

1. If a force F is derivable from a potential function $V(r)$, where r is the distance from the origin of the co-ordinate system it follows that

(a) $\vec{\nabla} \times \vec{F} = 0$ (b) $\vec{\nabla} \cdot \vec{F} = 0$ (c) $\vec{\nabla} V = 0$ (d) $\nabla^2 V = 0$

Answer: (a) $\vec{\nabla} \times \vec{F} = 0$

2. The space-time dependence of the electric field of a linearly polarized light in free space is given by $\hat{x}E_0 \cos(\omega t - KZ)$ where E_0 , ω and K are the amplitude, the angular frequency and the wave vector respectively. The time average energy density associated with the electric field is

(a) $\frac{1}{4}\epsilon_0 E_0^2$ (b) $\frac{1}{2}\epsilon_0 E_0^2$ (c) $\epsilon_0 E_0^2$ (d) $2\epsilon_0 E_0^2$

Answer: (a) $\frac{1}{4}\epsilon_0 E_0^2$

3. A plane electromagnetic wave travelling in free space is incident normally on a glass plate of refractive index $\frac{3}{2}$. If there is no absorption by the glass, its reflectivity is

(a) 16% (b) 20% (c) 4% (d) 50%

Answer: (c) 4%

4. At a surface current, which one of the magnetostatic boundary conditions is not correct?

(a) Normal component of the magnetic field is continuous.

(b) Normal component of the magnetic vector potential is continuous.

(c) Tangential component of the magnetic vector potential is continuous.

(d) Tangential component of the magnetic vector potential is not continuous.

Answer: (d) Tangential component of the magnetic vector potential is not continuous.

5. For a scalar function ϕ satisfying the Laplace equation, $\vec{\nabla}\phi$ has

(a) Zero curl and non-zero divergence.

(b) Non-zero curl and zero divergence.

(c) Zero curl and zero divergence.

(d) Non-zero curl and non-zero divergence.

Answer: (c) Zero curl and zero divergence.

6. A circular polarized monochromatic plane wave is incident on a dielectric interface at Brewster angle. Which one of the following statements is correct?

- (a) The reflected light is plane polarized in the plane of incidence and the transmitted light is circularly polarized.
- (b) The reflected light is plane polarized perpendicular to the plane of incidence and the transmitted light is plane polarized in the plane of incidence.
- (c) The reflected light is plane polarized perpendicular to the plane of incidence and the transmitted light is elliptically polarized.
- (d) There will be no reflected light and the transmitted light is circularly polarized.

Answer: (c) The reflected light is plane polarized perpendicular to the plane of incidence and the transmitted light is elliptically polarized.

7. Which one of the following quantities is invariant under Lorentz transformation?

- (a) Charge density
- (b) Charge
- (c) current
- (d) Electric field

Answer: (b) Charge

8. An unpolarized light wave is incident from air on a glass surface at the Brewster angle. The angle between reflected and refracted wave is

- (a) 0°
- (b) 45°
- (c) 90°
- (d) 120°

Answer: (c) 90°

9. For an optical fibre with core and cladding index of $n_1 = 1.45$ and $n_2 = 1.44$, respectively, what is the approximate cut-off angle of incidence? Cut-off angle of incidence is defined as the incidence angle below which light will be guided.

- (a) 7°
- (b) 22°
- (c) 5°
- (d) 0°

Answer: (a) 7°

10. The Skin depth of a metal is dependent on the conductivity (σ) of the metal and the angular frequency ω of the incident field. For a metal of high conductivity which of the following relation is correct? (Assume that $\sigma \gg \omega\epsilon$, where ϵ is the electrical permittivity of the medium).

(a) $d \propto \sqrt{\frac{\sigma}{\omega}}$

(b) $d \propto \sqrt{\frac{1}{\sigma\omega}}$

(c) $d \propto \sqrt{\sigma\omega}$

(d) $d \propto \sqrt{\frac{\omega}{\sigma}}$

Answer: (b) $d \propto \sqrt{\frac{1}{\sigma\omega}}$

11. How much force does light from a 1.8 W laser exert when it is totally absorbed by an object?

(a) 6.0×10^{-9} N (b) 0.6×10^{-9} N (c) 0.6×10^{-8} N (d) 4.8×10^{-9} N

Answer: (a) 6.0×10^{-9} N

12. An electromagnetic wave is incident on a water-air interface. The phase of the perpendicular component of the electric field, E_{\perp} , of the reflected wave into the water is found to remain the same for all angles of incidence. The phase of the magnetic field H

(a) Does not change

(b) Changes by $\frac{3\pi}{2}$

(c) Changes by $\frac{\pi}{2}$

(d) Changes by π

Answer: (d) Changes by π

13. If one of the inputs of a J-K flipflop is high and the other is low, then the outputs Q and \bar{Q}

(a) oscillate between low and high in race around condition.

(b) toggle and the circuit acts like a T flip flop.

(c) are opposite to the inputs.

(d) follow the inputs and the circuit acts like an R-S flip flop.

Answer: (d) follow the inputs and the circuit acts like an R-S flip flop.

14. Which one of the following does not represent an exclusive OR operation for inputs A & B?

- (a) $(A+B) \overline{AB}$
- (b) $A\overline{B}+B\overline{A}$
- (c) $(A+B) (\overline{A}+\overline{B})$
- (d) $(A+B) AB$

Answer: (d) $(A+B) AB$

15. The minimum number of NAND gates required to construct an OR gate is

- (a) 2
- (b) 3
- (c) 4
- (d) 5

Answer: (b) 3

16. The logic expression $\overline{A}BC + A\overline{B}C + AB\overline{C} + A\overline{B}\overline{C}$ can be simplified to

- (a) A XOR C
- (b) A AND C
- (c) 0
- (d) 1

Answer: (a) A XOR C

17. Which one of the following is an INCORRECT Boolean expression?

- (a) $\overline{P}Q + PQ = Q$
- (b) $(P+\overline{Q})(P+Q) = P$
- (c) $P(P+Q) = Q$
- (d) $(\overline{P}\overline{Q}\overline{R} + \overline{P}\overline{Q}R + P\overline{Q}\overline{R} + P\overline{Q}R) = \overline{Q}$

Answer: (c) $P(P+Q) = Q$

18. Octal equivalent of decimal number $(478)_{10}$ is

- (a) 736_8
- (b) 673_8
- (c) 637_8
- (d) 367_8

Answer: (a) 736_8

19. In an AM wave useful power is carried by –

- (a) Carrier
- (b) Sidebands
- (c) Both Sidebands and Carrier
- (d) None of the above

Answer: (b) Sidebands

20. In an AM wave, the majority of the power is in –

- (a) Lower Side Band
- (b) Upper Side Band
- (c) Carrier
- (d) None of the above

Answer: (c) Carrier

21. In TV transmission, sound signal is modulated

- (a) Amplitude
- (b) Frequency
- (c) Phase
- (d) None of the above

Answer: (b) Frequency

22. Open-loop gain of an amplifier is given by

- (a) A
- (b) $A\beta$
- (c) β
- (d) None of the above

Answer: (a) A

23. For oscillation to begin, voltage gain around the positive feedback loop must be

- (a) 1
- (b) Greater than 1
- (c) Less than 1
- (d) 0

Answer: (b) Greater than 1

24. Most commonly used modulation system for telegraphy is

- (a) Multi-tone modulation
- (b) Single tone modulation
- (c) PCM
- (d) FSK

Answer: (d) FSK

25. Diameter of antenna is doubled. The maximum range will –

- (a) Be doubled
- (b) Be halved
- (c) Become four times
- (d) Decrease to one fourth

Answer: (a) Be doubled