe a body-centered cubic (BCC) lattice and compare it to the FCC and simple cubic lattices in terms of atom arrangement.

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. A steam engine takes in steam at 120°C and exhausts it at 40°C. If the engine does 5000 J of work in each cycle, calculate the heat transferred to the engine in each cycle. Given Cv = 20.92 J/(mol·K).

17. A concave mirror has a focal length of 20 cm. An object is placed 30 cm in front of the mirror. Calculate the position, nature (real or virtual), and magnification of the image.

18. Derive the equation for the velocity of a transverse waves along a stretched string with the help of the neat sketch.

19. Explain the concept of total EMF in a thermocouple. How does the total EMF depend on temperature differences and the Seebeck coefficients of the thermocouple materials. Provide a mathematical expression for total EMF.

20. Derive the one dimensional wave equation with the help of neat sketch.

21. In a Young's double slit experiment, two slits are separated by 0.32 mm and the screen is placed at 1.5 m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.3 cm. Determine the wavelength of light.

22. Discuss the Bravais lattice types and their relationships to crystal systems. Explain how the choice of Bravais lattice affects the calculation of lattice constants. Calculate the lattice constant for a face-centered cubic (FCC) crystal.