



CVM
UNIVERSITY

Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY
Effective from Academic Batch: 2025-26

Program: B. TECH. (Mechanical Engineering)

Semester: I

Course Code: 102001216

Course Title: Quantum Mechanics and Semiconductors

Course Group: Basic Science

Course Objectives: This course is thoughtfully designed to provide engineering students with a strong interdisciplinary foundation by exploring advanced applications rooted in modern physics and materials science. It introduces learners to the fundamentals and innovations in emerging fields such as basics of Quantum Mechanics, Quantum Computing, Semiconductor Technology, LASER, Fiber Optics, Superconductivity, Advanced Engineering Materials and Remote Sensing.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Theory		J/V/P*		Total
				Internal	External	Internal	External	
3	0	2	4	50 / 18	50/18	25 / 9	25/9	150 /54

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

SR. NO.	CONTENTS	HOURS
1	Quantum Mechanics and Quantum Computing Introduction, Limitation of classical mechanics, Wave particle duality- De-Broglie hypothesis, Schrodinger's wave equation, Superposition principle, Properties of photon, Uncertainty principle, Photoelectric Effect. Applications: Quantum computing, Difference between classical and quantum computing, Quantum Entanglement, Qubit and Quantum gates, Quantum Cryptography.	7



2	<p>Semiconductors Introduction, Band theory of solids, Classification of semiconductors, Fermi level, Effective mass of an electron, Formation and biasing of p-n Junction, Applications: P-N junction diode, Zener Diode, Solar Cell (monocrystalline and polycrystalline), Active display device (LED) and passive display devices (LCD), Nano semiconductors: Organic Light Emitting Diodes, AMOLED.</p>	5
3	<p>Advanced Engineering Materials Nano materials and Nanodevices: Introduction, Classification of nano materials, Properties, and Synthesis of nanomaterials (Physical Vapor Deposition), Nanodevices: Giant Magneto Resistance (GMR) and Carbon Nano tubes (CNTs). Magnetic Materials: Introduction and Classification of magnetic materials, Applications: Magnetic principles in computer data storage, Computer aided tomography, sensors, ITO based sensor. Shape Memory Alloys: Introduction, Phase transformation, Properties, and Applications: SMA actuators. Dielectric Materials: Introduction, Dielectric parameters, Types of Dielectric materials, and Applications. Biomaterials: Classification (Bio active, Bio inert, Biodegradable), Properties, and Applications.</p>	9
4	<p>Superconductivity Introduction, General properties of superconducting materials, Classification of superconductors, Bardeen, Cooper and Schrieffer (BCS) Theory, Applications: Maglev trains, SQUID and Cryotron.</p>	5
5	<p>Nonlinear Optics (LASER and Fiber Optics) LASER: Introduction, Characteristics of Laser, Einstein Theory: Induced Absorption, spontaneous Emission, Stimulated Emission with their rate equations, Types of Lasers, He – Ne Laser, Nd- YAG Laser, Applications: Holography, 3D profiling, Computer peripherals (Optical disks), LASIK surgery and LIDAR. Fiber Optics: Introduction, Principle of Optical Fiber, Structure of optical fiber, Acceptance angle and Numerical Aperture, Types of Optical Fibers, Applications: Optical Fiber sensors, Pressure or Temperature sensor, Displacement sensor, Fiber Endoscope.</p>	9
6	<p>Fundamentals of Remote Sensing and Geographic Information System (GIS) Introduction, Interaction of EMR with the Earth's Surface, Sensors and image processing, Geographic Information Systems (GIS), Applications of GIS: Weather forecasting, Geology, Hydrology, Marine, Urban planning, Agriculture,</p>	5



	INSAT program.	
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List of Practical:

Sr. No.	Title of the Experiment
1	To determine the wavelength of laser using grating.
2	To measure numerical aperture of optical fiber cable.
3	To Study of bending loss and measurement of propagation loss or attenuation loss in fiber optic cable.
4	To study the characteristics of p-n junction diode.
5	To study zener diode characteristics.
6	To study the characteristics of Light Emitting Diode (LED).
7	To study full wave bridge rectifier.
8	To study the current–voltage characteristic and the power curve to find the Maximum Power Point (MPP) and efficiency of a solar cell.
9	To measure dielectric constant of different materials.
10	Determination of resistivity and band gap of semiconductors by four probe method at different temperatures.
11	To study Hall effect and its applications.
12	To determine the angle of prism using spectrometer.
13	To determine the refractive indices of colors using prism and spectrometer.
14	To measure the velocity of ultrasonic waves in liquid and calculate the compressibility and bulk modulus of liquid.
15	To study seven-segment LED display.
16	To determine the radius of curvature of a given plano-convex lens by setting up Newton's rings.
17	Demonstration of shape memory alloys. (Nano kit)
18	Simulation in quantum computing.
19	Simulation in remote sensing.
20	Study of damped simple harmonic motion.
21	Melde's experiment for resonance.

Reference Books:

1	Engineering Physics by V Rajendran, McGraw Hill Education
2	A textbook of Engineering Physics by M N Avadhanulu and P G Kshirsagar, S Chand Technical
3	Quantum computing for quantum curious by Ciaran Hughes et. Al. Springer Nature



4	Quantum computing for high school students by Yuly Billing, Qubit Publishing
5	Engineering Physics by G Senthil Kumar, P Mariappan and V Rajendran Mc Graw Hill Education
6	Overview of Remote Sensing and GIS applications, IIRS, ISRO

Supplementary learning Material:

1	How things work by Louis A Bloomfeild, Wiley Publications
2	Physics of Everyday Phenomena by W. Thomas Griffith, Juliet Brosing, McGraw Hill Education
3	Physics (Part I and II) by R Resnik and D Halliday, Wiley Publications
4	Concepts of Physics by H C Verma, Bharati Bhawan Publishers & Distributors

Pedagogy:

- Direct classroom teaching
- Audio visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods
- Seminar/Poster presentation
- Mini project

Internal Evaluation:

The internal evaluation comprised of written exam (50% weightage) along with combination of various components such as Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
10%	30%	25%	20%	10%	5%	



Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

COs	Course Outcome Statements	%weightage
CO1	Explain the fundamentals of Quantum mechanics, quantum computing and semiconducting materials.	35
CO2	Apply the quantum mechanics and study nano materials, magnetic materials, shape memory alloys, biomaterials, and superconducting materials.	35
CO3	Apply principles of lasing action in LASER and propagation of light in optical fiber cable.	20
CO4	Acquire the knowledge of remote sensing and GIS.	10

Curriculum Revision:	
Version:	
Drafted on (Month-Year):	April-2025
Last Reviewed on (Month-Year):	-
Next Review on (Month-Year):	



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