

Question No. 1 is compulsory. Do any two from the rest.

1.

1. If earth receives 1400 W/m^2 of solar radiation, what are the amplitudes of electric and magnetic fields of radiation? (2)
2. For an electromagnetic wave in vacuum, are the energy densities in electric and magnetic fields are equal? (2)
3. State the basic postulates of special theory of relativity. (2)
4. What is a light like event? How is it different from a space or time like event? (2)
5. Explain a wave impedance. Does vacuum has wave impedance? (2)

2.

1. A plane electromagnetic wave travelling in positive z-direction in an unbounded lossless dielectric medium with relative permeability $\mu_r = 1$ and relative permittivity $\epsilon_r = 3$ has peak electric field intensity $E_0 = 6 \text{ V/m}$. Find (a) the speed of the wave, (b) the intrinsic impedance of the medium, and (c) the peak magnetic field intensity H_0 . (6)
2. Write the expression for velocity transformation in special theory of relativity. Reference frame S' is moving w. r. t. S with a velocity c . Show that a particle moving with the velocity c in S' is also seen as moving with moving a velocity c in the reference frame S . (4)

3.

1. Write the four Maxwell's equation in both integral and differential form and give their significance. (4)
2. Is the Magnetic field continuous at the boundary of a medium? Describe. (2)
3. Kinetic energy of a particle is twice its rest energy. Find its velocity. (4)

4.

1. Write the expression, how the Kinetic Energy, rest energy and total energy of a relativistic particle are related to each other. Describe (with the help of a diagram, no derivation), how do they change with the momentum? (4)
2. Describe what is meant by Time Dilation, Length Contraction (4)
3. Is the Electric field continuous at the boundary of a medium? Describe. (2)

$$2240$$

$$E = \frac{1}{2} B_0^2 \mu_0$$

$$2800$$

$$\frac{1}{2} \mu_0 c^2$$

$$\frac{1}{2}$$

$$158.2 \times 10^2$$

$$\frac{1400 \text{ W/m}^2}{2} = \frac{1}{2} \epsilon_0 E_0^2 =$$

$$465.15 \times 10^3$$

$$8.85 \times 10^{-12}$$

$$1.25 \times 10^6$$