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 2022-2023

SEMICONDUCTORS AND OPTOELECTRONIC DEVICES

L : T : P	Credits	CIE		SEE		Course Code
		Marks	Exam Duration	Marks	Exam Duration	
3 :0 : 0	03	40	90 min	60	03 hours	U22BS110PH
CIE	Assignments (03)		Quizzes (03)	Internal Exams (02)		Total CIE Marks
Ave. Marks	05		05	30		40

CO code	Course Objectives	Course Outcomes	Highest BTL
BS110PH.1	Demonstrate the use of crystal structure in device applications.	Classify crystals based on their structure and apply effects of defects on manipulation of properties of solids.	3
BS110PH.2	Appreciate the merits of quantum mechanics over classical mechanics.	Apply Schrodinger wave equation to quantum mechanical systems and obtain eigen values.	4
BS110PH.3	Arrive at the expressions for carrier concentration in semiconductors	Articulate the concepts of semiconductor theory for various devices	3
BS110PH.4	Describe working of optoelectronic devices	Categorize optoelectronic devices and explain their device structure	2
BS110PH.5	Comprehend lasing action and relate the use of lasers in optical fiber communication	Compare different types of lasers and summarize merits and demerits of optical fiber communication	3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	2	-	-	-	-	-	-	-	-	-	1	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	1	1
CO4	2	1	-	-	-	-	-	-	-	-	-	1	1
CO5	3	1	-	-	-	-	-	-	-	-	-	1	1

UNIT-I: FUNDAMENTALS OF CRYSTALLOGRAPHY (12 hours)

Introduction to crystallography-Miller Indices, inter planar spacing (d_{hkl}), Bragg's law, x- ray diffraction methods: rotating crystal method and Debye-Scherrer method, distinction between crystalline, polycrystalline, and amorphous materials, Diamond crystal Structure, Point Defects and their effects, expression for concentration of Schottky and Frankel defects and applications relevant to computer science and engineering.

UNIT-II: INTRODUCTION TO QUANTUM MECHANICS (12 hours)

De Broglie Hypothesis, wave packet, group velocity and phase velocity, wave function and its significance, Schrodinger time dependent and independent wave equations, quantum mechanical operators, Eigen values and Eigen functions of infinite square-well potential (particle in a box). Potential barrier-quantum tunneling problem. Introduction to bra and ket vector notation, representation of Qubit, applications of quantum computing.

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UNIT-III: SEMICONDUCTOR PHYSICS (12 hours)

Kronig-Penny model-introduction to origin of band gap, E-k diagram, effective mass of an electron, energy bands in solids, Fermi energy level, density of states, expression for intrinsic and extrinsic equilibrium carrier concentration, conductivity of intrinsic and extrinsic semiconductors, law of mass action, variation of Fermi level with doping and temperature, Hall effect and its applications, formation of a PN junction, diode current equation. Applications of semiconductor devices to computer architecture.

UNIT-IV: OPTOELECTRONIC DEVICES (12 hours)

Light Emitting Diode (LED): Direct and indirect band gap semiconductors, electron-hole pair generation and recombination, non- radiative and radiative recombination in semiconductors, differences between homo and hetero junction LEDs, construction and working of homo junction LED, characteristics of LED, quantum efficiency of LED, advantages, and applications of LED.

Photodetectors: Principle of a photodetector, construction and working of photodiode and PIN diode, applications of photodetectors.

Solar Cell: Photovoltaic effect, construction and working of solar cell, V-I characteristics of solar cell, conversion efficiency, fill factor, types of solar cells, applications of solar cells.

UNIT-V: LASERS AND OPTICAL FIBERS (12 hours)

Lasers: induced absorption, spontaneous and stimulated emissions, Einstein's coefficients; characteristics of lasers, population inversion, meta-stable states, pumping mechanisms, components of laser, types of lasers, construction and working of Ruby laser and semiconductor laser, advantages of lasers, applications of lasers including computer devices such as memory, printers and interconnects.

Optical Fibers: principle of optical fiber, propagation of light in optical fiber, numerical aperture, acceptance angle, types of optical fibers, V- number, signal losses in optical fibers: Attenuation-absorption, scattering, bending and alignment losses, Signal distortion: intermodal and intra model dispersions, block diagram of optical communication system, advantages and application of optical fibers including broad band communications.

Learning Resources:

1. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & Sons, 2008.
2. Donald A Neamen, Semiconductor Physics and Devices, 3rd Edition, Tata McGraw 2008.
3. S.O. Kasap, Optoelectronic and Photonics: Principles and Practices, Pearson, 2012
4. Gerd Keiser, Optical Fiber Communications, 4th edition, Tata McGraw, 2010
5. M.N. Avadhanulu and P.G. Kshirsagar and TVS Arun, Murthy A Textbook Engineering Physics, 11th Edition, S. Chand, 2018.
6. M.R Shenoy, NPTEL MOOCS course, Semiconductor opto-electronics. 2020

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DEPARTMENT OF PHYSICS

B.E Syllabus for **ECE** and **EEE** Branches w.e.f 2022-23

QUANTUM MECHANICS AND MATERIALS SCIENCE

L : T : P	Credits	CIE		SEE		Course Code
		Marks	Exam Duration	Marks	Exam Duration	
3 : 0 : 0	03	40	90 min	60	03 hours	U22BS210PH
CIE	Assignments (03)	Quizzes (03)		Internal Exams (02)		Total CIE Marks
Ave. Marks	05	05		30		40

CO code	Course Objectives	Course Outcomes	Highest BTL
BS210PH.1	Demonstrate the use of crystal structure in device applications.	Classify crystals based on their structure and their appropriate uses	3
BS210PH.2	Appreciate the advantages of quantum mechanics over classical mechanics.	Apply Schrodinger wave equations to quantum mechanical systems.	4
BS210PH.3	Arrive at the expressions for carrier concentration in semiconductors	Articulate the concepts of semiconductor theory for various electronic devices	3
BS210PH.4	Comprehend lasing action and relate the use of lasers in optical fiber communication	Compare different types of lasers and summarize merits and demerits of optical fiber communication	2
BS210PH.5	Choose appropriate dielectric, magnetic and superconducting materials for required applications	Select various dielectric, magnetic and superconducting materials for specific applications in engineering.	3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	3	-	-	-	-	-	-	-	-	-	1	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	1	1
CO4	3	1	-	-	-	-	-	-	-	-	-	1	1
CO5	2	1	-	-	-	-	-	-	-	-	-	2	1

UNIT-I: FUNDAMENTALS OF CRYSTAL STRUCTURE (12 hours)

Introduction to crystallography-Miller Indices, inter planar spacing (d_{hkl}), Bragg's law, x- ray diffraction methods: rotating crystal method and Debye-Scherrer method, distinction between crystalline, polycrystalline, and amorphous materials, Diamond crystal Structure, Point Defects and their effects, expression for concentration of Schottky and Frankel defects and applications relevant to electronics and communication engineering.

UNIT-II: QUANTUM MECHANICS (12 hours)

De Broglie Hypothesis, wave packet, group velocity and phase velocity, Davisson and Germer's experiment, G.P. Thomson experiment, wave function and its significance, Schrodinger time dependent and independent wave equations, quantum mechanical operators, Eigen values and Eigen functions of infinite square-well potential (particle in a box). Potential barrier-quantum tunnelling problem. Introduction to bra and ket vector notation, representation of Qubit, applications of quantum computing.

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UNIT-III: SEMICONDUCTOR PHYSICS (12 hours)

Classical free electron Drude theory and its limitations, Somerfield theory, Fermi-Dirac Statistical distribution, Density of states, Kronig-Penney model, formation of energy bands, E-k diagram, types of semiconductors, fermi energy level, variation of Fermi energy level with temperature and doping concentration, expression for equilibrium carrier concentration in intrinsic and extrinsic semiconductors, conductivity of intrinsic and extrinsic semiconductors, law of mass action, Hall effect and its applications. Applications of semiconductor devices to computer architecture.

UNIT-IV: LASERS AND OPTICAL FIBRES (12 hours)

Lasers: induced absorption, spontaneous and stimulated emissions, Einstein's coefficients; characteristics of lasers, population inversion, meta-stable states, pumping mechanisms, components of laser, Properties of laser beam, types of lasers, construction and working of Ruby laser and semiconductor laser, advantages and optoelectronic applications of lasers.

Optical Fibers: principle of optical fiber, propagation of light in optical fiber, numerical aperture, acceptance angle, types of optical fibers, V- number, signal losses in optical fibers: Attenuation-absorption, scattering, bending, alignment losses, Signal distortion: intermodal and intra model dispersions, block diagram of optical communication system, advantages and application of optical fibers including broad band communications.

UNIT-V: MATERIALS SCIENCE (12 hours)

Dielectric Materials: Polar and non-polar dielectrics, types of dielectric polarizations, Expressions for electronic polarizability and ionic polarizability, Frequency and temperature dependence of dielectric polarizations, electronic applications of dielectric materials.

Magnetic Materials: Origin of magnetism, Ferromagnetic materials, antiferromagnetic materials and ferri-magnetic (ferrites) materials, Weiss molecular field theory of ferromagnetism, magnetic domains, hysteresis curve, soft and hard magnetic materials and their applications including electro-magnetic shielding.

Superconductivity: Introduction to superconductivity, General properties of superconductors, Meissner effect, Type I and Type II superconductors-fundamentals of BCS Theory - Josephson's Junctions-Josephson's effects–SQUIDS- Applications of superconductors in communications.

Learning Resources:

1. Charles Kittel, Introduction to Solid State Physics, 7th Edition, John Wiley & Sons, 2008
2. S O Pillai, Solid State Physics, 8th edition, New Age International Publishers, 2018
3. M.N. Avadhanulu and P.G. Kshirsagar and TVS Arun Murthy, A Textbook Engineering Physics, 11th Edition, S. Chand, 2018.
4. Senior, Optical Fiber Communications: Principles and Practice, 3rd edition, Pearson, 2010
5. NPTEL MOOCS, Introduction to Solid State Physics, Satyajit Banerjee

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DEPARTMENT OF PHYSICS

B.E Syllabus for **Civil Engineering** Branch w.e.f 2022-23

OPTICS, ACOUSTICS AND SENSORS

L : T : P	Credits	CIE		SEE		Course Code
		Marks	Exam Duration	Marks	Exam Duration	
3 :0 : 0	03	40	90 min	60	03 hours	U22BS220PH
CIE	Assignments (03)		Quizzes (03)		Internal Exams (02)	Total CIE Marks
Ave. Marks	05		05		30	40

CO code	Course Objectives	Course Outcomes	Highest BTL
BS220PH.1	Explain mathematical formulations of waves and oscillations.	Interpret behavior of mechanical oscillators with and without damping effects	2
BS220PH.2	State principles of interference, diffraction and polarization of light.	Outline the principles of wave optics and their applications	1
BS220PH.3	Comprehend lasing action and state application of lasers	Compare different types of lasers and summarize merits and demerits of optical fiber communication	3
BS220PH.4	Describe characteristics of acoustics quieting effects required for a hall.	Explain production of ultrasonics and summarize good building acoustics	2
BS220PH.5	Interpret the advantages of using sensors in civil engineering.	List various sensors used for structural health monitoring	3

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	3	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	2
CO4	3	2	-	-	-	-	-	-	-	-	-	1	2
CO5	2	1	-	-	-	-	-	-	-	-	-	2	2

UNIT-I: OSCILLATIONS (12 hours)

Definition of SHM, equation of motion and solution to simple harmonic oscillator, energy of simple harmonic oscillator, equation of motion and solution to damped harmonic oscillator, logarithmic decrement, energy of damped oscillator, relaxation time, equation of motion and solution to forced harmonic oscillator, Resonance, Q-factor, electromechanical analogy. Real life applications of mass-spring systems and mechanical oscillators.

UNIT-II: WAVE OPTICS (12 hours)

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

Diffraction: Phenomenon of diffraction of light, classes of diffractions, Fraunhofer diffraction due to a single slit, diffraction due to N- slits (plane transmission grating), resolving power, application 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 of wave optics in the field of civil engineering such as stress management.

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UNIT-III: LASERS AND OPTICAL FIBRES (12 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, He-Ne laser, advantages and applications of lasers including highway engineering.

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

UNIT-IV: ACOUSTICS (12 hours)

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

Ultrasonics: properties of ultrasonics, types of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics by piezoelectric, Kundt's tube, flame test, thermal detector, applications of Ultrasonics: SONAR, cavitation, welding, sonogram. ultrasonic non-destructive testing applications in civil engineering.

UNIT-V: SENSORS FOR STRUCTURAL HEALTH MONITORING (12 hours)

Introduction to Structural Health Monitoring (SHM), Types of sensors in Structural Health Monitoring: Load Cells, Strain Gauges, Optical Fiber Sensors, Accelerometer, Vibrating Wire Traducers, Linear Variable Differential Transformer (LVDT), Inclinometer (Slope Indicator), Tiltmeter, Temperature Sensors.

Learning Resources:

1. J Walker, D., Halliday and R Resnick, Principles of Physics, 10th edition, Wiley, 2016.
2. Jewett and Serway, Physics for Scientists and Engineering, 7th edition, 2012.
3. M.N. Avadhanulu and P.G. Kshirsagar and TVS Arun Murthy A Textbook Engineering Physics, 11th Edition, S. Chand, 2018.
4. Senior, Optical Fiber Communications: Principles and Practice, 3rd Edition, Pearson, 2010
5. John G. Webster and Halit Eren, Measurement, instrumentation, and Sensors handbook: Spatial, Mechanical, Thermal,and Radiation Measurement, CRC press, 2014.

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DEPARTMENT OF PHYSICS

B.E Syllabus for **Mechanical Engineering** Branch w.e.f 2022-23
ENGINEERING PHYSICS

L : T : P	Credits	CIE		SEE		Course Code
		Marks	Exam Duration	Marks	Exam Duration	
3 :0 : 0	03	40	90 min	60	03 hours	U22BS230PH
CIE	Assignments (03)	Quizzes (03)		Internal Exams (02)		Total CIE Marks
Ave. Marks	05	05		30		40

CO code	Course Objectives	Course Outcomes	Highest BTL
BS220PH.1	State principles of interference, diffraction and polarization of light	Outline the principles of wave optics and their applications	3
BS220PH.2	Comprehend lasing action and state various applications of lasers	Compare different types of lasers and summarize their merits and demerits	2
BS220PH.3	Describe characteristics of acoustic quieting effects required for a hall	Explain production of ultrasonics and summarize good building acoustics	3
BS220PH.4	List out various properties of magnetic materials	Select various magnetic and for specific applications in mechanical engineering.	2
BS220PH.5	Summarize the principles of liquefaction of gasses	Describe liquefaction of gases and their significant applications	2

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	3	-	-	-	-	-	-	-	1	-	1	1
CO2	3	3	-	-	-	-	-	-	-	1	-	1	1
CO3	2	2	-	-	-	-	-	-	-	1	-	1	1
CO4	3	2	-	-	-	-	-	-	-	1	-	1	1
CO5	2	2	-	-	-	-	-	-	-	1	-	2	1

UNIT-I: WAVE OPTICS (12 hours)

Interference: conditions for sustained interference, interference due to thin parallel film, Newton's rings, applications of interference.
Diffraction: Phenomenon of diffraction of light, classes of diffractions, Fraunhofer diffraction due to a single slit, diffraction due to N- slits (plane transmission grating), resolving power.
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 of wave optics in the field of mechanical engineering.

UNIT-II: LASERS AND OPTICAL FIBRES (12 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, He-Ne laser, CO_2 laser, advantages and applications of lasers in mechanical engineering such as Laser Marking, Laser Drilling, Laser Cutting, Laser Welding.

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Optical Fibers: introduction to optical fibers, propagation of light in an optical fiber, 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, advantages and application of optical fibers. Applications of optical fiber sensors in mechanical measurements.

UNIT-III: ACOUSTICS (12 hours)

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

Ultrasonics: properties of ultrasonics, types of ultrasonic waves, production of ultrasonics by piezoelectric and magnetostriction methods, detection of ultrasonics by piezoelectric, Kundt's tube, flame test, thermal detector, applications of ultrasonics: SONAR, cavitation, welding, sonogram. Ultrasonic non-destructive testing applications in mechanical engineering.

UNIT-IV: MAGNETIC MATERIALS (12 hours)

Origin of magnetism, Ferromagnetic materials, antiferromagnetic materials and ferri-magnetic (ferrites) materials, Weiss molecular field theory of ferromagnetism, magnetic domains, hysteresis curve, soft and hard magnetic materials and their applications including electro-magnetic shielding.

Introduction to superconductivity, General properties of superconductors, Meissner effect, Type I and Type II superconductors-Josephson's Junctions-SQUIDS- Applications of superconductors.

UNIT-V: CRYOGENICS (12 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, liquefaction of helium, properties of liquid helium, adiabatic demagnetization, Applications of cryogenic liquids including cryogenic treatment of mechanical machine tools.

Learning Resources:

1. J Walker, D., Halliday and R Resnick, Principles of Physics, 10th edition, Wiley, 2016,
2. M.N. Avadhanulu and P.G. Kshirsagar and TVS Arun Murthy, A Textbook Engineering Physics, 11th edition, S. Chand, 2018.
3. Senior, Optical Fiber Communications: Principles and Practice, 3rd edition, Pearson, 2010
4. Brijlal, N. Subrahmaniyam and P.S. Hemne, Heat, Thermodynamics and Statistical Physics, S. Chand, 2018.

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DEPARTMENT OF PHYSICS

B.E Syllabus for **CSE, CSE (AI & ML) and IT Branches** w.e.f academic year 2022-2023

SEMICONDUCTOR AND OPTOELECTRONICS LAB

L : T : P	Credits	CIE Marks	SEE Marks	Semester	Course Code
0 : 0 : 2	01	30	50	I	U22BS111PH

Course Objectives	Course Outcomes	Highest BTL
• to study and discuss the characteristics of a given device	1. 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. Outline the precautions required to be taken for each experiment	1
• to compare the experimental and theoretical values and draw possible conclusions.	3. Compare the experimental results with standard values and estimate errors	2
• To interpret the results from the graphs drawn using experimental values.	4. Draw graphs and interpret the results with respect to graphical and theoretical values	2
• To write the record independently with appropriate results.	5. Write the summary of the experiment and draw appropriate conclusions	1

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	-	-	-	-	-	-	-	2	-	-	2	1
CO2	3	-	-	-	-	-	-	-	-	-	-	1	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO4	3	-	-	-	-	-	-	-	-	-	-	1	1
CO5	2	-	-	-	-	-	-	1	-	-	-	2	1

1. Comparative study of I-V characteristics of P-N Junction diode and Zener Diode
2. Comparative study of I-V characteristics of LED and Photodiode
3. Determination of wavelength of Semiconductor lasers
4. Calculation of numerical aperture, acceptance angle and power loss due to bending of an optical fiber.
5. Study of I-V characteristics of solar cell and to calculate fill factor and efficiency
6. Determination of Planck's constant using Photocell
7. Determination of Hall's coefficient, carrier concentration of given semiconductor- Hall's effect
8. Study of resonance in LCR series circuits and estimation of resonant frequency & Q-factor
9. Study of resonance in LCR parallel circuits and estimation of resonant frequency & Q- factor
10. Determination of energy gap of a given semiconductor by four probe method
11. Estimation of Thermistor constants
12. Determination of Seebeck coefficient
13. Determination of e/m of electron by Thomson's method

Each student should perform at least 10 (Ten) experiments.

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DEPARTMENT OF PHYSICS

B.E Syllabus for **ECE and EEE Branches** w.e.f academic year 2022-2023
ENGINEERING PHYSICS LAB

L : T : P	Credits	CIE Marks	SEE Marks	Semester	Course Code
0 : 0 : 2	01	30	50	II	U22BS211PH

Course Objectives	Course Outcomes	BTL
• to study and discuss the characteristics of a given device	1. 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. Outline the precautions required to be taken for each experiment	1
• to compare the experimental and theoretical values and draw possible conclusions.	3. Compare the experimental results with standard values and estimate errors	2
• To interpret the results from the graphs drawn using experimental values.	4. Draw graphs and interpret the results with respect to graphical and theoretical values	2
• To write the record independently with appropriate results.	5. Write the summary of the experiment and draw appropriate conclusions	1

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	-	-	-	-	-	-	-	2	-	-	2	1
CO2	3	-	-	-	-	-	-	-	-	-	-	1	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO4	3	-	-	-	-	-	-	-	-	-	-	1	1
CO5	2	-	-	-	-	-	-	1	-	-	-	2	1

1. Determination of wavelength of He-Ne lasers.
2. Comparative study I-V characteristics of P-N Junction diode and Zener Diode
3. Calculation of numerical aperture, acceptance angle and power loss due to bending of an optical fibre.
4. Determination of energy gap of a given semiconductor by four probe method
5. Study of I-V characteristics of solar cell and to calculate fill factor and efficiency
6. Determination of Hall's coefficient using Hall's effect
7. Determination of e/m of an electron by Thomson's method
8. Study of resonance in LCR series circuits and to find resonant frequency & Q- factor
9. Study of resonance in LCR parallel circuits and to find resonant frequency & Q- factor
10. Estimation of Thermistor constants
11. Determination of Seebeck coefficient
12. Helmholtz coil –calculation of magnetic field along the axis of a solenoid
13. B-H curve-estimation of Hysteresis loss of a ferromagnetic sample

Each student should perform at least 10 (Ten) experiments.

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DEPARTMENT OF PHYSICS
B.E Syllabus for **Civil and Mechanical Branches** w.e.f academic year 2021-2022
APPLIED PHYSICS LAB

L : T : P	Credits	CIE Marks	SEE Marks	SEE Duration	Course Code
0 : 0 : 2	01	30	50	3 hours	U22BS221PH

Course Objectives	Course Outcomes	BTL
• to study and discuss the characteristics of a given device	1. 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. Outline the precautions required to be taken for each experiment	1
• to compare the experimental and theoretical values and draw possible conclusions.	3. Compare the experimental results with standard values and estimate errors	2
• To interpret the results from the graphs drawn using experimental values.	4. Draw graphs and interpret the results with respect to graphical and theoretical values	2
• To write the record independently with appropriate results.	5. Write the summary of the experiment and draw appropriate conclusions	1

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	-	-	-	-	-	-	-	2	-	-	2	1
CO2	3	-	-	-	-	-	-	-	-	-	-	1	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO4	3	-	-	-	-	-	-	-	-	-	-	1	1
CO5	2	-	-	-	-	-	-	1	-	-	-	2	1

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

***Each student should perform at least 10 (Ten) experiments.**

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VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
DEPARTMENT OF PHYSICS
Open elective Course
SMART MATERIALS AND APPLICATIONS

L : T : P	Credits	CIE		SEE		Course Code
		Marks	Exam Duration	Marks	Exam Duration	
02 :0 :0	02	40	90 min	60	3hours	U22OE310PH
CIE	Assignments (02)		Quizzes (02)	Internal Exams(02)		Total CIE Marks
Ave. Marks	05		05	30		40

Course Objectives	Course Outcomes	BTL
The student will be able to	**the student should at least be able:**	
1. grasp the concepts of peizo and ferro electric materials	1. summarize various properties and applications of peizo and ferro electric materials	2
2. Learn fundamentals of pyro and thermo electric materials	2. apply fundamental principles of pyro and thermo electricity in relevant fields of engineering	3
3. gain knowledge on shape memory alloys	3. Explain types of shape memory alloys and their properties and applications	3
4. acquire fundamental knowledge on chromic materials	4. Outline the importance of chromic materials in engineering fields.	2

UNIT I: PIEZO AND FERRO 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 ferro-electric materials, Curie-Weiss law, applications of Ferro electric materials

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

Pyroelectricity: 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 III: SHAPE MEMORY MATERIALS (8 hours)

Introduction to shape memory alloys (SMA)- Shape Memory Effect (SME), Austenite, Martensite phases, Properties and characteristics SMAs, Super elasticity, 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.

UNIT-IV: (6 hours)

Electro-chromaticity, Electro-chromic materials, Electro-chromic sensors and devices.
Photo-chromaticity, Photo-chromic materials, Photo-chromic sensors and devices.
Thermo-chromaticity, thermo-chromic materials, thermo-chromic sensors and devices.
Smart fluids: Magneto-rheological and Electro-rheological fluids.

Learning Resources:

1. K. Otsuka and C M Wayman, Shape memory materials, Cambridge university press, 1998.
2. T W Duerig, K N Melton, D Stockel, C M Wayman, Engineering aspects of shape memory alloys, Butterworth-Heinemann, 1990
3. A.K. Sawhney, A Course in Electronic Measurements and Instrumentation, Dhanpat Rai & Sons, 2015
4. D. Patranabis, Sensors and Transducers, PHI Learning Pvt. Ltd., 2013

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VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
DEPARTMENT OF PHYSICS

Open elective Course
THIN FILM TECHNOLOGY AND APPLICATIONS

L : T : P	Credits	CIE		SEE		Course Code
		Marks	Exam Duration	Marks	Exam Duration	
03 :0 :0	03	40	90 min	60	3hours	U22OE510PH

CIE	Assignments (03)	Quizzes (03)	Internal Exams(02)	Total CIE Marks
Ave. Marks	05	05	30	40

Course Objectives	Course Outcomes	BTL
Students are able to	***The students acquire the ability to***	
1. Learn the fundamental atomistic mechanisms.	1. State fundamental definitions of thin film technology	1
2. Narrate thin film deposition techniques	2. Describe thin film deposition techniques	2
3. Acquire knowledge on thin film devices	3. Illustrate thin film devices and their use	3
4. Appreciate applications of thin films	4. Apply thin films coatings for a variety industrial applications	3

UNIT-I: THIN FILM GROWTH

Classification of films- formation of thin films- Condensation and nucleation, growth and coalescence of islands, -nucleation theories: capillarity and atomistic models, sticking coefficient, adhesion, substrate effect, film thickness effect.

UNIT-II: DEPOSITION TECHNIQUES

Thin film deposition techniques- simple thermal evaporation- Chemical vapor deposition technique- Advantages and disadvantages of Chemical Vapor deposition (CVD), physical vapour deposition electron beam evaporation- RF sputtering, Laser ablation- spin coating- molecular beam epitaxy (MBE), Film thickness measurement-ellipsometry, quartz crystal oscillator techniques.

UNIT-III: THIN FILM 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).

UNIT-IV: PROPERTIES OF THIN FILMS

Electrical conduction in continuous and discontinuous metallic thin films. Transport and optical properties of metallic, semiconducting and dielectric films.

UNIT-V: THIN FILM DEVICES AND APPLICATIONS

Anti-reflection coatings, fabrication of thin film gas sensors and temperature sensors. Thin film solar cells, Quantum well and Quantum dot solar cells. Application of thin films in different areas such as electronics, medical, defense, sports, automobiles, applications of thin films in various fields etc.

Learning resources:

1. Kasturi Chopra Thin Film Device Applications, Mac Graw Hill, New York, 2012
2. A. Goswami, thin film fundamentals, New age international, 2006

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