231PYB111L	PHYSICS LABORATORY (Common to all branches of Engineering and Technology)	Periods per week				Credits
		L	T	P	R	
Regulation - R23		**0**	**0**	2	0	1

SCHEME OF EXAMINATION					
Duration of End Semester Examination in Hours	Maximum Marks - 100		Minimum marks for Pass - 50		
	Weightage		Weightage		
	Continuous assessment Examination	End Semester Examination	Continuous assessment Examination	End Semester Examination	Overall
3	60%	40%	-	45%	50%

PREREQUISITES:
Nil

COURSE OBJECTIVES:	
1.	To impart knowledge on experimental skills to determine elastic, optical and thermal properties of materials.
2.	To demonstrate the experimental determination of compressibility of liquid and band gap of a semiconductor.

COURSE OUTCOMES (COs):		
Upon completion of this course, student will be able to:		Bloom's level
CO1:	determine the elastic properties of materials using torsional pendulum and non uniform bending.	K3
CO2:	determine the optical properties of light waves using optical fibre, laser and spectrometer.	K3
CO3:	determine the physical properties of materials using Lee's disc apparatus and air wedge.	K3
CO4:	calculate the compressibility of liquid using ultrasonic interferometer.	K3
CO5:	calculate the band gap of a semiconductor using band gap apparatus.	K3

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAMME OUTCOME (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

3 – High : 2 - Medium : 1 – Low : '-' - No correlation

ANY FIVE EXPERIMENTS	
S. No	**NAME OF THE EXPERIMENT**
1	Torsion Pendulum – Rigidity modulus of wire and moment of inertia of disc
2	Non Uniform Bending – Determination of Young's modulus
3	Semiconductor Laser –Wavelength of laser light and Size of particle
4	Optical Fiber – Numerical Aperture and Acceptance Angle
5	Lee's Disc method - Determination of thermal conductivity of a bad conductor
6	Spectrometer – Dispersive power of the prism
7	Air Wedge – Measurement of thickness of thin wire
EXPERIMENTS BEYOND THE SYLLABUS	
ANY ONE EXPERIMENT	
1	Ultrasonic Interferometer - Velocity of sound and Compressibility of liquid
2	Determination of the Band gap of a semiconductor

TOTAL PERIODS:	**15**

REFERENCE BOOKS:	
1	Physics Laboratory Manual, Department of Physics, Easwari Engineering College.
2	R.K.Shukla and Anchal Srivastava, Practical Physics, 1st Edition, New Age International (P) Ltd, New Delhi, 2006.
3	G.L.Souires, Practical Physics, 4th Edition, Cambridge University, UK, 2001.
4	D.Chattopadhyay, P.C. Rakshit and B.Saha, An Advanced Course in Practical Physics, 2nd ed., Books & Allied Ltd., Calcutta, 1990.

COURSE DESIGNERS			
1.	Dr. S. Nirmala	Assoc Professor & Head	Department of Physics
2.	Dr. G. Rajkumar	Professor	Department of Physics
3.	Dr. R. Sivakumar	Asst Professor	Department of Physics
4.	Dr. K. Raju	Asst Professor	Department of Physics

Recommended by Board of Studies	Date: 12.10.23	Syllabus version	1
Approved by the Academic Council	Date: 24.01.24	Meeting No.	6

231PYB101T	ENGINEERING PHYSICS (Common to all branches of Engineering and Technology)	Periods per week				Credits
		L	T	P	R	
Regulations - R23		3	0	0	0	3

SCHEME OF EXAMINATION					
Duration of End Semester Examination in Hours	Maximum Marks - 100		Minimum marks for Pass - 50		
	Weightage		Weightage		
	Continuous assessment Examination	End Semester Examination	Continuous assessment Examination	End Semester Examination	Overall
3	40%	60%	-	45%	50%

PREREQUISITES:
Nil

COURSE OBJECTIVES:	
1.	To impart knowledge on the basic principle of mechanics.
2.	To enable the students to gain knowledge on thermal physics.
3.	To explain the application of ultrasonics devices in engineering and medicine.
4.	To teach the description of various crystal structures and crystal defects for industrial applications.
5.	To learn the importance of laser and optical fibers for industry, telecommunication and medical applications.

COURSE OUTCOMES (COs):		
Upon completion of this course, student will be able to:		Bloom's level
CO1:	apply the basic principle of dynamics in torsional pendulum.	K3
CO2:	evaluate the heat energy flow in thermal devices.	K5
CO3:	design ultrasonic devices for engineering and medical disciplines.	K6
CO4:	analyze the crystal structures and crystal defects for industrial applications.	K4
CO5:	select the appropriate laser and optical fibers for industry, telecommunication and medical applications.	K4

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAMME OUTCOME (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

3 – High : 2 - Medium : 1 – Low : '-' - No correlation

UNIT I	MECHANICS	9

Multiparticle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M.I – moment of inertia of uniform rod, circular disc, solid cylinder – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – gyroscope – Torsional pendulum.

UNIT II	THERMAL PHYSICS	9

Fundamentals of thermal energy - Expansion joints - Bimetallic strips - Thermal conductivity, conductions in solids, Determination of thermal conductivity- Forbe's and Lee's disc method - Conduction through compound media – Thermal insulation – thermal shock resistance - Applications: Solar water heater- tempered glass- cryogenic materials.

UNIT III	SOUND WAVES AND VIBRATIONS	9

Propagation, Intensity, Loudness of sound waves – Determination of absorption coefficient, Reverberation, Sabine's formula for reverberation time - Factors affecting acoustics of buildings and their remedies - Ultrasonic waves and properties, Methods of Ultrasonic production, Applications of Ultrasonic in engineering and medicine.

UNIT IV	CRYSTAL PHYSICS	9

Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults.

UNIT V	APPLIED OPTICS	9

Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion – He-Ne laser, CO2 laser, Semiconductor laser – Basic applications of lasers in industry. Principle and propagation of light in optical fibre, Derivation for Numerical aperture and Acceptance angle - Types and losses of optical fibre - Fibre Optical Communication (Block diagram) – Fibre Optic Endoscope.

TOTAL PERIODS:	45

TEXT BOOKS:

1.	R. K. Gaur and S. L. Gupta, Engineering Physics, Dhanpat Rai Pub., 2018.
2.	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.
3.	D.Kleppner and R.Kolenkow, An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.

REFERENCE BOOKS:

1.	Jeff Sanny, Samuel J. Ling, and William Moebs, University Physics, Volume 1- 3, OpenStax, ISBN-13: 978-1-947172-15-9, 2023.
2.	D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
3.	Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.

4.	D.K.Bhattacharya & T.Poonam, Engineering Physics, Oxford University Press, 2015.
5.	V. Rajendran, Engineering Physics, McGraw Hill Publication, 2017.

WEBSITES:	
1.	https://www.britannica.com/technology/laser/Laser-applications
2.	https://en.wikipedia.org/wiki/Crystal_structure

COURSE DESIGNERS			
1.	Dr. S. Nirmala	Assoc Professor & Head	Department of Physics
2.	Dr. G. Rajkumar	Professor	Department of Physics
3.	Dr. R. Sivakumar	Asst Professor	Department of Physics
4.	Dr. K. Raju	Asst Professor	Department of Physics

Recommended by Board of Studies	Date: 12.10.23	Syllabus version	1
Approved by the Academic Council	Date: 24.01.24	Meeting No.	6

231PYS204T	ELECTRICAL ENGINEERING MATERIALS (For Electrical and Electronics Engineering)	Periods per week				Credits
		L	T	P	R	
Regulations - R23		**3**	**0**	**0**	**0**	**3**

SCHEME OF EXAMINATION					
Duration of End Semester Examination in Hours	Maximum Marks - 100		Minimum marks for Pass - 50		
	Weightage		Weightage		
	Continuous assessment Examination	End Semester Examination	Continuous assessment Examination	End Semester Examination	Overall
3	40%	60%	-	45%	50%

PREREQUISITES:
Nil

COURSE OBJECTIVES:	
1.	To impart knowledge on electrical properties of materials.
2.	To introduce the concepts of dielectric materials and insulators.
3.	To explain the importance of magnetic properties and superconductivity.
4.	To teach the principles of quantum mechanics for semiconducting materials.
5.	To enable the students to gain knowledge on nanomaterials.

COURSE OUTCOMES (COs):		
Upon completion of this course, student will be able to:		Bloom's level
CO1:	analyse the classical and quantum electron theories towards the formation of energy bands.	K4
CO2:	evaluate the dielectric strength of dielectric materials in static and alternating field.	K5
CO3:	compare the properties of magnetic materials and superconductors for electrical engineering.	K4
CO4:	apply the principles of quantum mechanics for semiconducting materials.	K3
CO5:	develop the nano materials and nano devices for electrical engineering.	K6

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAMME OUTCOME (PO)												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO5	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
3 – High : 2 - Medium : 1 – Low : '-' - No correlation												

UNIT I	CONDUCTIVITY OF METALS	9
Classical free electron theory - Ohm's law and relaxation time of electrons, collision time and mean free path, electron scattering and resistivity of metals - Expression for electrical conductivity and thermal conductivity - temperature dependence of resistivity - skin effect - Fermi- Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole.		
UNIT II	**DIELECTRIC PROPERTIES OF INSULATORS IN STATIC AND ALTERNATING FIELD**	**9**
Definitions: Relative permittivity, dipole moment and polarization vector - Polarization mechanisms: electronic, ionic, orientational, interfacial polarization - Frequency dependence of Electronic and Ionic Polarizability - Dielectric constant of mono-atomic gases, poly-atomic molecules and solids, Internal field in solids and liquids – Clausius - Mosotti equation - properties of Ferro-Electric and Piezo-Electric materials, dielectric losses - dielectric strength-dielectric breakdown.		
UNIT III	**MAGNETIC PROPERTIES AND SUPERCONDUCTIVITY**	**9**
Magnetic Material Classification - Domain Theory of Ferro magnetism - Curie-Weiss Law -Soft and Hard Magnetic Materials. Quantum interference devices – GMR devices and applications. Superconductivity and its origin - Zero resistance and Meissner Effect - critical current density - Properties – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.		
UNIT IV	**SEMICONDUCTOR MATERIALS**	**9**
Classification of semiconductors, semiconductor conductivity, Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors (Qualitative Study) – Variation of carrier concentration with temperature – Trends in materials used in Electrical Equipment - Hall effect and devices – Introduction to solid state drive.		
UNIT V	**NANO DEVICES**	**9**
Introduction to Nanomaterials - Energy values for 0D, 1D, 2D and 3D – Quantum confinement – Quantum structures – Density of states for quantum wells, wires and dots – Band gap of nanomaterials – Carbon nanotubes : Types, properties and applications - Tunneling – Single electron phenomena – Single Electron Transistor. Conductivity of metallic nanowires – Ballistic transport – Quantum resistance and conductance – Spintronic devices and applications.		

TOTAL PERIODS:	**45**

TEXT BOOKS:	
1.	Electrical Engineering Materials Adrianus J Dekker, Phi Learning Publishers.
2.	Introduction to Electrical Engineering Materials 4th Edn. 2004 Edition by Indulkar C, S. Chand & Company Ltd-New Delhi.
3.	Electrical and Electronic Engineering Materials by SK Bhattacharya, Khanna Publishers, New Delhi.

REFERENCE BOOKS:	
1.	S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
2.	Umesh K Mishra and Jasprit Singh, Semiconductor Device Physics and Design, Springer, 2008.
3.	M.A.Wahab, Solid State Physics: Structure and Properties of Materials, Narosa Publishing House, 2009.
4.	V.Rajendran, Materials Science, Mc Graw Hill Education (India) Private Ltd., 2017.
5.	G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education.

WEBSITES:	
1.	https://archive.nptel.ac.in/courses/113/105/113105081/
2.	https://nptel.ac.in/courses/115102025

COURSE DESIGNERS			
1.	Dr. S. Nirmala	Assoc Professor & Head	Department of Physics
2.	Dr. G. Rajkumar	Professor	Department of Physics
3.	Dr. R. Sivakumar	Asst Professor	Department of Physics
4.	Dr. K. Raju	Asst Professor	Department of Physics

Recommended by Board of Studies	Date: 12-10-2023	Syllabus version	1
Approved by the Academic Council	Date: 24-01-2024	Meeting No.	6

231PYS203T	MATERIALS SCIENCE FOR ELECTRONICS ENGINEERING (Common to Electronics and Communication Engineering, Robotics and Automation)	Periods per week				Credits
		L	T	P	R	
Regulations - R23		3	0	0	0	3

SCHEME OF EXAMINATION					
Duration of End Semester Examination in Hours	Maximum Marks - 100		Minimum marks for Pass - 50		
	Weightage		Weightage		
	Continuous assessment Examination	End Semester Examination	Continuous assessment Examination	End Semester Examination	Overall
3	40%	60%	-	45%	50%

PREREQUISITES:
Nil

COURSE OBJECTIVES:	
1.	To impart knowledge on electrical and magnetic properties of materials.
2.	To teach the principles of quantum mechanics and transport phenomena for semiconducting materials.
3.	To introduce the concepts of dielectric materials and insulators.
4.	To explain the functioning of optical materials for optoelectronics.
5.	To enable the students to gain knowledge on smart materials and nanomaterials.

COURSE OUTCOMES (COs):		
Upon completion of this course, student will be able to:		Bloom's level
CO1:	analyse the classical and quantum electron theories towards the formation of energy bands and the properties of magnetic materials.	K4
CO2:	apply the principles of quantum mechanics and transport phenomena for semiconducting materials.	K3
CO3:	evaluate the dielectric strength of dielectric materials in static and alternating field.	K5
CO4:	design the optical materials and devices for optoelectronics.	K6
CO5:	select the smart materials for applicatios in engineering and technology.	K4

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAMME OUTCOME (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

3 – High : 2 - Medium : 1 – Low : '-' - No correlation

UNIT I	ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS	9
Classical free electron theory - Expression for electrical conductivity and Thermal conductivity – Fermi - Dirac statistics – Density of energy states – Electron in periodic potential – Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole. Magnetic materials: Diamagnetism, Para magnetism, Ferromagnetism - exchange interaction - Soft & Hard Magnetic material. Quantum interference devices – GMR devices and applications.		
UNIT II	**SEMICONDUCTORS AND TRANSPORT PHYSICS**	**9**
Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors– extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors (Qualitative Study) – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode – Introduction to solid state drive.		
UNIT III	**DIELECTRIC MATERIALS**	**9**
Dielectric polarization and relative permittivity: definition – dipole moment and polarization vector Polarization mechanisms: electronic, ionic, orientational, interfacial and total polarization – frequency dependence – local field and Clausius-Mosotti equation – dielectric constant and dielectric loss – dielectric strength - dielectric breakdown – capacitor materials – typical capacitor constructions.		
UNIT IV	**OPTICAL PROPERTIES OF MATERIALS**	**9**
Optical absorption and emission, charge injection and recombination, loss and gain. Optical processes in quantum wells – Optoelectronic devices: light detectors and solar cells – light emitting diode – laser diode - optical processes in organic semiconductor devices – excitonic state – Electro-optics - Modulators and switching devices.		
UNIT V	**SMART MATERIALS AND NANOMATERIALS**	**9**
Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): characteristics, properties and applications of Ni-Ti alloy – Nanomaterials - Quantum size effect - Quantum dot, Wire and Well - Carbon nanotube and its types, Potential uses of nanomaterials in electronics, robotics, computers, sensors, mobile electronic devices –Classification of Biomaterials and its applications.		

TOTAL PERIODS:	45

TEXT BOOKS:	
1.	S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.
2.	Umesh K Mishra and Jasprit Singh, Semiconductor Device Physics and Design, Springer, 2008.
3.	M.A.Wahab, Solid State Physics: Structure and Properties of Materials, Narosa Publishing House, 2009.

REFERENCE BOOKS:	
1.	S.O.Pillai, Solid State Physics, New Age International (P) Ltd., publishers, 2009.
2.	V.Rajendran, Materials Science, Mc Graw Hill Education (India) Private Ltd., 2017.

3.	Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
4.	Lawrence H. Vanvlack, Elements of Material Science and Engineering, Pearson, 2002.
5.	David Jiles, Introduction to the Electronic Properties of Materials, CRC Press, e-book, 2017.
6.	Charles P. Poole Jr., Frank J. Owens, Introduction to nano technology, Wiley, 2003.
7.	Mark Fox, Optical Properties of Solids, Oxford Univ.Press, 2001.

WEBSITES:	
1.	https://archive.nptel.ac.in/courses/113/105/113105081/
2.	https://nptel.ac.in/courses/115102025

COURSE DESIGNERS			
1.	Dr. S. Nirmala	Assoc Professor & Head	Department of Physics
2.	Dr. G. Rajkumar	Professor	Department of Physics
3.	Dr. R. Sivakumar	Asst Professor	Department of Physics
4.	Dr. K. Raju	Asst Professor	Department of Physics

Recommended by Board of Studies	Date: 12.10.23	Syllabus version	1
Approved by the Academic Council	Date: 24.01.24	Meeting No.	6

231PYS201T	MATERIALS TECHNOLOGY (Common to Mechanical and Automobile Engineering)	Periods per week				Credits
		L	T	P	R	
Regulations - R23		3	0	0	0	3

SCHEME OF EXAMINATION					
Duration of End Semester Examination in Hours	Maximum Marks - 100		Minimum marks for Pass - 50		
	Weightage		Weightage		
	Continuous assessment Examination	End Semester Examination	Continuous assessment Examination	End Semester Examination	Overall
3	40%	60%	-	45%	50%

PREREQUISITES:
Nil

COURSE OBJECTIVES:	
1.	To introduce the mechanism of crystallization and importance of phase diagrams in the field of materials science and engineering.
2.	To impart knowledge on electrical and magnetic properties of materials.
3.	To teach the principles of quantum mechanics and transport phenomena for semiconducting materials.
4.	To explain the functioning of optical materials for optoelectronics.
5.	To enable the students to gain knowledge on synthesis and fabrication of nanomaterials.

COURSE OUTCOMES (COs):		
Upon completion of this course, student will be able to:		Bloom's level
CO1:	evaluate the method of crystallization and importance of phase diagrams in the field of materials science and engineering.	K5
CO2:	analyse the classical and quantum electron theories towards the formation of energy bands and the properties of magnetic materials.	K4
CO3:	apply the principles of quantum mechanics and transport phenomena for semiconducting materials.	K3
CO4:	design the optical materials and devices for optoelectronics.	K6
CO5:	apply nanomaterials for energy storage systems.	K3

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAMME OUTCOME (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

3 – High : 2 - Medium : 1 – Low : '-' - No correlation

UNIT I	INTRODUCTION TO CRYSTALLINE MATERIALS	9
Crystallography – Solid Solutions - Nucleation - Homogeneous and Heterogeneous Nucleation - Growth of Single crystals - solution and melt growth - Czochralski technique. Polycrystalline Materials- Principles of solidification – Crystal characterization using x-ray diffraction technique. Phase Diagrams: Phase Rule – Unary System- Binary Phase diagrams - Isomorphous systems - Tie Line - Lever Rule - Eutectic, Peritectic, Eutectoid and Peritectoid Reactions - Typical Phase diagrams – Fe- Fe_3C system.		
UNIT II	ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS	9
Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory: Tunneling – degenerate states – Fermi - Dirac statistics – Density of energy states –– Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole. Magnetic materials: Dia, para and ferromagnetic effects – Para magnetism in the conduction electrons in metals – exchange interaction and ferromagnetism – quantum interference devices – GMR devices.		
UNIT III	SEMICONDUCTORS AND TRANSPORT PHYSICS	9
Energy band diagram – Carrier concentration in intrinsic semiconductors– extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors (Qualitative Study) – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode – Introduction to solid state drive.		
UNIT IV	OPTICAL PROPERTIES OF MATERIALS	9
Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain. Optical processes in quantum wells – Optoelectronic devices: light detectors and solar cells – light emitting diode – laser diode - optical processes in organic semiconductor devices – Electro-optics - Modulators and switching devices.		
UNIT V	MATERIALS FOR ENERGY APPLICATIONS	9
Materials for energy storage: Properties of nano materials - carbon Nano-Tubes (CNT), Carbon Nano-Fibers (CNF), CNTs and CNFs for hydrogen storage. Advanced Batteries, Super capacitors for electro chemical energy storage - Role of carbon nanomaterials as electrodes in batteries and super capacitors - Fuel Cells and its applications.		
TOTAL PERIODS:		**45**

TEXT BOOKS:	
1.	V.Raghavan. Materials Science and Engineering: A First Course, Prentice Hall India Learning Private Limited, 2015.
2.	S.O. Kasap, Principles of Electronic Materials and Devices, Mc-Graw Hill, 2018.
3.	Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, Mc-Graw Hill India (2019).
4.	K.E. Aifantis, S.A. Hackney, and R. V. Kumar (Ed.) High Energy Density Lithium Batteries Materials, Engineering, Applications, WILEY-VCH Verlag GmbH & Co. KGaA, 2010.

REFERENCE BOOKS:	
1.	R.Balasubramaniam, Callister's Materials Science and Engineering. Wiley (Indian Edition), 2014.
2.	Wendelin Wright and Donald Askeland, Essentials of Materials Science and Engineering, CL Engineering, 2013.
3.	Robert F.Pierret, Semiconductor Device Fundamentals, Pearson, 2006.
4.	Pallab Bhattacharya, Semiconductor Optoelectronic Devices, Pearson, 2017.
5.	V. Hacker, S. Mitsushima(Eds.), Fuel Cells and Hydrogen: From Fundamentals to Applied Research, Elsevier, 2018.
6.	Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, Springer, 2015.

WEBSITES:	
1.	https://archive.nptel.ac.in/courses/113/104/113104068/
2.	https://nptel.ac.in/courses/115102025

COURSE DESIGNERS			
1.	Dr. S. Nirmala	Assoc Professor & Head	Department of Physics
2.	Dr. G. Rajkumar	Professor	Department of Physics
3.	Dr. R. Sivakumar	Asst Professor	Department of Physics
4.	Dr. K. Raju	Asst Professor	Department of Physics

Recommended by Board of Studies	Date: 12.10.23	Syllabus version	1
Approved by the Academic Council	Date: 24.01.24	Meeting No.	6

231PYS202T	PHYSICS FOR INFORMATION SCIENCE (Common to CSE, IT, CS, AIML and AI & DS)	Periods per week				Credits
		L	T	P	R	
Regulations - R23		3	0	0	0	3

SCHEME OF EXAMINATION					
Duration of End Semester Examination in Hours	Maximum Marks - 100		Minimum marks for Pass - 50		
	Weightage		Weightage		
	Continuous assessment Examination	End Semester Examination	Continuous assessment Examination	End Semester Examination	Overall
3	40%	60%	-	45%	50%

PREREQUISITES:
Nil

COURSE OBJECTIVES:	
1.	To teach the principles of quantum mechanics and transport phenomena for semiconducting materials.
2.	To explain the functioning of optical materials for optoelectronics.
3.	To introduce the basic principles of quantum mechanics to one dimensional motion of particles.
4.	To enable the students to gain knowledge on applied quantum mechanics to form energy bands.
5.	To teach the basics of quantum structures and their applications and quantum computing.

COURSE OUTCOMES (COs):		
Upon completion of this course, student will be able to:		Bloom's level
CO1:	apply the principles of quantum mechanics and transport phenomena for semiconducting materials.	K3
CO2:	design the optical materials and devices for optoelectronics.	K6
CO3:	apply the principles of quantum mechanics to one dimensional motion of particles.	K3
CO4:	analyse the quantum mechanical principles towards the formation of energy bands.	K4
CO5:	recommend the nano devices and nano materials for quantum computing.	K5

MAPPING OF COURSE OUTCOMES (CO) WITH PROGRAMME OUTCOME (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1

3 – High : 2 - Medium : 1 – Low : '-' - No correlation

UNIT	TITLE	PERIODS
I	SEMICONDUCTOR PHYSICS	9

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors (Qualitative study) – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – Carrier transport in Semiconductor: random motion, drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.

UNIT	TITLE	PERIODS
II	LIGHT - SEMICONDUCTOR INTERACTION	9

Classification of optical materials – carrier generation and recombination processes - Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) - photo current in a PIN diode – solar cell - LED – Organic LED – Laser diodes – Optical data storage techniques.

UNIT	TITLE	PERIODS
III	BASIC QUANTUM MECHANICS	9

Inadequacies of Classical Mechanics – Black body radiation - Planck's theory of radiation - Dual nature of electromagnetic radiation – De Broglie hypothesis for matter waves – Heisenberg's uncertainty principle – Schrodinger's time dependent and independent wave equation, significance of wave function - Born interpretation - Particle confinement in 1D box.

UNIT	TITLE	PERIODS
IV	APPLIED QUANTUM MECHANICS	9

The harmonic oscillator - Barrier penetration and quantum tunneling – Scanning Tunneling Microscope (STM) - Resonant diode - Finite potential wells - Bloch's theorem for particles in a periodic potential –Basics of Kronig - Penney model and origin of energy bands.

UNIT	TITLE	PERIODS
V	NANODEVICES AND QUANTUM COMPUTING	9

Introduction - quantum confinement – quantum structures: quantum wells, wires and dots – band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade – resonant tunneling diode – single electron transistor – quantum system for information processing - quantum states – classical bits – quantum bits or qubits – CNOT gate - multiple qubits – Bloch sphere – quantum gates – advantage of quantum computing over classical computing.

TOTAL PERIODS:	**45**

TEXT BOOKS:

1.	Jasprit Singh, "Semiconductor Devices: Basic Principles", Wiley (Indian Edition), 2007.
2.	S.O. Kasap. Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition), 2020.

3.	Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.

REFERENCE BOOKS:	
1.	Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2.	Y. B. Band and Y. Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013.
3.	B. Rogers, J.Adams and S.Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2014.
4.	Nouredine Zettili, Quantum Mechanics Concepts and Applications, 2nd Edition, Wiley, 2009.
5.	V.Rajendran, Materials Science, McGraw Hill Education (India) Private Ltd., 2017.
6.	G. Aruldhas, Quantum Mechanics, PHI Learning, 2008.

WEBSITES:	
1.	https://nptel.ac.in/courses/115102025

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2.	Dr. G. Rajkumar	Professor	Department of Physics
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4.	Dr. K. Raju	Asst Professor	Department of Physics

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