Assignment 1

Unit 2

1. If $A = 2\hat{j} + 3\hat{k}$ and $B = \hat{i} - 2\hat{j}$, find (a) $A.B$, and (b) $A + B$.

2. If $A = 2\hat{i} + 2\hat{j} - \hat{k}$ and $B = 6\hat{i} - 3\hat{j} + 2\hat{k}$, find the angle between A and B.

3. What do you mean by scalar and vector fields? Define ∇ operator.

4. Explain the terms (a) gradient, (b) divergence, (c) curl by bringing out their physical significance.

5. The potential function in an electric field is represented as $V_{x,y,z} = C(x^2 + y^2 + z^2)$, where C is an arbitrary constant. Show that the electric field is radial.

6. If $V = 2x^2 - 3y^2 + z^2$ represents the electrostatic potential at a point, find the electric field intensity at a point (3,2,-2).

7. Prove that the divergence of a vector field which obeys the inverse square law is zero.

8. If $\phi(x, y, z) = 3(x^2y - y^2x)$, calculate $grad\ \phi$ at the point (1,-2,-1).

9. The electric field due to a point charge Q is given by E=(1/(4πε)) (Q/r^3) r , where E and r are vector quantity. Show that ∇ X E = 0.

10. Write the Maxwell's equations in free space in both integral and differential form. Give the physical significance of each equation.

11. Derive Maxwell's equations in differential and integral form.

12. Show that equation of continuity is contained in Maxwell's equations.

13. Explain the propagation of plane electromagnetic waves in free space and show that the electromagnetic waves propagate with the speed of light in free space.

14. Deduce an expression for the velocity of propagation of a plane electromagnetic wave in a medium of dielectric constant ϵ and relative permeability μ.

15. If the amplitude of H in a plane wave is 1 A/m, calculate the magnitude of E for plane wave in free space.

16. What is electric flux? If electric field is given by $E = 4\hat{i} + 8\hat{j} + 3\hat{k}$, then calculate the electric flux through a surface of area 400 units lying in y-z plane.

17. Derive Poynting theorem. Write short note on Poynting vector. What are its SI units?

Assignment 2

Unit 4

1. What are the characteristics of laser beams? Describe its important applications.
2. Why two level lasers does not exist.
3. Calculate the number of photons emitted per second by 5 mW lasers assuming that it emits light of wavelength 632.8 nm.
4. What do you understand by Einstein A and B coefficents? Derive an expression for them. What do they signify?
5. What is population inversion? How it is achieved in Ruby Laser. Describe the construction of Ruby Laser.
6. Explain the operation of a gas Laser with essential components. How stimulated emission takes place with exchange of energy between Helium and Neon atom?
7. What is the difference between the working principle of three level and four level lasers. Give an example of each type. How a four level Laser is superior to a three level Laser.
8. What do you mean by Inertial and non Inertial frames of reference? Is earth an inertial frame?
9. Describe the Michelson Morley experiment and discuss the importance of its negative result. Derive the expression for fringe shift in the Michelson Morley experiement.
10. Calculate the fringe shift in Michelson-Morley experiment. Given that: $l = 11\,m$, $\lambda = 6238\,\overset{0}{A}$, $v = 3 \times 10^6\,cm/s$, and $c = 3 \times 10^8\,m/s$.
11. State the fundamental postulates of Einstein special theory of relativity.
12. A rod has length 100 *cm*. When the rod is in a satellite moving with velocity 0.9 *c* relative to the laboratory, what is the length of the rod as measured by an observer (i) in the satellite, and (ii) in the laboratory?.

13. How fast would a rocket ship have to go relative to an observer for its length to be contracted to 99% of its length at rest?
14. A clock keeps correct time. With what speed should it be moved relative to an observer so that it may appear to lose 4 minutes in 24 hours?
15. State the law of equivalence of mass and energy.
16. The speed of an electron is doubled from 0.2 c to 0.4 c. By what ratio does its momentum increase?

Unit - 3

Assignment-1

Q1A motor car tyre has a pressure of 2 atmospheres at the room temperature of 27 ^{o}C. If the tyre suddenly bursts, find the resulting temperature.

Q2 Find the efficiency of the Carnot's engine working between the steam point and the ice point. How much heat is rejected, if it absorbd 80 cals of heat.

Q3Define a thermodynamic system. Distinguish between open and closed systems.

Q4Explain how first law of thermodynamics leads to the concept of internal energy.

Q5Give applications of the first law to a) isobaric b) adiabatic processes c) isothermal process.

Q6Write short notes on a) Carnot cycle b) Carnot's theorem c) Efficiency of Carnot's heat engine d) Second Law of thermodynamics e) Zeroth Law of thermodynamic f) Internal Energy

Q7 Calculate the work done in a Carnot cycle of operation.

Q8 Define specific heat at constant volume and at constant pressure. Which one is larger? Give reasons.

Q9 From first law of thermodynaics prove that Cp-Cv =R.

Q10 Show that for an adiabatic change in a perfect gas PV^{γ} = constant.