St John Baptist De La Salle Catholic School, Addis Ababa Final Examination Preparation Problems 4th Quarter

June, 2022

Useful Constants

- $\mathbf{e} = 1.6 \times 10^{-19}$ C elementary charge $\mathbf{m}_e = 9.11 \times 10^{-31}$ kg mass of an electron
- $\mathbf{m}_p = 1.673 \times 10^{-27}$ kg mass of a proton $\mu_0 = 4\pi \times 10^{-7} \frac{H}{m}$ permeability of free space
- $\epsilon_0 = 8.85 \times 10^{-12} \frac{F}{m}$ permittivity of free space $\mathbf{G} = 6.672 \times 10^{-12} \frac{Nm^2}{kg^2}$ gravitational constant
- $N_A = 6.022 \times 10^{23} \frac{1}{mol}$ Avogadro's number $\mathbf{a}_g = 10m/s^2$ acceleration due to gravity
- $\sin 60^0 = \cos 30^0 = \frac{\sqrt{3}}{2}$ AND $\sin 30^0 = \cos 60^0 = \frac{1}{2}$
- sin $37^0 = \cos 53^0 = 0.6$ AND sin $53^0 = \cos 37^0 = 0.8$

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$$\sin 45^0 = \cos 45^0 = \frac{\sqrt{2}}{2}$$
 AND $\sin 90^0 = \cos 0^0 = 1$ AND $\sin 0^0 = \cos 90^0 = 0$

Prroblems

- 1. The scattering of light rays when it encounters a tiny passage is called:
- 2. What is the reasoning behind Lenz's law?
- 3. State the difference between half-wave and fill-wave rectifications and how they occur.
- 4. State the properties of images created by plane, converging and diverging mirrors and their notable properties.
- 5. A generator supplies 120V to the primary coil of a transformer. The primary has 40 turns and the secondary has 800 turns. What is the secondary voltage?
- 6. An object stands erect 20cm from a converging mirror of focal length 40cm. How far apart are the pin and its image?
- 7. A long solenoid has 5000 turns uniformly distributed over a length of 0.50m. What current is required in the windings to produce a magnetic field of $\pi \times 10^{-2}$ T at the center of the solenoid?
- 8. We saw quantities being expressed in units of MWh(Mega-Watt hour), what physical quantity does the unit represent?
- 9. An input of direct current is sent into an unknown electrical device and when current emerges out of the device, the output current is alternating. What device could the unknown be?
- 10. What is the inductive time constant of a circuit with a resistance of $400 \text{K}\Omega$ and L=220mH?

- 11. What is magnetic flux density and what is its SI unit?
- 12. Why is doping important when dealing with semi-conductors?
- 13. What is thermionic emission?
- 14. The period of a transverse electromagnetic wave is 0.06s, what is its frequency?
- 15. If a mirror produces a real image that is four times as large as the object and the object is located 50cm from the mirror, what is the focal length of the mirror?
- 16. Explain why a **NOT-NAND** gate is the same as an **AND** gate.
- 17. What does it mean when a P-N junction is reverse biased?
- 18. In a CRO, the distance between the crests of the singal is 10cm. The time base is set at 20ms/cm and the gain control is set at 9V/cm. If the vertical distance between the crests is 18cm, what is the period of the wave?
- 19. What is the magnetic field strength at the center of the solenoid of 500 turns and 90cm long when it is carrying a current of 8A?
- 20. A coil consists of 2 turns of wire. Each turn is a square of side 1mcm and a uniform magnetic field is directed into the plane and it changes from 1.0 to 0.5T in 1 s, what is the magnitude of the induced EMF?
- 21. A transistor is used to amplify current and can also be used as a switch. A transistor has two junctions and what are the three terminals?
- 22. The energy stored in the inductor of an RL circuit is given by:_____
- 23. Calculate the induced EMF as a result of inductance when the current changes from 10A to 20A in 4 seconds and the inductance is 10H. What will the induced EMF do?
- 24. Plot a signal for a CRO for a signal of frequency 200Hz and maximum voltage 4V if the gain control is 2V/cm and time base is 2ms/cm.
- 25. Calculate the inductive time constant of a circuit which has an inductor with an inductance of 6mH and a resistor of resistance 500 Ω . If the EMF supplied by the battery is 100V, calculate the time needed for the current to drop to 0.1A.
- 26. An object of height 10cm is placed in front of a convex mirror of radius 80 cm 50 cm away from the mirror. Determine the height of the image, how far it is from the mirror, whether it is real or virtual and whether it is upright or inverted.