VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
Ibrahimbagh, Hyderabad-31

DEPARTMENT OF PHYSICS
B.E Syllabus for **CSE, CSE (AI & ML)** and **IT** Branches w.e.f 2025-2026

PHYSICS OF SEMICONDUCTORS (POS)
(Course Code: U25BS110PH)

L : T : P	Credits	CIE		SEE		SEMESTER
2 :0 : 0	02	Marks:40	Exam Duration:90 min	Marks:60	Exam Duration: 3hrs	I

CO code	Course Objectives	Course Outcomes	Highest BTL
BS110PH.1	To appreciate the merits of quantum mechanics over classical mechanics.	To apply quantum mechanical laws and interpret quantum tunnelling phenomenon.	3
BS110PH.2	To arrive at the expression for carrier concentration in semiconductors and analyze various semiconductor devices	To estimate required carrier concentration and elucidate working of optoelectronic devices	4
BS110PH.3	To comprehend lasing action and relate the use of lasers in optical fiber communication	To compare different types of lasers and summarize merits and demerits of optical fibers.	3
BS110PH.4	To introduce basics of quantum computing	To interpret various types of qubits and their probable advantages	2

CO-PO Mapping

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

UNIT-I: FUNDAMENTALS OF QUANTUM MECHANICS (08 hours)
de Broglie waves and their properties, wave packet, wave function and its significance, Schrodinger time dependent and independent wave equations. Eigen values and Eigen functions of one-dimensional infinite square-well potential (particle in a box). Potential barrier problem and tunnelling phenomenon.

UNIT-II: PHYSICS OF SEMICONDUCTORS AND DEVICES (10 hours)
Kronig-Penny model, effective mass of an electron, Fermi energy level and variation of Fermi energy level with temperature, density of states, expression for intrinsic equilibrium carrier concentration, conductivity of intrinsic and extrinsic semiconductors, Hall effect and its applications.

Optoelectronic Devices: Principle, construction and working of LED, photodiode, solar cell and applications.

UNIT-III: LASERS AND OPTICAL FIBERS (10 hours)
Lasers: Stimulated emissions, characteristics of lasers, population inversion, meta-stable states, pumping mechanisms, components of laser, types of lasers, construction and working of semiconductor laser, advantages, and applications of lasers.

Optical Fibers: principle of optical fiber, propagation of light in optical fiber, numerical aperture, acceptance angle, types of optical fibers, signal losses in optical fibers: Attenuation-absorption, scattering, bending and alignment losses, signal distortion, block diagram of optical communication system, advantages, and application of optical fibers.

Dr A.S.Sai Prasad
Chairman,BoS in Physics &
Head, Department of Physics

Contd... (2)

UNIT-IV: BASICS OF QUANTUM COMPUTING (12hours)

Introduction to Ket and Bra vectors, Qubits, superposition, entanglement, interference, decoherence of qubits, difference between quantum and classical computers, basics of quantum gates: Pauli's X-gate, CNOT gate and Hadamard gate.

Physical implementation of qubits (very qualitative description)
Solid State Qubits: Semiconducting Qubits- quantum dots, spins
Superconducting Qubits: Josephson's junctions, SQUIDS, Charge, Flux and Phase
Applications of quantum computers.

Learning Resources:

1. Donald A Neamen, Semiconductor Physics and Devices, 3rd edition, Tata McGraw 2008.
2. S O Pillai, Solid State Physics, 8th edition, New Age International Publishers, 2018
3. S.O. Kasap, Optoelectronic and Photonics: Principles and Practices, Pearson, 2001
4. M.N. Avadhanulu and P.G. Kshirsagar and TVS Arun, Murthy A Textbook Engineering Physics, 11th edition, S. Chand, 2019.
5. Quantum Mechanics: Theory and Applications" by Ajoy Ghatak and S. Lokanathan, Springer-Verlag New York Inc., 2004.
6. Quantum Computation and Quantum Information Michael A. Nielsen & Isaac L. Chuang, 10th Anniversary Edition, Cambridge University Press
7. "Quantum Computing for Computer Scientists" by Noson S. Yanofsky and Mirco A. Mannucci Cambridge University Press, 2008.

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Chairman,BoS in Physics &
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DEPARTMENT OF PHYSICS
B.E Syllabus for CSE, CSE (AI & ML) and IT Branches w.e.f academic year 2025-2026

SEMICONDUCTOR AND OPTOELECTRONICS LAB (SOE LAB)

L : T : P	Credits	CIE Marks	SEE Marks	Semester	Course Code
0 : 0 : 2	01	30	50	I	U25BS111PH

Course Objectives	Course Outcomes	Highest BTL
• to study and discuss the characteristics of a given device	1. to conduct experiment independently and in team to record the measurements	2
• to identify probable errors and take in the readings and known possible precautions	2. To outline the precautions required to be taken in each experiment	1
• to compare experimental and theoretical values and draw possible conclusions.	3. To compare the experimental results with standard values and estimate error percentage	2
• To interpret the results from the graphs drawn using experimental values.	4. To draw graphs and interpret the results with respect theoretical results.	2
• To write the record independently with appropriate results.	5. To effectively write summary of the experiment and draw appropriate conclusions	1

CO-PO Mapping

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

1. Study of I-V characteristics of P-N Junction diode.
2. Study of I-V characteristics of Zener Diode
3. Study of I-V characteristics of LED
4. Study of characteristics of Photodiode
5. Study of I-V characteristics of solar cell and to calculate fill factor and efficiency
6. Determination of wavelength of laser light.
7. Determination of energy gap of a given semiconductor by four probe method
8. Hall's effect- Determination of Hall's coefficient, carrier concentration of given semiconductor
9. Calculation of numerical aperture, acceptance angle and power loss due to bending of an optical fiber.
10. Determination of Planck's constant using Photocell
11. Determination of e/m of an electron by Thomson's method
12. Determination of Seebeck coefficient

Prof. D Karuna Sagar O.U Nominee & Dean, Faculty of Sciences,Osmania University	**Prof. S. Srinath** Subject Expert, School of Physics University of Hyd	**Prof. M. Prasad** Head, Dept. of Physics, Osmania University	**Prof. A.S. Sai Prasad** Head & BOS chairman, Dept of Physics, VCE

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
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DEPARTMENT OF PHYSICS
B.E Syllabus for **ECE** and **EEE** Branches w.e.f 2025-26

QUANTUM MECHANICS FOR ENGINEERS (QME)
(Course Code: U25BS210PH)

L : T : P	Credits	CIE		SEE		SEMESTER
2 :0 : 0	02	Marks:40	Exam Duration:90 min	Marks:60	Exam Duration: 3hrs	II

CO code	Course Objectives	Course Outcomes	Highest BTL
BS110PH.1	To arrive at the expression for carrier concentration in semiconductors and analyze various semiconductor devices	To estimate required carrier concentration and elucidate working of optoelectronic devices	3
BS110PH.2	To appreciate the merits of quantum mechanics over classical mechanics.	To apply quantum mechanical laws and interpret quantum tunnelling phenomenon.	4
BS110PH.3	To introduce basics of quantum bit theory	To interpret various types of qubits and their probable advantages	3
BS110PH.4	To comprehend advantages of superconductors	To explore SQUIDs and formulate different types of superconducting qubits	2

CO-PO Mapping

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

UNIT-I: FUNDAMENTALS OF QUANTUM MECHANICS (08 hours)
de Broglie waves and their properties, wave packet, wave function and its significance, Schrodinger time dependent and independent wave equations. Eigen values and Eigen functions of one-dimensional infinite square-well potential (particle in a box). Potential barrier problem and tunnelling phenomenon.

UNIT-II: PHYSICS OF SEMICONDUCTORS AND DEVICES (10 hours)

Kronig-Penny model, effective mass of an electron, Fermi energy level and variation of Fermi energy level with temperature, density of states, expression for intrinsic equilibrium carrier concentration, conductivity of intrinsic and extrinsic semiconductors, Hall effect and its applications.
Optoelectronic Devices: Principle, construction and working of LED, photodiode, solar cell and applications.

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UNIT-III: SUPERCONDUCTIVITY (10 hours)

Introduction to superconductivity, General properties of superconductors: Zero resistivity, persistent currents, critical temperature, Critical magnetic field, critical current density, effect of pressure on T_c, Isotope effect, entropy, Meissner effect, London penetration depth, Type I and Type II superconductors-fundamentals of BCS Theory - Josephson's Junctions-Josephson's dc and ac effects–SQUID- High temperature superconductors- Applications of superconductors.

UNIT-IV: BASICS OF QUANTUM BIT THEORY (12hours)

Introduction to Ket and Bra vectors, Qubits, superposition, entanglement, interference, decoherence of qubits, difference between quantum and classical computers.
Physical implementation of qubits (very qualitative description)
Solid State Qubits: Semiconducting Qubits- quantum dots, spins
Superconducting Qubits: Charge, Flux and Phase
Applications of quantum computers.

Learning Resources:

1. Donald A Neamen, Semiconductor Physics and Devices, 3rd edition, Tata McGraw 2008.
2. S.O. Kasap, Optoelectronic and Photonics: Principles and Practices, Pearson, 2001
3. S O Pillai, Solid State Physics, 8th edition, New Age International Publishers, 2018
4. M.N. Avadhanulu and P.G. Kshirsagar and TVS Arun Murthy, A Textbook Engineering Physics, 11th edition, S. Chand, 2019.
5. Quantum Mechanics: Theory and Applications" by Ajoy Ghatak and S. Lokanathan, Springer-Verlag New York Inc., 2004.
6. Quantum Computation and Quantum Information Michael A. Nielsen & Isaac L. Chuang, 10th Anniversary Edition, Cambridge University Press

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DEPARTMENT OF PHYSICS

B.E Syllabus for ECE and EEE Branches w.e.f academic year 2025-2026

APPLIED PHYSICS LAB (AP LAB)

L : T : P	Credits	CIE Marks	SEE Marks	Semester	Course Code
0 : 0 : 2	01	30	50	II	U25BS111PH

Course Objectives	Course Outcomes	Highest BTL
• to study and discuss the characteristics of a given device	1. to conduct experiment independently and in team to record the measurements	2
• to identify probable errors and take in the readings and known possible precautions	2. To outline the precautions required to be taken in each experiment	1
• to compare experimental and theoretical values and draw possible conclusions.	3. To compare the experimental results with standard values and estimate error percentage	2
• To interpret the results from the graphs drawn using experimental values.	4. To draw graphs and interpret the results with respect theoretical results.	2
• To write the record independently with appropriate results.	5. To effectively write summary of the experiment and draw appropriate conclusions	1

CO-PO Mapping

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

1. Study of I-V characteristics of P-N Junction diode.
2. Study of I-V characteristics of Zener Diode
3. Study of I-V characteristics of LED and Photodiode
4. Study of I-V characteristics of solar cell and to calculate fill factor and efficiency.
5. Determination of energy gap of a given semiconductor by four probe method
6. Hall's effect- Determination of Hall's coefficient, carrier concentration of given semiconductor
7. Helmholtz coil –calculation of magnetic field along the axis of a solenoid
8. B-H curve-estimation of Hysteresis loss of a ferromagnetic sample
9. Determination of wavelength of laser light.
10. Calculation of numerical aperture, acceptance angle and power loss due to bending of an optical fiber.
11. Study of resonance in LCR series and parallel circuits and estimation of band width & Q- factor
12. Determination of Seebeck coefficient.
13. Determination of Dielectric constant.

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DEPARTMENT OF PHYSICS

B.E Syllabus for **Mechanical Engineering** Branch w.e.f 2025-26

ENGINEERING PHYSICS (EP)

(Course Code: U25BS230PH)

L : T : P	Credits	CIE		SEE		SEMESTER
2 :0 : 0	02	Marks:40	Exam Duration:90 min	Marks:60	Exam Duration: 3hrs	II

CO code	Course Objectives	Course Outcomes	Highest BTL
BS230.PH.1	• To describe characteristics of acoustics quieting effects required for a hall.	• To interpret acoustics of a hall and suggest good building acoustics	3
BS230.PH.2	• To comprehend lasing action and state application of lasers	• To compare different types of lasers and identify their utilization in mechanical engineering sector	3
BS230.PH.3	• To grasp basic principles of liquefaction of gasses	• To summarize liquefaction of gases and their applications in various fields.	3
BS230PH.4	• To acquire basic knowledge on nanomaterials and their applications	• To interpret characterization of nanomaterial and summarize their applications.	2

CO-PO Mapping

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

UNIT-I: ACOUSTICS (10 hours)

Architectural Acoustics: classification of sound: musical sound and noise, Characteristics of musical sound: pitch, loudness, timbre, sound intensity, reverberation time, absorption coefficient, Sabine's formula, sound absorbent materials, conditions for acoustic quieting: effects and remedies.

Ultrasonics: properties of ultrasonics, types of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction method, detection of ultrasonics by piezoelectric, thermal detector, applications of ultrasonics: SONAR, Ultrasonic non-destructive testing.

UNIT-II: LASERS AND OPTICAL FIBRES (10 hours)

Lasers: Induced absorption, spontaneous and stimulated emissions, Properties of laser light, population inversion, meta-stable states, pumping mechanisms, components of laser, construction and working of Ruby laser, applications of lasers in mechanical engineering.

Optical Fibers: introduction to optical fibers, expression for numerical aperture, acceptance angle, types of optical fibers, signal losses in optical fibers: Attenuation-absorption, bending and alignment losses, Block diagram of optical communication system, application of optical fibers in mechanical engineering.

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UNIT-III: CRYOGENICS (10 hours)

Introduction to low temperature Physics- Joule Thomson effect, porous plug experiment, J-T effect for a Van der Waal's gas, Inversion temperature, Boyle temperature and critical temperature. Regenerative cooling process, Liquefaction of hydrogen, properties of liquid helium, adiabatic demagnetization, thermal and mechanical properties of materials at cryogenic temperatures, superconductivity, Applications of cryogenic liquids.

UNIT-IV: NANOMATERIALS (10 hours)

Nanoscale, Nanoscience and nano technology, distinction between bulk, thin films and nanomaterials, quantum confinement, surface to volume ratio, quantum wires, quantum wells, and quantum dots, properties of nanomaterials, bottom-up and top-down approaches: sol-gel and Ball milling techniques, block diagrams of Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) and Atomic Force Microscope (AFM). Engineering applications of nano materials.

Learning Resources:

1. M.N. Avadhanulu and P.G. Kshirsagar and TVS Arun Murthy, A Textbook Engineering Physics, S. Chand, 11th edition, 2019.
2. Mamata Mukhopadhyay, Fundamentals of Cryogenics Engineering,3rd edition, PHI, 2016
3. S O Pillai, Solid State PhysicsNew Age International Publishers, 8th edition, 2018
4. Nanotechnology: Principles and Practices" by Sulabha K. Kulkarni, 3rd edition, 2015

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DEPARTMENT OF PHYSICS

B.E Syllabus for **CIVIL AND MECHANICAL BRANCHES** w.e.f academic year 2025-2026

ENGINEERING PHYSICS LAB (E.P. lab)

L : T : P	Credits	CIE Marks	SEE Marks	Semester	Course Code
0 : 0 : 2	01	30	50	II	U25BS211PH

Course Objectives	Course Outcomes	Highest BTL
• to study and discuss the characteristics of a given device	1. to conduct experiment independently and in team to record the measurements	2
• to identify probable errors and take in the readings and known possible precautions	2. To outline the precautions required to be taken in each experiment	1
• to compare experimental and theoretical values and draw possible conclusions.	3. To compare the experimental results with standard values and estimate error percentage	2
• To interpret the results from the graphs drawn using experimental values.	4. To draw graphs and interpret the results with respect theoretical results.	2
• To write the record independently with appropriate results.	5. To effectively write summary of the experiment and draw appropriate conclusions	1

CO-PO Mapping

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

1. Determination of moment of inertia of a Fly Wheel
2. Computation of rigidity modulus of material of a wire using Torsional Pendulum
3. Estimation of frequency of electrically maintained Tuning fork- Melde's experiment.
4. Determination of radius of gyration and acceleration due to gravity using Compound Pendulum.
5. Assessment of velocity of ultrasonic waves in liquids
6. Calculation of wavelength of laser light & Estimation of distance by laser light source
7. Measurement of radius of curvature of a Plano-convex lens by forming Newton's Rings.
8. Determination of wavelengths of mercury vapour lamp- diffraction grating
9. Calculation of numerical aperture, acceptance angle and power loss due to bending of an optical fibre.
10. Study of I-V characteristics of P-N Junction diode.
11. Gyroscope- study of gyroscopic effects.

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DEPARTMENT OF PHYSICS

B.E Syllabus for **Civil Engineering** Branch w.e.f 2025-26

OPTICS, ACOUSTICS & SENSORS (OAS)

(Course Code: U25BS220PH)

L : T : P	Credits	CIE		SEE		SEMESTER
2 :0 : 0	02	Marks:40	Exam Duration:90 min	Marks:60	Exam Duration: 3hrs	II

CO code	Course Objectives	Course Outcomes	Highest BTL
BS220PH.1	To summarize principles of interference, diffraction and polarization of light.	To articulate principles of wave optics and use them for various measurements.	2
BS220PH.2	To comprehend lasing action and state application of lasers	To compare different types of lasers and identify their utilization in civil engineering sector	1
BS220PH.3	To describe characteristics of acoustics quieting effects required for a hall.	To interpret acoustics of a hall and suggest good building acoustics	3
BS220PH.4	To interpret the advantages of using sensors in civil engineering and learn fundamentals of thermodynamics	To list out various sensors to monitor health of structures and suggest remedies.	2

CO-PO Mapping

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

UNIT-I: WAVE OPTICS (10 hours)

Interference: conditions for sustained interference, interference due to thin parallel film, Newton's rings, applications of interference.

Diffraction: Phenomenon of diffraction of light, types of diffraction, Fraunhofer diffraction due to a single slit, diffraction due to N- slits (plane transmission grating), applications of diffraction.

Polarization: Polarization of light, types of polarized light, double refraction, construction and working of Nicol's Prism, Polarizer and analyzer, Quarter wave and Half wave plates. Relevant applications.

UNIT-II: LASERS AND OPTICAL FIBRES (10 hours)

Lasers: stimulated emission, properties of laser light, population inversion, meta-stable states, pumping mechanisms, components of laser, construction and working of He-Ne laser, advantages and applications of lasers in engineering.

Optical Fibers: introduction to optical fibers, propagation of light in optical fiber, numerical aperture, acceptance angle, types of optical fibers, signal losses in optical fibers: Attenuation-absorption, Scattering, bending, alignment losses, Signal distortion. Block diagram of optical communication system, advantages and application of optical fibers.

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UNIT-III ACOUSTICS (10 hours)

Architectural Acoustics: classification of sound: musical sound and noise, Characteristics of musical sound-pitch, loudness, timbre, sound intensity, sound pressure levels, reverberation time, absorption coefficient, Sabine's formula, sound absorbent materials, Building acoustic requirements, conditions for acoustic quieting: effects and remedies. Sound proofing applications in Civil Engineering.

Ultrasonics: properties of ultrasonics, types of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics by piezoelectric, thermal detector, applications of Ultrasonics: SONAR, Ultrasonic non-destructive testing applications in civil engineering.

UNIT- IV: SENSORS FOR STRUCTURAL HEALTH MONITORING & INTRODUCTION TO THERMODYNAMICS (10 hours)

Introduction to Structural Health Monitoring (SHM): Types of Sensors in structural health monitoring: Strain Gauge (load cells), Optical Fiber Sensors, Accelerometer, Tiltmeter, Temperature Sensors: Thermocouple and Thermistor.

Introduction to Thermodynamics: Thermodynamic equilibrium, zeroth law, first law and second law of thermodynamics, work done in isothermal and adiabatic process, Carnot cycle (Qualitative).

Learning Resources:

1. M.N. Avadhanulu and P.G. Kshirsagar and TVS Arun Murthy, A Textbook Engineering Physics, 11th edition, S. Chand, 2019.
2. John G. Webster and HalitEren, Measurement, instrumentation, and Sensor's handbook: Spatial, Mechanical, Thermal and Radiation Measurement, CRC press, 2014.
3. D. Patranabis, Sensors and Transducers,2nd edition, PHI Learning Pvt Ltd.,2015
4. P.K Nag, ENGINEERING THERMODYNAMICS, 6th edition -2017.

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DEPARTMENT OF PHYSICS

B.E Syllabus for **CIVIL AND MECHANICAL BRANCHES** w.e.f academic year 2025-2026

ENGINEERING PHYSICS LAB (E.P. lab)

L : T : P	Credits	CIE Marks	SEE Marks	Semester	Course Code
0 : 0 : 2	01	30	50	II	U25BS211PH

Course Objectives	Course Outcomes	Highest BTL
• to study and discuss the characteristics of a given device	1. to conduct experiment independently and in team to record the measurements	2
• to identify probable errors and take in the readings and known possible precautions	2. To outline the precautions required to be taken in each experiment	1
• to compare experimental and theoretical values and draw possible conclusions.	3. To compare the experimental results with standard values and estimate error percentage	2
• To interpret the results from the graphs drawn using experimental values.	4. To draw graphs and interpret the results with respect theoretical results.	2
• To write the record independently with appropriate results.	5. To effectively write summary of the experiment and draw appropriate conclusions	1

CO-PO Mapping

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

1. Determination of moment of inertia of a Fly Wheel
2. Computation of rigidity modulus of material of a wire using Torsional Pendulum
3. Estimation of frequency of electrically maintained Tuning fork- Melde's experiment.
4. Determination of radius of gyration and acceleration due to gravity using Compound Pendulum.
5. Assessment of velocity of ultrasonic waves in liquids
6. Calculation of wavelength of laser light & Estimation of distance by laser light source
7. Measurement of radius of curvature of a Plano-convex lens by forming Newton's Rings.
8. Determination of wavelengths of mercury vapour lamp- diffraction grating
9. Calculation of numerical aperture, acceptance angle and power loss due to bending of an optical fibre.
10. Study of I-V characteristics of P-N Junction diode.
11. Gyroscope- study of gyroscopic effects.

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VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
DEPARTMENT OF PHYSICS
OPEN ELECTIVE COURSE
FUNDAMENTALS OF SMART MATERIALS AND APPLICATIONS

L : T : P	Credits	CIE Marks	SEE Marks	SEE Duration	Course Code
02: 0: 0	02	40	60	3 hours	U25OE310PH

CO-PO Mapping

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

Course Objectives	Course Outcomes	BTL
The student will be able to	**the student should at least be able:**	
1. To introduce various types of smart materials used in engineering.	1. Identify various smart materials and their significant applications.	2
2. Grasp the concepts of piezo and ferroelectric materials.	2. Summarize various properties and applications of peizo and ferroelectric materials.	3
3. Learn fundamentals of pyro and thermoelectric materials	3. Apply fundamental principles of pyro and thermoelectricity in relevant fields of engineering.	3
4. Gain knowledge on shape memory alloys	4. Explain types of shape memory alloys and their properties and applications	2

UNIT I: INTRODUCTION TO SMART MATERIALS (6 hours)

Characteristics of metals, polymers and ceramics. Introduction to smart materials, need for smart materials, Classification of smart materials, Components of a smart System, Applications of smart material, role of smart materials in developing intelligent systems and adaptive structures.

UNIT II: PIEZO AND FERRO ELECTRIC MATERIALS (8 hours)

Piezo electric effect and inverse piezoelectric effect, Piezo electric materials, Structure of Quartz crystal, piezoelectric oscillator, Magnetostriction, Magnetostriction oscillator, piezo-electric sensors, applications of Piezo-electric materials. Characteristics and properties of ferroelectric materials, Curie-Weiss law, applications of Ferro electric materials.

UNIT III: PYRO AND THERMO-ELECTRIC MATERIALS (6 hours)

Pyro electricity: pyro electric effect, pyro electric materials, pyro-electric detector.
Thermoelectricity: thermoelectric effect, Seebeck effect, Peltier effect, thermocouple, Principle and working of thermoelectric generator and Thermoelectric cooler, applications of thermoelectric materials

UNIT IV: SHAPE MEMORY MATERIALS (8 hours)

Introduction to shape memory alloys (SMA)- Shape Memory Effect (SME), Austenite, Martensite phases, Properties and characteristics SMAs, one-way and two-way shape memory effects, Properties of Ni-Ti shape memory alloy, Cu-based shape memory alloys, and their applications, Applications of SMAs.

Learning Resources:

1. Mukesh V. Gandhi, Brian S Smart Materials and Structures, Thompson, Springer, May- 1992
2. D. Patranabis, Sensors and Transducers, PHI Learning Pvt. Ltd., 2022
3. Nachiketa Tiwari, B. Bhattacharya, Smart Material, Adaptive Structures & Intelligent Mechanical systems

Prof. D Karuna Sagar O.U Nominee & Dean, Faculty of Sciences,Osmania University	**Prof. S. Srinath** Subject Expert, School of Physics University of Hyd	**Prof. M. Prasad** Head, Dept. of Physics, Osmania University	**Prof. A.S. Sai Prasad** Head & BOS chairman, Dept of Physics, VCE

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
Ibrahimbagh, Hyderabad-500 031, Telangana State
DEPARTMENT OF PHYSICS
OPEN ELECTIVE COURSE
INTRODUCTION TO NANOTECHNOLOGY

L : T : P	Credits	CIE		SEE		Course Code
		Marks	Exam Duration	Marks	Exam Duration	
03 :0 :0	03	40	90 min	60	3hours	**U25OE610PH**

CO-PO Mapping

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

Course objectives	Course outcomes	BTL
Students will be able to learn	At the end of the course students will be	
1. Learn bulk, thin and nano structures. 2. Acquire knowledge on properties of nano materials. 3. Appreciate fabrication techniques of nano materials. 4. Learn nanomaterial characterization techniques.	1. Distinguish bulk, thin and nano materials from the point of view of size effects. 2. List various properties of nano materials. 3. Narrate various nanomaterial preparation techniques. 4. Describe characterization techniques of nano materials. 5. Write various applications of CNTs &nano structures.	2 2 2 3 2

UNIT-I: INTRODUCTION TO NANOSCIENCE
The distinction between bulk, thin films and nano materials-surface to volume ratio, change of electronic structure, density of states of nano materials, quantum confinement-quantum size effect, Quantum wells, Quantum wires, Quantum dots.

UNIT-II: PROPERTIES OF NANO MATERIALS
Electrical properties: conductivity, ballistic transport, Magnetic properties: soft and permanent magnetic nano materials, Giant Magneto Resistance (GMR), chemical properties, optical properties and thermal properties.

UNIT-III: NANOMATERIALS PREPARATION TECHNIQUES
Bottom-up and Top-down approaches. Preparation techniques Bottom-up methods: Physical Vapor Deposition, Laser Ablation, Chemical Vapor Deposition, Molecular Beam Epitaxy, Sol-gel method, top-down methods: ball milling, Nanolithography.

UNIT-IV: NANO MATERIAL CHARACTERIZATION TECHNIQUES
Characterization techniques: X-Ray Diffraction (XRD), working principles of Scanning Electron Microscopy (SEM), working of Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscope (STM), Field Emission Microscope (FEM).

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UNIT-V: CARBON NANO MATERIALS AND APPLICATIONS

Graphene, Elementary ideas on Carbon nanotubes, types of CNTs-single wall (SWCNT) and multiwall carbon nanotubes (MWCNT), properties and characteristics of SWCNTS and MWCNTS. Applications of nano materials in cosmetic sector, food, agricultural, engineering, automotive Industry, environment, medical applications, textiles, paints, energy and space Applications.

Learning Resources:

1. K.K. Chattopadhyay and A.N. Benerjee, Introduction to Nanoscience and Nanotechnology, PHI, 2019.
2. Nanomaterials and their Properties, IIT-Kanpur, NPTEL Course

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