B.E. FOOD TECHNOLOGY AND BIOCHEMICAL ENGINEERING
FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAM. 2018

Subject : PHYSICS-I | Time : Three Hours | Full Marks : 100

Answer any five questions

1. a) Find the direction cosine of line joining the points (3,2,-4) and (1,-1,2).

b) Find the projection of vector $2\boldsymbol{i} - 3\boldsymbol{j} + 4\boldsymbol{k}$ on the vector $\boldsymbol{i} + 2\boldsymbol{j} + -2\boldsymbol{k}$.

c) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at points (2,-1,2).

d) Show curl of gradient of any scalar field $\phi(x,y,z)$ is always zero.

e) If $\boldsymbol{A} = x^2 z\,\boldsymbol{i} - 2y^3z^2\,\boldsymbol{j} + xy^2z\boldsymbol{k}$ find $\nabla.\boldsymbol{A}$ at point (1,-1,1).

3+4+6+3+4

2. a) Describe Carnot's reversible cycle. Show that the efficiency of a Carnot's engine working between a source and sink at absolute temperature T_1 and T_2 respectively is $1 - T_2/T_1$.

b) The efficiency of a Carnot's engine is 1/6. If temperature of sink is lowered by 65K, the efficiency becomes 1/3. Find out the temperature of source and sink.

c) What do you mean by *'entropy'* of a system? Draw Carnot's cycle in *TS* diagram (*T* along Y-axis and *S* along X-axis).

12+4+4

3. a) An ideal gas obeys the relation PV^{γ} = constant. Identify the process for $\gamma = 0$, 1 and 1.4.

b) State and explain the first law of thermodynamics.

c) One mole of ideal gas expands from a state (V_1, T_1) to a state (V_2, T_2) by quasi stable adiabatic process. Show that the work done by the gas is proportional to $(T_1 - T_2)$.

d) Write two different forms of statement of second law of thermodynamics.

3+4+8+5

4. a) State Biot-Savert law and calculate the magnetic field at an external point due to an infinitely long current carrying wire.

b) When current flows through two parallel wires, the wires get either repelled or attracted. Explain its reason.

c) State and explain Ampere's law in magneto-statics. When it is convenient to use Ampere's law over Biot-Savert law. Give an example.

d) Show that Ampere's law leads to the same results as obtained in part a) of this question.

(2+6)+3+4+5

5. a) State the condition that must be fulfilled to observe an interference pattern.

b) Show that in Young's experiment fringe width between consecutive bright and dark fringes are constant.

c) Derive an expression for displacement of fringes if a thin glass plate is introduced in one of the paths of the interfering light rays.

d) In an Young's double slit experiment interference band are produced on a screen placed at 1.5m from the slits which are separated by a distance of 0.15mm and illuminated by a light of wavelength 450nm. Find the change in fringe width when screen is brought nearer to slits by 50cm.

4+6+5+5

6. a) Derive Van der Waal's equation of state for a gas introducing short range interaction terms over the assumption of ideal gas. Draw schematic isotherms for this equation.

b) Calculate the expressions of critical temperature, critical pressure and critical volume volume for Van der Waal's gas.

c) Discuss behavior of gas below critical temperature in unstable region.

5+10+5

7. a) Distinguish between Fresnel and Fraunhofer class of diffraction.

b) Derive an expression of intensity of Fraunhofer diffraction due to single slit. Calculate the direction of minima and maxima of this diffraction pattern.

c) Fraunhofer diffraction pattern is obtained with a single slit width 0.25mm and light source of wavelength 6000Å. Determine the angle at which first dark bad are formed.

3+12+5

8. a) Explain the formation of Newton's ring. Derive an expressions for diameters of dark rings in this experiment. How this experiment can be used to determine wavelength of light?

b) What is double refraction? Describe properties of ordinary and extraordinary rays.

c) What is polarizing angle? The critical angle of light refraction certain medium is 45^0. Calculate value of its polarizing angle?

10+5+5