KISHKINDA UNIVERSITY

Advancing Knowledge Transforming Lives

17th May 2025

Proceedings of the Third Board of Studies meeting (BoS) of Physics
Held through blended mode on 17.05.2025 at 12.00 pm

The chairperson of Board of studies (BoS) of Physics Dr. Manjunatha S. welcomed all the members of BoS who have joined the meeting through online and offline mode.

Agenda 1:	To approve the scheme and syllabus of the course 'Engineering Physics' of B.Tech programme.
Resolution:	After elaborate discussions & deliberations on each module BoS has approved the syllabus of course 'Engineering Physics' of B.Tech programme as per the draft copy with minor modifications. Scheme of the examination approved as per the draft.

Agenda 2:	To approve the scheme and syllabus of the course work 'Research and Publication Ethics' of PhD programme.
Resolution:	Scheme and syllabus of the course work of 'Research and Publication Ethics' of the PhD programme was accepted.

Agenda 3:	Any other matter with the permission of the chair.
Resolution:	No such matter was placed in the meeting.

Approval:
Following members of BoS in Physics have attended the meeting and approved the scheme and syllabus of the course 'Engineering Physics' of B.Tech programme and also of the course work 'Research and Publication Ethics' of PhD programme.

SN	Name of the person	Designation	Signature
01	**Dr. Manjunatha S.** Chairperson, Dept. of Physics Kishkinda University, Ballari	Chairperson	S. Manjunatha
02	**Dr. Hanumantagouda Basavanagoudra,** Asst. Professor, Dept. of Physics, Kishkinda University, Ballari	Member	online attended
03	**Dr. Kasi Viswanath A.** Dean Research & Development, Ballari Institute of Technology & Management, Ballari	Member	
04	**Dr. Khadke Udaykumar** Professor, Dept. of Physics, Vijayanagara Sri Krishnadevaraya University, Ballari	Member	

05	**Dr. M. Madesh kumar** Professor, Dept. of Physics, School of Applied Sciences Reva University, Bengaluru	Member	Not attended
06	**Dr. U. Mahaboob Pasha** Professor & Head, Department of Physics, Presidency University, Bengaluru	Member	
07	**Dr. Machappa T.** Professor & HOD of Physics Ballari Institute of Technology & Management, Ballari	Member	Online attended

S. Manjunatha

Dr. Manjunatha S.
Chairperson
Board of Studies in Physics
Kishkinda University, Ballari

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ENGINEERING PHYSICS

Course Code	**25PHY12/22**	CIE Marks	**50**
Teaching Hours/Week (L: T:P:SL)	**3:1:2:3**	SEE Marks	**50**
Total Hours of Pedagogy (L: T:P:SL)	**120 (42:14:28:36)**	Total Marks	**125**
Credits	**04**	Exam Hours	**03**

Pre-requisites: Basics of physics concepts studied in 11th and 12th classes.

Course Learning Objectives (CLOs):

- To establish a foundation in quantum mechanics and to understand the electronic properties and of semiconductors.
- To study the dielectric behavior of solids, magnetic properties of materials and to explore the phenomenon of superconductivity along with its applications.
- To understand the principles of laser as well as optical fibres, along with their applications in communication technology.
- To understand the fundamental principles of electromagnetism, Maxwell's equations also to explore the principles of quantum computing significance of physics in artificial Intelligence (AI) and the Internet of Things (IoT).
- To perform the experiments in engineering physics and to understand their underlying basic principles.

Module-1

	Page No.	From:				
	Number of hours of engagement	L	T	P	SL	Total
		10	3	8	8	29
Quantum Mechanics and Semiconductors	**Quantum Mechanics:** de-Broglie Hypothesis and Matter Waves, de-Broglie wavelength and derivation of expression by analogy, Phase Velocity and Group Velocity (Qualitative), Heisenberg's uncertainty principle and its application (Non-existence of electron inside the nucleus-Non-Relativistic), Time independent Schrodinger wave equation, Wave Function, Physical significance of a wave function, Normalization of wave function, Eigen Values and Eigen functions, Particle inside one-dimensional infinite potential well. Numerical problems: de-Broglie Hypothesis, Heisenberg's uncertainty principle, One-dimensional infinite potential well. **Semiconductors:** Classification of materials based on band theory of solids, Fermi level in intrinsic semiconductors (Derivation), Concentration of electrons in conduction band & holes concentration in valance band (only mention the expression), Electrical conductivity of a semiconductor (derivation), Numerical problems: Fermi energy, Conductivity of semiconductors,					
Practical	1. Planck's Constant using LEDs. 2. Fermi energy of copper 3. Transistor characteristics 4. Photo-diode characteristics 5. Solar cell characteristics 6. Energy Gap of the given Semiconductor					
Team work and self -learning	Video Tutorials	Watch introductory videos or animation on de-Broglie waves				
	Assignment on physics derivations	Derive the uncertainty relation. Study application: Non-existence of electrons in the nucleus. Solve few numerical examples. Derive the equation of Time-independent Schrodinger equation. Practice normalization examples, Discuss physical meaning with visual graphs. Concept of eigen values/functions in quantum systems. Solving Schrodinger				

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		equation for infinite well, derive wave functions and energy levels, visualize standing wave solutions, Solve simple problems.

Reference Books

Quantum Mechanics	A textbook of engineering physics by M N Avadhanulu,11e, S Chand, ISBN-978-93-528-3399-3	Page No. 663-730
	Solid state physics by S O Pillai, 10th edition, New Age publications.	Page No. 158-165 & 197-231
Semiconductors	A textbook of Engineering physics by M N Avadhanulu,11e, S Chand, ISBN-978-93-528-3399-3	Page No. 970 - 1017
	Solid state physics by S O Pillai, 10th edition, New Age publications.	Page No. 202-219 & 521-605

Module-2

	Page No.	From:				
	Number of hours of engagement	L	T	P	SL	Total
		8	3	8	7	26

Dielectric & Magnetic Properties of Solids, and Superconductors		**Dielectric and magnetic properties of solids:** Polar and non-polar dielectrics, Dielectric constant, Relation between polarization and dielectric constant (Derivation), Types of Polarization, internal fields in solid (Derivation), Clausius- Mossotti equation (Derivation), Application of dielectrics. Susceptibility & permeability, Classification & properties of magnetic materials (Dia, Para and Ferro), Magnetic hysteresis, Soft & Hard magnetic materials. Numerical problems: Dielectric constant, Polarization, Clausius - Mossotti equation. **Superconductors:** Temperature dependence of resistivity, Effects of Magnetic fields, Meissner's Effect, Types of Superconductors, BCS theory (Qualitative), High-Temperature superconductivity, Applications: SQUID and MAGLEV. Numerical problems: Critical field. Susceptibility, Relative permeability
Practical		1. Charging and Discharging of a Capacitor 2. Series and Parallel LCR Circuits
	Assignment-1	**Dielectric Properties of Solids:** Introduction to Dielectrics. Study definitions and examples. Derive relation between polarization and dielectric constant. Practice simple numerical problems. Study each type polarization with diagrams and examples and create a comparative summary table. Understand Internal fields, Derivation of Clausius-Mossotti Equation Practice 2–3 numerical problems. Applications of Dielectrics in Capacitors, Insulation, Optical devices.
	Assignment-2 Video Tutorials	**Magnetic Materials:** Learn definitions, units, and relations, of basic magnetic properties. Practice numerical problems, Classification of Magnetic Materials, study their properties, examples, and microscopic origin, make a comparison chart. Magnetic Hysteresis, Hysteresis loop, Energy loss, Sketch and interpret B-H curves, learn significance of loop area. Compare soft and hard magnetic materials, Link properties with use-cases (transformers, memory cores, etc.).
	Assignment-3 and short videos or	**Superconductors:** Introduction, temperature and magnetic field dependence of resistivity, interpretation of their graphs. Contrast with normal conductors, Meissner effect, visualize

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	demos	exclusion of magnetic field, understand critical magnetic field concept. Distinguish type I & type II, High-Tc superconductors. BCS Theory (Qualitative), Cooper pairs, energy gap. Applications of superconductors, SQUID, MAGLEV. Watch short videos or demos, Learn working principles and real-world significance.

Reference Books

Dielectric Properties of Solids	A textbook of Engineering physics by M N Avadhanulu,11e, S Chand, ISBN-978-93-528-3399-3	Page No. 1071-1113
	Solid state physics by S O Pillai, 10th edition, New Age publications.	Page No. 623-691
Magnetic Materials	A textbook of Engineering physics by M N Avadhanulu,11e, S Chand, ISBN-978-93-528-3399-3	Page No. 1114-1150
	Solid state physics by S O Pillai, 10th edition, New Age publications.	Page No. 427-517
Superconductors	A textbook of Engineering physics by M N Avadhanulu,11e, S Chand, ISBN-978-93-528-3399-3	Page No. 1151-1175
	Solid state physics by S O Pillai, 10th edition, New Age publications.	Page No. 356-424

Module-3

Photonics and Optical Fibers	Page No.	From:				
	Number of hours of engagement	L	T	P	SL	Total
		8	2	6	7	23
	Lasers: Induced absorption, spontaneous emission & stimulated emissions, Expression for energy density equation in terms of Einstein's coefficients, Requisites of a Laser system, Conditions for Lasing action (Qualitative). Principle, Construction and working of Semiconductor laser, Applications of Lasers (He-Ne, CO_2, Nd-YAG, Semiconductor Laser) Numerical problems: Power of laser, Population inversion. **Optical Fibers:** Structure of optical fibers, Propagation mechanism, Acceptance angle and Acceptance cone, Numerical aperture (Derivation), Fractional index change, Modes of propagation, Number of modes and V-parameter, Types of optical fibers. Attenuation and expression for attenuation coefficient (Derivation), Applications: Point-to-point communication. **Numerical problems:** Numerical aperture, Number of modes, Attenuation.					
Practical	Numerical Aperture of an optical fiber using laser					
	Assignment-1	Basic Concepts of Laser Physics: Induced absorption, Spontaneous emission, Stimulated emission, Understand the energy transitions and their characteristics, use diagrams to visualize the processes, Watch short videos or animations for clarity. Einstein's Coefficients and Energy Density, Derivation of energy density equation using Einstein's coefficients.				
	Assignment-2	Components of a Laser System. Lasing action and study population inversion, visualize using diagrams, Semiconductor Laser – Principle, Construction and working, Diagram-based learning of P-N junction lasers, compare with other types of lasers, Applications of He-Ne, CO_2, Nd:YAG, and Semiconductor Lasers, List common applications by type, solve few related numerical problems.				
	Assignment-3	Optical Fibers: Structure, Propagation mechanism, understanding through ray diagrams, Angle of acceptance, Acceptance cone, Numerical Aperture (Derivation), Modes of				

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		Propagation and V-Parameter, Study single-mode vs multi-mode behavior, Practice numerical problems on number of modes, Types of optical fibers, Attenuation and its derivation, Derive attenuation coefficient expression, Practice attenuation-related numerical problems, Applications in point-to-point communication.

Reference Books

Photonics	A textbook of Engineering physics by M N Avadhanulu,11e, S Chand, ISBN-978-93-528-3399-3	Page No. 1191-1229
	Solid state physics by S O Pillai, 10th edition, New Age publications.	Page No. 705-727
Optical Fibres	A textbook of Engineering physics by M N Avadhanulu,11e, S Chand, ISBN-978-93-528-3399-3,	Page No. 1258-1301
	Solid state physics by S O Pillai, 10th edition, New Age publications.	Page No. 727-740

Module-4

	Page No.	From:				
	Number of hours of engagement	L	T	P	SL	Total
		8	3	6	7	24
Electromagnetism and Electromagnetic waves	**Vector Calculus:** Gradient: electric potential & field, Divergence: Gauss law in electrostatics, Curl: Ampère's Law (2 Hrs) **Gauss & Stokes's theorems:** Gauss divergence theorem, deriving Maxwell's equations in integral form. Stokes' theorem, Faraday's Laws of induction, Ampere's law. (2 Hrs) **Maxwell's Equations:** Maxwell's equations: (in integral form) Gauss's Law in Electric Field, Gauss's Law for Magnetism, Faraday's Law of Induction, Ampere-Maxwell Law (2 Hrs) **EM Waves:** Wave equation in terms of electric field using Maxwell's equations. Plane electromagnetic waves in vacuum along with the equations for E, B and c in terms of μ_0 and ε_0, E and B. Transverse nature of electromagnetic waves (2 Hrs)					
Practical	Magnetic Field at any point along the axis of a circular coil.					
	Assignment-1	**Vector Calculus and Physical Interpretation** Gradient: Electric potential and field ($E = -\nabla V$) Divergence: Gauss's law in electrostatics ($\nabla \cdot E = \rho/\varepsilon_0$) Curl: Ampère's Law ($\nabla \times B = \mu_0 J$) Study definitions and visualize each operation using field line diagrams. Understand how each operator connects to physical laws. Practice problems involving potential → field and checking divergence/curl of a given vector field.				
	Assignment-2	Gauss and Stokes's Theorem: Gauss Divergence Theorem: Convert surface integrals to volume integrals. Convert line integrals to surface integrals. Applications: Gauss Law, Faraday's Law, Ampère's Law. Write the physical meaning and applications of each law. Activities: Derive Maxwell's equations in integral form using these theorems. Solve simple problems applying these theorems to closed surfaces and loops. Visualize flux and circulation using vector field animations.				

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		Create a flashcard or summary sheet of all four laws.
	Assignment 3	Derive wave equation for E using Maxwell's equations: $\nabla^2 E = \mu\varepsilon\, \partial^2 E/\partial t^2$, using $c = 1/\sqrt{(\mu_0\varepsilon_0)}$ to find wave speed. Transverse nature of EM waves, Direction of propagation (E ⊥ B ⊥ direction). Activities: Derive step-by-step and understand assumptions (source-free, vacuum, etc.), practice numerical problems. Use simulation tools to visualize E and B oscillating perpendicularly and propagation of EM Waves. Draw field diagrams for wave propagation. Derive relation between E, B, and c. Solve a couple of conceptual and numerical problems

Reference Books

Electromagnetism	A textbook of Engineering physics by M N Avadhanulu,11e, S Chand, ISBN-978-93-528-3399-3	Page No. 170-183
Electromagnetic Waves		Page No.184-199

Module-5

	Page No.	From:				
	Number of hours of engagement	L	T	P	SL	Total
		8	3	0	7	18
Quantum Computing, Physics in AI and IOT	**Quantum Computing**: Qubits, superposition, entanglement. Significance of quantum computing (Cryptography, optimization). 2 Hrs **Quantum Gates & Circuits:** Pauli-X, Hadamard, CNOT gates. Simple quantum algorithms (Deutsch's algorithm). Applications & Challenges: Quantum cryptography (BB84 protocol). 2 Hrs **Sensors & IOT:** Physics of Data Acquisition, MEMS accelerometers (Newton's laws in IoT devices). Temperature/light sensors (thermistors, photodiodes). weather prediction using physics informed machine learning. 2 Hrs **IoT Energy Challenges:** Low-power electronics (quantum tunnelling in flash memory). Energy harvesting (piezoelectric / pyroelectric materials). 2 Hrs					
Practical	Study of some basic sensor set up using kits.					
	Assignment-1	Quantum Computing – Fundamentals & Applications: Qubits: Superposition and Bloch sphere Entanglement: Basics and importance, Applications: Cryptography (quantum key distribution), Optimization, learn how qubits differ from classical bits? Watch simulations of superposition and entanglement. Read short articles or watch videos on how quantum computers help in cryptography (e.g., Shor's algorithm) and optimization problems (e.g., quantum annealing). Quantum Gates: Pauli-X, Hadamard (H), CNOT, Simple Algorithms: Deutsch's Algorithm, Quantum Cryptography: BB84 Protocol. Learn the matrix representation of Pauli-X, H, and CNOT gates, simulate basic circuits using free tools like IBM Quantum Composer or Quirk. Study how the BB84 protocol ensures secure communication. Watch a visual walkthrough of Deutsch's algorithm.					
	Assignment-2	Sensors & IoT in Action: Physics of Data Acquisition, MEMS Accelerometers based on Newton's laws. Study how MEMS sensors measure motion and how Newton's laws are applied? Temperature & Light Sensors. Thermistors and photodiodes, Weather Prediction, using machine learning in IoT. Explore a basic example of weather data prediction using Python or online					

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		demos, Check a case study: IoT in smart agriculture or weather monitoring.
	Assignment 3	IoT Energy Challenges & Sustainable Solutions: Low-Power Electronics: Quantum tunneling in flash memory, Energy Harvesting: Piezoelectric Materials (mechanical to electric) Pyroelectric Materials (heat to electric). Understand how quantum tunneling helps in reducing energy use in memory devices? Learn real-world uses of piezo/pyro materials in wearables or environmental sensors. Explore a mini case study of smart wearables using energy harvesting, Make a note of pros/cons of these technologies in IoT design.

Reference Books

Quantum Computing & Physics in AI	Quantum computation and Quantum information, Nielsen and Chuang, 10th edition, Cambridge university, ISBN- 978-1-107-61919-7.	Page No. 13-22 32-34, 71-184, 571-593
Physics in AI and IOT	IOT fundamentals- Networking Technologies, Protocols, and use cases for the internet of things, Hanes, Salgueiro, ISBN- 978-93-868-7374.	Page No. 76-84

Course Outcomes (COs):

After completion of the course, students shall be able to

CO-1: Understand the fundamental principles of Quantum Mechanics, semiconductors and applications.

CO-2: Realize the concepts of dielectrics, magnetic materials, superconductors, and applications.

CO-3: Understand the principles of LASER, Optical fibers, and their relevant applications.

CO-4: Acquire the fundamental knowledge & working principles of electromagnetism, electromagnetic waves, quantum computing, physics in AI and IOT.

CO-5: Perform the engineering physics experiments and realize their underlying basic principles.

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Department of Physics

PhD Course Work Syllabus
Research and Publication Ethics
(UGC Prescribed Mandatory course)

Course Title:	**Research and Publication Ethics**	Credits:	**02**
Course Code:	**25RPE01**	SEE Marks:	**50**
Course Type:	**Self-Study**	Exam Duration:	**02**

Theory

Module 1: Philosophy, Ethics and Scientific Conduct (08 hours)

- Introduction to philosophy: definition, nature and scope, concept, branches
- Ethics: definition, moral philosophy, nature of moral judgments and reactions
- Ethics with respect to science and research
- Intellectual honesty and research integrity
- Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)
- Redundant publications: duplicate and overlapping publications, salami slicing
- Selective reporting and misrepresentation of data

Module 2: Publication Ethics (Theory) (07 hours)

- Publication ethics: definition, introduction and importance
- Best practices / standards setting initiatives and guidelines: COPE, WAME etc.
- Conflicts of interest
- Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
- Violation of publication ethics, authorship and contributorship
- Identification of publication misconduct, complaints and appeals
- Predatory publishers and journals.

Practice

Module 3: Open Access Publishing (Practice) (04 hours)

- Open access models: green, gold, and hybrid.
- Benefits and challenges of open access.
- Creative Commons licensing.
- Institutional repositories.

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Module 4: Publication Misconduct (04 hours)

- Types: plagiarism, data fabrication, duplication.
- Tools and techniques for detecting plagiarism (Turnitin, DrillBit, etc.).
- Handling allegations of misconduct.
- Retraction, corrigendum, and erratum.

Module 5: Databases and Research Metrics (07 hours)

- Databases (4 hours)
  - Indexing databases
  - Citation databases: Web of Science, Scopus etc.
- Research Metrics (3 hours)
  - Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
  - Metrics: h-index, g index, i10 index, altmetrics.

References:

1. "On Being a Scientist: A Guide to Responsible Conduct in Research" – National Academy of Sciences.
2. "Publication Ethics and Malpractice" – COPE Guidelines.
3. "Avoiding Plagiarism, Self-plagiarism, and Other Questionable Writing Practices" – Miguel Roig.
4. UGC & ICMR Guidelines on Research Ethics.

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