Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/BNS/SEM-1/BNS-103/2011-12

2011

NAUTICAL PHYSICS AND ELECTRONICS-I

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) The magnifying power of a telescope can be increased by

      a) increasing focal length

      b) fitting eyepiece of higher power

      c) fitting eyepiece of lower power

      d) increasing the distance of object.

   ii) The communication of light wave through optical fibre is due to

      a) Refraction

      b) Total internal reflection

      c) Dispersion

      d) Polarisation.

iii) White light enters in a lens. It undergoes a change in

a) frequency only

b) wavelength only

c) velocity only

d) wavelength and velocity.

iv) The product of the molecular weight (M) and characteristic gas constant (R) is

a) more for lighter gases

b) more for heavy gases

c) constant

d) dependent upon the temperature of the gas.

v) The ratio of the two specific heats γ of a gas is

a) equa to 1

b) always less than 1

c) always greater than 1.

vi) The speed of sound in air at N.T.P. is 300 m/s. If air pressure becomes four times, then the speed of sound will be

a) 150 m/s b) 300 m/s

c) 600 m/s d) 1200 m/s.

vii) A ship of mass $3 \infty 10^4$ kg initially at rest is pulled by a force of $5 \infty 10^4$ through a distance of 3m. Assume that the resistance due to water is negligible. The speed of the ship is

a) 1·5 m/s b) 60 m/s

c) 0·1 m/s d) 5 m/s.

viii) Dimensions of work are

a) $M^2 L^1 T^2$ b) $M^0 L^2 T^{-2}$

c) $M^3 L^2 T^3$ d) $M^1 L^2 T^{-2}$.

ix) If a particle excutes S.H.M. having time period T then the period with which P.E. changes is

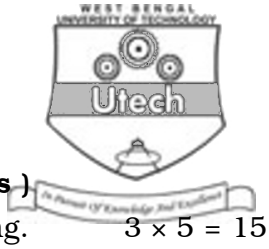
a) T b) $3T$

c) $2T$ d) $T/2$.

x) An iceberg is floating partly immersed in sea water. The density of sea water is 1·03 gm/c.c. and that of ice is 92 gm/c.c. The fraction of the total volume of the iceberg above the level of sea water is

a) 8·1% b) 11%

c) 34% d) 0·8%.



GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. a) Define dew point and relative humidity.

   b) Why much more deposition of dew occurs in winter than that occurring in summer ?

3. a) What do you mean by anomalous expansion of water ? 2

   b) A quantity of air occupies 10^3 m^3 at 25°C and $2{\cdot}5 \infty 10^5$ N/m^2 pressure. At what temperature will it occupy $3 \infty 10^3$ m^3 at $0{\cdot}8 \infty 10^5$ N/m^2 pressure ? 3

4. a) Explain the origin of surface tension using the molecular theory. 2

   b) A body is suspended in a spring and causes a stretch of x metres. If the body is now set in vertical oscillations of small amplitude, calculate time period of oscillation. 3

5. Define convective equilibrium of earth's atmosphere. Discuss the role of convection in

   i) Trade wind

   ii) Chimneys.

6. With a neat diagram write the principle of sextant.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Prove that the time taken by any particle to reach one end to another end of earth in nearly 42 minutes when the particle is executing simple harmonic motion in a tunnel connecting the two ends through the centre of earth. (Given R = 6400 km and g = 9·8 m/s^2). 3

   b) Deduce the relation between coefficeint of linear expansion (α), surface expansion (β) and volume expansion (γ) of solid. 3

   c) Find the relation between specific heat at constant pressure (C_p) and specific heat at constant volume (C_v) of a gas. 3

   d) Show that adiabatic curve is steeper than isothermal curve. 3

   e) State and prove Bernoulli's theorem in hydrodynamics. 3

8. a) Define internal energy and show that it is a property of a system. $7\frac{1}{2}$

   b) A gas occupies 0·35 m^3 at a pressure of 1 atmosphere at 25°C. Find the work done on the gas and the heat rejected if the gas is compressed isothermally to a pressure of 16 atmosphere. Find also the volume of the gas. $7\frac{1}{2}$

9. a) What is Doppler effect ? 3

b) What is an echo ? Find the minimum distance between a person and a reflector so that he may hear the echo of the sound of small duration produced by him. 2 + 6

c) A ship's sound ranging equipment sends out pulses looking for echos from submarines within a 3 km radius. What should be the repetition frequency ? Given velocity of sound in water = 1500 m/s. 4

10. a) What is resonance in forced vibration ? Explain the meaning of sharpness of resonance. 3

b) What is meant by bending moment of a beam ? 2

c) What is cantilever ? Find the expression for the depression of its free end when a load is added to it. 2 + 3

d) State and explain Archimedes principle. 2

e) Explain the origin of surface tension using the molecular theory. 3

11. a) What is interference of light ? 2

b) The critical angle of light is 45° when ray is incident from glass to water. The refractive index of water is 1·33. Find the refractive index of glass. 3

c) How does acceleration due to gravity '*g*' vary with depth from earth surface ? Deduce the formula. 4

d) Describe the principles of submarine. 3

e) Define Young's modulus and Poisson's ratio. 3