GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING FOR WOMEN
(AUTONOMOUS)
(Affiliated to Andhra University, Visakhapatnam)
I B.Tech. - II Semester Regular Examinations, June/July – 2025
ENGINEERING PHYSICS
SCHEME OF VALUATION

---

1. a. Explain interference in thin films in reflected light and build an expression for maxima condition and minima condition. **[10 Marks]**

- Explanation of reflected ray interference in a parallel thin film - 02 Marks
- Diagram related to the parallel thin film interference - 02 Mark
- Derivation of path difference, $\delta = 2\mu t \cos r + \frac{\lambda}{2}$ - 04 Marks
- Conditions for Maxima and Minima - 02 Marks

For maxima the path difference, $\delta = 2\mu t \cos r = (2n-1)\frac{\lambda}{2}$,where, n= 1, 2, 3…
For minima the path difference, $\delta = 2\mu t \cos r = n\lambda$, where, n= 0, 1, 2, 3…

1. b. State and Explain Brewster's Law. **[4 Marks]**

- Statement of Brewster's law - 01 Mark
- Diagram related to Brewster's law - 01 Mark
- Explanation - 02 Marks

2. a. Derive an expression for resultant intensity due to single slit diffraction. **[10 Marks]**

- Description of Fraunhoffer diffraction due to a single slit - 02 Marks
- Diagram depicting single slit diffraction - 01 Mark
- Expression for path difference due to a single slit - 01 Mark

$\delta = e \sin\theta$ and the phase difference = $\frac{2\pi}{\lambda}(e \sin\theta)$

- Derivation of Resultant amplitude $R = A\left(\frac{\sin\alpha}{\alpha}\right)$, (where A=na) - 04 Marks
- The Intensity expression, $I = A^2\left(\frac{\sin^2\alpha}{\alpha^2}\right)$ - 02 Mark

2. b. Summarize the phenomenon of double refraction in calcite crystal. **[4 Marks]**

- Double Refraction phenomena - 01 Mark
- Illustration of Double Refraction - 01 Mark
- Properties of E-ray and O-ray - 02 Marks

3. a. What is Carnot's cycle? Build an equation for the efficiency of Carnot's heat engine. [10 Marks]

- Carnot cycle and diagram - 01 Mark
- Work done by four cycles - 06 Marks
- Network done - 02 Marks
- Efficiency of Carnot's engine - 01 Mark

3. b. Analyse the relation between Entropy and Second Law of Thermodynamics. [4 Marks]

- Entropy definition, Mathematical expression -01 Mark
- Second Law of Thermodynamics statement and explanation - 01 Mark
- Relation between Entropy and II Law of T.D. -02 Marks

4. **a. What is an adiabatic process? Derive an expression for the work done in adiabatic process**. [**10 Marks]**

- Explanation of Adiabatic process - 02 Marks
- Derivation for work done in Adiabatic process - 08 Marks

4. b. Find the efficiency of Carnot's engine working between steam and ice points. [4 Marks]

- Carnot's Engine efficiency formula and substitution $\eta_c = 1 - T_H/T_L$ - 02 Marks
- The maximum possible efficiency of a Carnot engine working between the steam and ice points is approximately 26.81%. - 02Marks

5. a. Applying Gauss's law of electrostatics, develop an expression for the electric field due to uniformly charged sphere at a point (i) outside the sphere and (ii) inside the sphere. [10 Marks]

- Diagram and description of Solid charged sphere - 04 Mark
- Derivation of Electric field at an outside point - 03 Marks
- Derivation of Electric field at an inside point - 03 Marks

5. b. Explain Lenz's law and mention its significance. [4 Marks]

- Lenz's Law statement and explanation - 03 Marks
- Significance of Lenz'a Law - 01 Mark

6.a. Derive an expression for electromagnetic wave equation in free space using the Maxwell's equations [10 Marks]

- Maxwell Equations - 2 Marks

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

$$\nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$$

- Applying Curl and solving for E.M. Wave equation - 8 Marks

6.b. State (i) Biot-Savart's law and (ii) Ampere's law [4 Marks]

- Statement, diagram and explanation of Biot-Savart's law - 2 Marks
- Statement, diagram and explanation of Ampere's law - 2 Marks

7. a. Explain the construction and working of Ruby Laser with neat sketch. **[10 Marks]**

- Construction of Ruby Laser - 02 Marks
- Diagram of Ruby laser - 01 Mark
- Working of Ruby laser - 03 Marks
- Energy level diagram - 02 Marks

7. b. List four characteristics of Lasers. **[4 Marks]**

- Explanation of Monochromacity, Directionality, Coherence, High Intensity – 1 Mark for each

8. a. Build an equation for acceptance angle and numerical aperture of an optical fibre. **[10 Marks]**

- Diagram and description of Optical fibre with core and cladding -02 Marks

  Diagram for derivation of acceptance angle -06 Mark
- Derivation for Numerical Aperture -02 Marks

$$\text{N.A.} = \sin\theta_a = \sqrt{(n_1^2 - n_2^2)}$$

8. b. Distinguish between step index and graded index optical fiber. **[4 Marks]**

Step index fiber	Graded index fiber
1. In step index fibers the refractive index of the core medium is uniform through and undergoes an abrupt change at the interface of core and cladding.	1. In graded index fibers, the refractive index of the core medium is varying in the parabolic manner such that the maximum refractive index is present at the center of the core.
2. The diameter of core is about 10micrometers in case of single mode fiber and 50 to 200 micrometers in multi mode fiber.	2. The diameter of the core is about 50 micro meters.
3. The transmitted optical signal will cross the fiber axis during every reflection at the core cladding boundary.	3. The transmitted optical signal will never cross the fiber axis at any time.
4. The shape of propagation of the optical signal is in zigzag manner.	4. The shape of propagation of the optical signal appears in the helical or spiral manner
5. Attenuation is more for multi mode step index fibers but Attenuation is less in single mode step index fibers	5. Attenuation is very less in graded index fibers
6. Numerical aperture is more for multi mode step index fibers but it is less in single mode step index fibers	6. Numerical aperture is less in graded index fibers

9.a) Derive Schrodinger Time-independent wave equation **10 Marks**

- Wave function and differentiating the wave function and substitute in classical wave equation - 08 Marks
- Final expression $= \nabla^2\psi + \frac{2m}{\hbar^2}(E - V)\psi = 0$ - 02 Marks

9.b) Outline the significance of wave function **4 Marks**

- ψ must be finite
- ψ must be single valued
- ψ and its first order space derivatives must exist and be continuous.
- ψ must be square integrable and normalized.

10.a) <u>Explain Bloch sphere and Entanglement in Quantum computing.</u> **7 Marks**

- Bloch sphere diagram 1 Mark
- Explanation of states of Q-bit on Bloch spehere 3 Marks
- Entanglement with example 3 Marks

10.b) <u>Distinguish between Q-bit and Classical bit .</u> **7 Marks**
(For any seven valid differences)

S.No.	Bits	Quantum Bits
1.	A Bit, also called Binary Digit or Classical Bit, is the smallest unit of information measurement in digital computing technology.	A Quantum Bit, also called Qubit, is the smallest unit of information measurement in quantum computing.
2.	A bit can have only two values, i.e. 0 and 1.	A quantum bit can have multiple values simultaneously.
3.	Classical bit does not follow superposition property.	Quantum bit follows superposition property.
4.	Bits are inherently stable, i.e. they do not change their states in the absence of external force.	Quantum bits are inherently unstable, i.e. they can change their states even no external force exists.
5.	The value or state of a bit can be determined precisely. Hence, they are deterministic.	The value or state of a quantum bit cannot be precisely determined. Hence, they are probabilistic.
6.	Bits are physically implemented through electronic and optical devices.	Quantum bits are implemented by using quantum systems like ions, atoms, superconductors, etc.
7.	Boolean operations are executed on bits.	Quantum operations are executed on quantum bits.
8.	Bits can be copied perfectly.	Quantum bits cannot be copied perfectly.
9.	The operations on bits are performed using digital logic gates, such as AND, OR, NOT, etc.	The operations on quantum bits are performed using quantum logic gates.