

**INDIAN MARITIME UNIVERSITY**  
(A Central University Government of India)  
Dec'24 ESE  
**Diploma in Nautical Science**  
Semester I  
**APPLIED SCIENCES**  
**Subject Code: UD11T5102**

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**Max. Marks: 70**  
**Time: 03 Hours**

**Pass Marks: 35**  
**Date: 03.12.2024**

**Note: Section A (20 Marks) – Q1 & Q2 are compulsory.**  
**Section B (50 Marks) - Answer any 5 questions from Q3 to Q9**

Use of Non-programmable Scientific Calculator is permitted

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Part A

1. Multiple Choice Questions (10 X 01 Mark)

(i) For a coil having a magnetic circuit of constant reluctance, the flux is \_\_\_\_\_ to the current.

- a) Directly proportional                      b) Inversely proportional  
c) Not related                                      d) Very large compared

(ii) Magnetic flux density at a point 'r' distance away from long wire due to electric current 'i' in it is \_\_\_\_\_

- a)  $\mu_i/2r$     b)  $\mu_i/r$   
c)  $\mu_i/2\pi r$     d)  $\mu_i/\pi r$

(iii) The current in a solenoid is 30A; the number of turns per unit length is 500 turns per metre. Calculate the magnetic field if the core is air.

- a) 18.84T    b) 18.84mT  
c) 1.84T    d) 1.84mT

(iv) What is the role of the transmitter in the communication system?

- a) to decode a signal to be transmitted  
b) to convert one form of energy into other  
c) to detect and amplify information signal from the carrier

d) to produce radio waves to transmit data

(v) Which type of ground wave travels over the earth surface by acquiring a direct path through air from transmitting to receiving antennas?

- a) Surface wave
- b) Space wave
- c) Both a & b
- d) None of the above

(vi) Sound propagates maximum in \_\_\_\_\_.

- a) Solids
- b) Liquids
- c) Gas
- d) All

(vii) Hearing range of human ear is

- a) Below 20Hz
- b) Above 20KHz
- c) 20Hz – 20KHz
- d) 20KHz – 80KHz

(viii) In SHM, maximum displacement of particle from mean position is known as \_\_\_\_\_.

- a) Amplitude
- b) Frequency
- c) Cycle
- d) Time period

(ix) In vacuum light travels at a speed of \_\_\_\_\_.

- a)  $3 \times 10^7$  m/s
- b)  $3 \times 10^{-7}$  m/s
- c)  $3 \times 10^8$  m/s
- d)  $3 \times 10^{-8}$  m/s

(x) Most common used temperature scale is \_\_\_\_\_.

- a) Kelvin
- b) Celsius
- c) Fahrenheit
- d) None of the above

2. Short answer questions

(2 x 5 = 10 Marks)

- a) Define real expansion & coefficient of real expansion.
- b) What is simple harmonic motion?
- c) Define RMS value of ac supply.

d) What is an antenna & list type of an antenna?

e) Define static electricity.

### Part B

3. a) Explain Law of conservation of energy. (5)

b) The resistivity of copper is  $1.724 \mu\Omega\text{-cm}$ . Find the resistance of copper rod having diameter of 1mm and length of 1m. (5)

4. (a) A nail of mass 0.02kg is driven into a fixed wooden block, its initial speed is 30 m/s and it is brought to rest in 5 m/s. Find impulse & Value of the force. (5)

(b) State ohm's law and what are limitations of ohm's law. (5)

5. Explain with neat diagram, construction and working of AC generator. (10)

6. (a) A harmonic oscillation is given by following equation,

$$y = 0.26 \cos \left[ 4000t + \frac{\pi}{6} \right]$$

Where "y" in mm and "t" in sec. Find amplitude, frequency, angular frequency, time Period. (5)

(b) Define self-induction and mutual induction. (5)

7. (a) Discuss the characteristics of sound. (5)

(b) Two trains traveling in opposite directions on parallel tracks at 100 km/hr each, cross each other. One of them is whistling a note of frequency 800Hz. Find the apparent pitch as heard by the passenger in the other train

I. Before they cross each other

II. After they cross each other

Velocity of sound is 340 m/s. (5)

8. (a) What is Total Internal Reflection (5)

(b) Draw & explain radio receiver. (5)

9. (a) If the refractive index of glass is 1.5, then what will be the speed of light in glass? Given speed of light in vacuum =  $3 \times 10^8$  m/s. (5)

(b) Explain basic working principle of RADAR system.

(5)