SAVEETHA ENGINEERING COLLEGE

AUTONOMOUS

Affiliated to Anna University | Approved by AICTE

NAAC A GRADE

DEPARTMENT OF PHYSICS

REGULATION - 2019

SYLLABUS

SAVEETHA ENGINEERING COLLEGE
AUTONOMOUS
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SUB. CODE	COURSE TITLE	L	T	P	Credit
19PH201	BASICS OF ENGINEERING PHYSICS Common to ECE, CIVIL, EIE	3	0	0	3

Preamble

Engineering physics integrates principles of physics and engineering in electronics and communication field. It encompasses the application of the basic principles of physics to the development of engineering..

Prerequisite

Nil

Course Outcomes

At the end of the course, the students should be able to

CO1	Understand the different types of crystals & different planes in a crystal.	Understand
CO2	Acquire the knowledge on the flow of viscous fluids by different methods.	Analyze
CO3	Analyze different types of vibrations & hence the different forms of waves.	Analyze
CO4	Make use of concept of Optical Properties of Materials in various fields	Apply
CO5	Explain about bio materials, bio sensors and tissue engineering and their applications.	Evaluate

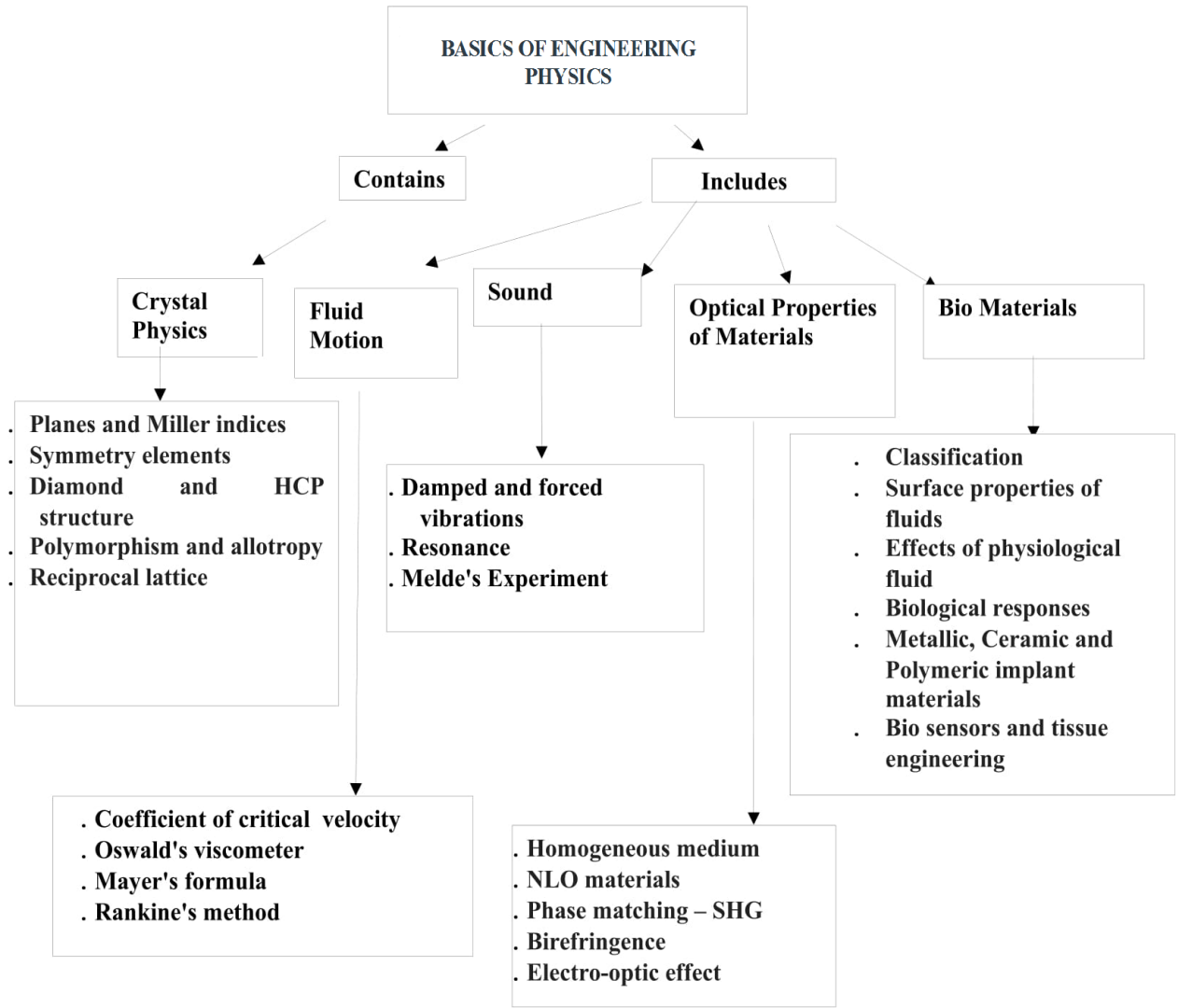
Mapping of COs with POs and PSOs

1 – LOW, 2 – MEDIUM, 3 – STRONG

Course Outcomes	Program Outcomes												Program Specific Outcomes/ECE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	1	1	-	1	2	1	1	-	-	-
CO2	3	3	2	-	-	1	1	-	1	1	1	2	-	-	-
CO3	3	3	3	-	-	1	1	-	1	1	1	1	-	-	-
CO4	3	3	2	-	-	1	1	-	1	2	1	1	1	-	-
CO5	3	3	2	-	-	1	1	-	1	1	1	1	1	-	-

Course Outcomes	Program Outcomes												Program Specific Outcomes/EIE	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	1	-	1	2	1	1	-	-
CO2	3	3	2	-	-	1	1	-	1	1	1	2	1	2
CO3	3	3	3	-	-	1	1	-	1	1	1	1	1	-
CO4	3	3	2	-	-	1	1	-	1	2	1	1	1	1
CO5	3	3	2	-	-	1	1	-	1	1	1	1	-	1
Course Outcomes	Program Outcomes												Program Specific Outcomes/CIVIL	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	1	-	1	2	1	1	-	-
CO2	3	3	2	-	-	1	1	-	1	1	1	2	-	-
CO3	3	3	3	-	-	1	1	-	1	1	1	1	1	-
CO4	3	3	2	-	-	1	1	-	1	2	1	1	1	-
CO5	3	3	2	-	-	1	1	-	1	1	1	1	-	1

Concept Map



SYLLABUS

UNIT - I CRYSTAL PHYSICS **9**

Introduction to crystals – crystal structures-Crystal directions – Planes and Miller indices – Symmetry elements – Diamond and HCP crystal structure – Polymorphism and allotropy – Reciprocal lattice – Diffraction of X-rays by crystal planes – Laue method and powder method – Imperfections in crystals.

UNIT - II FLUID MOTION **9**

Viscosity - Coefficient of critical velocity – Poiseuille's formula for coefficient of viscosity and its correction - Determination of coefficient of viscosity by capillary flow method - comparison of viscosities Oswald's viscometer - Viscosity of a highly viscous liquid - Stoke's method for the Coefficient of a highly viscous liquid - Variations of viscosity with temperature and pressure - Viscosity of gases - Mayer's formula for the rate of flow of a gas through a capillary tube - Rankine's method for the determination of viscosity of a gas.

UNIT –III SOUND **9**

Sound - Definition of free, damped and forced vibrations – Theory of forced vibrations -Resonance - Sharpness of resonance - Fourier's theorem – Maxwell's equation in Fourier space-Application for Saw- tooth wave and square wave - Determination of frequency using Melde's apparatus.

UNIT –IV OPTICAL PROPERTIES OF MATERIALS **9**

Light waves in a homogeneous medium – refractive index – dispersion: refractive index-wave-length behavior – group velocity and group index – NLO materials – phase matching – SHG, sum frequency generation, parametric oscillations – difference frequency generation (qualitative)-applications- – complex refractive index and light absorption –polarization – optical anisotropy: uniaxial crystals, birefringence, dichroism – electro-optic effect and amplitude modulators- electro-absorption.

UNIT -V BIO MATERIALS **9**

Classification of biomaterials –Surface properties of fluids- Comparison of properties of some common biomaterials – introduction to in-vitro, in-vivo, biodegradable, biocompatibility, osteoconductive Effects of physiological fluid on the properties of biomaterials – Biological responses (extra and intra vascular system) – Metallic, Ceramic and Polymeric implant materials – Introduction to bio sensors and tissue engineering.

TOTAL: 45 PERIODS

Text Books

1. Gaur, R.K. & Gupta, S.L., Engineering Physics, Dhanpat Rai Publishers, 2012.
2. Murugesan R., Properties of Matter and Acoustics, Revised Edition, S.Chand and Company, 2005.
3. Eugene Hecht, Optics, 4 th Edition, Addison Wesley, 2002.

References

1. Halliday, D., Resnick, R. & Walker, J. Principles of Physics‖. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. Physics for Scientists and Engineers‖. Cengage Learning, 2010.
3. Tipler, P.A. & Mosca, G. Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.
4. Eugene Hecht, Optics, 4th Edition, Addison Wesley, 2002.
5. Edition,Qizhi Chen, George Thouas, Biomaterials: A Basic Introduction, 1st Edition, CRC Press, 2018.

Course Designers

S.No	Name of the Faculty	Email ID
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SUB. CODE	COURSE TITLE	L	T	P	Credit
19PH202	FUNDAMENTALS OF ENGINEERING PHYSICS Common to MECH, MED ELE & BIO MED	3	0	2	4

Preamble

Fundamentals of Engineering Physics integrate the principles of physics and engineering with machines, materials and related basic physical concepts. It encompasses the application of the basic principles of physics to the development of various engineering fields..

Common to MECH, BME, ME

Prerequisite

Nil

Course Outcomes

At the end of the course, the students should be able to

CO1	To gain the knowledge on different symmetry planes in a crystal and identify the crystal using X- Ray crystallography.	Remember& Understand
CO2	To acquire the knowledge on the flow of viscous fluids by different methods.	Analyze
CO3	To gain the knowledge on different types of vibrations and hence to analyze the different forms of waves.	Understand& Analyze
CO4	To obtain the concept of Optical Properties of Materials and apply those materials in various fields	Understand& Apply
CO5	To learn about the bio materials and hence to know the applications of biomaterials and apply them in necessary fields. To gain the knowledge on bio sensors and tissue engineering.	Understand& Apply

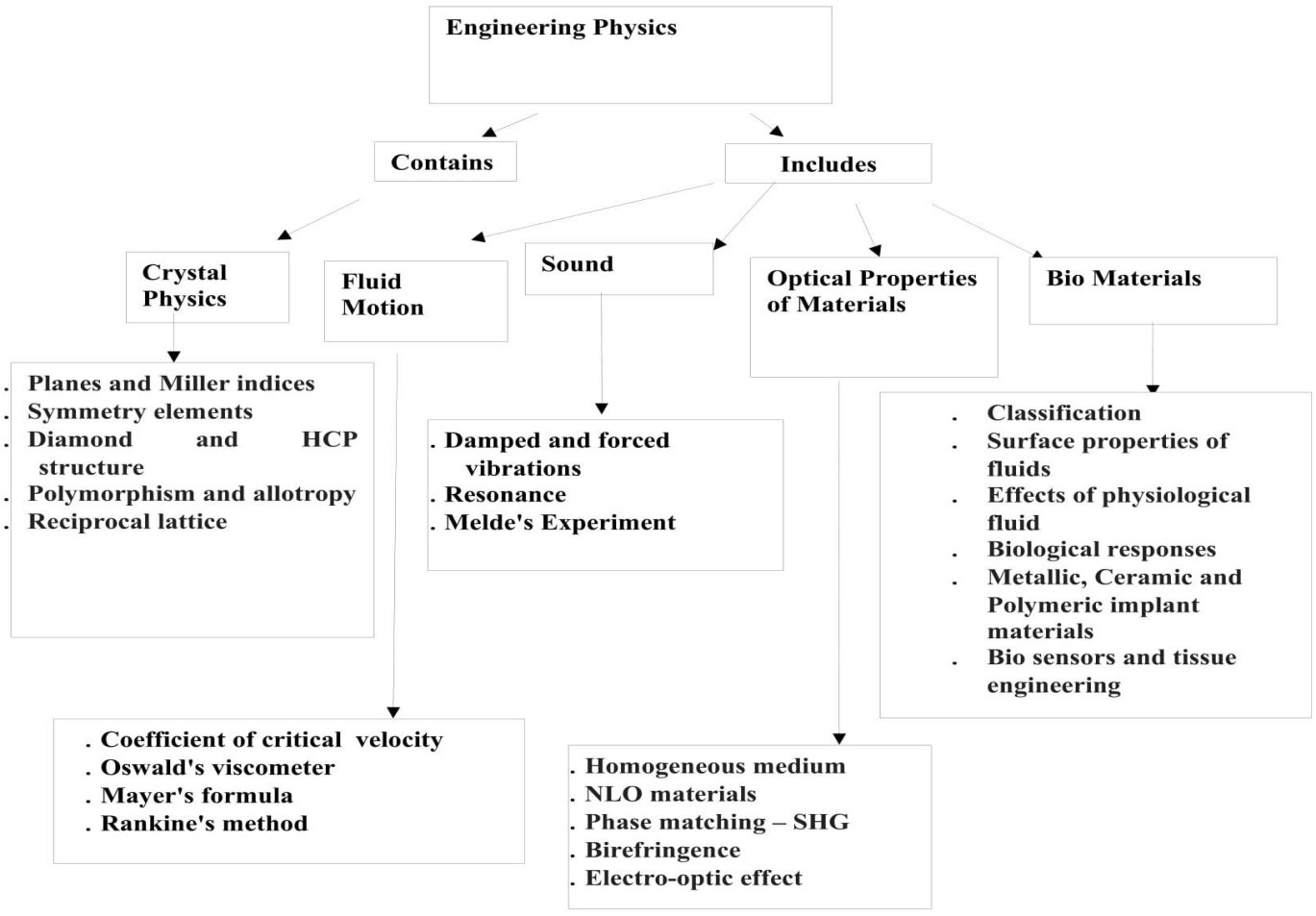
Mapping of COs with POs and PSOs

Course Outcomes	Program Outcomes												Program Specific Outcomes/Med-Ele	
	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO12	PSO1	PSO2
CO1	3	3	2	-	-	1	1	-	1	2	1	1	1	-
CO2	3	3	2	-	-	1	1	-	1	1	1	2	-	1
CO3	3	3	3	-	-	1	1	-	1	1	1	1	-	-
CO4	3	3	2	-	-	1	1	-	1	2	1	1	2	2
CO5	3	3	2	-	-	1	1	-	1	1	1	1	2	2

Course Outcomes	Program Outcomes												Program Specific Outcomes/Mech		
	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	1	1	-	1	2	1	1	1	-	2
CO2	3	3	2	-	-	1	1	-	1	1	1	2	-	-	-
CO3	3	3	3	-	-	1	1	-	1	1	1	1	-	-	-
CO4	3	3	2	-	-	1	1	-	1	2	1	1	1	-	2
CO5	3	3	2	-	-	1	1	-	1	1	1	1	1	-	1

Course Outcomes	Program Outcomes												Program Specific Outcomes/Bio-Med		
	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	1	1	-	1	2	1	1	-	-	-
CO2	3	3	2	-	-	1	1	-	1	1	1	2	-	-	-
CO3	3	3	3	-	-	1	1	-	1	1	1	1	-	-	-
CO4	3	3	2	-	-	1	1	-	1	2	1	1	1	-	-
CO5	3	3	2	-	-	1	1	-	1	1	1	1	2	-	-

Concept Map



SYLLABUS

UNIT –I CRYSTAL PHYSICS **15**

Basic crystal structures, concept of miller indices, Symmetry elements – Diamond and HCP crystal structure –Reciprocal lattice – Diffraction of X-rays by crystal planes – Laue method and powder method. Application of X-Ray crystallography

Determine the crystal structure of a crystal using the XRD pattern

UNIT – II FLUID MOTION **15**

Poiseuille's formula for coefficient of viscosity and its correction - Determination of coefficient of viscosity by capillary flow method - comparison of viscosities – different viscometers- Oswald's viscometer - Viscosity of a highly viscous liquid - Stoke's method for the Coefficient of a highly viscous liquid. Variations of viscosity with temperature and pressure - Viscosity of gases - Mayer's & Rankine's method for the determination of viscosity of a gas.

Determination of viscosity of a given liquid by Poiseuille's method.

Determination of viscosity of a given liquid by Stokes method

UNIT –III SOUND **15**

Sound - Definition of free, damped and forced vibrations – Theory of forced vibrations -Resonance - Sharpness of resonance - Application for Saw- tooth wave and square wave - Determination of frequency using Melde's apparatus.

Determination of velocity of sound and compressibility using Ultrasonic interferometer.

UNIT -IV OPTICAL PROPERTIES OF MATERIALS **15**

NLO materials – phase matching – SHG – complex refractive index and light absorption – polarization – optical anisotropy: uniaxial crystals, birefringence, dichroism – electro-optic effect-complex refractive index and light absorption –polarization – optical anisotropy: uniaxial crystals, birefringence, dichroism – electro-optic effect and amplitude modulators- electro-absorption.

Determination of wavelength and crystalline size using laser.

Determination of Numerical Aperture of an optical fibre

Determination of thickness using interference of light - Airwedge

Dispersive power of a prism using spectrometer

Determination of wavelength of spectral lines using grating

Determination of SHG of crystals/materials

UNIT –V BIO MATERIALS **15**

Classification of biomaterials- Comparison of properties of some common biomaterials, introduction to in-vitro, in-vivo, biodegradable, biocompatibility and osteoconductive, Metallic, Ceramic and Polymeric implant materials – Introduction to bio sensors and tissue engineering.

Project – Bio implant materials

TOTAL: 75 PERIODS

Text Books

1. Gaur, R.K. & Gupta, S.L. ―Engineering Physics, Dhanpat Rai Publishers, 2012.
2. Murugesan R., Properties of Matter and Acoustics, Revised Edition, S.Chand and Company, 2005.
3. Eugene Hecht, Optics, 4 th Edition, Addison Wesley, 2002.

References

1. Halliday, D., Resnick, R. & Walker, J. ―Principles of Physics. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. ―Physics for Scientists and Engineers‖. Cengage Learning, 2010.

3. Tipler, P.A. & Mosca, G. ―Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007.
4. Eugene Hecht, Optics, 4th Edition, Addison Wesley, 2002.
5. Edition,Qizhi Chen, George Thouas, Biomaterials: A Basic Introduction, 1st Edition, CRC Press, 2018.

LIST OF EQUIPMENTS: For the strength of Thirty Students

Sl.No.	Name of The Experiment	Equipments Required	Number Required
1	Determination of viscosity of a given liquid by Poiseuille's method	Burette Capillary tube Stand, rubber tube Stop watch	6 6 6 6
2	Determination of viscosity of a given liquid by Stokes method	Stop watch Steel balls Stokes tube	6 6 6
3	Determination of velocity of sound and compressibility using Ultrasonic interferometer	Ultrasonic Interferometer	6
4	Dispersive power of a prism using spectrometer grating	Spectrometer Prism	6 6
5	Determination of wavelength of spectral lines using grating	Spectrometer Mercury lamb Grating element	6 6 6
6	Determination of wavelength and crystalline size using laser.	Laser Kit Glass with Lycopodium Powder	6 6
7	Determination of Numerical Aperture of an optical fibre using LASER	LASER Fibre Optic Kit	6 6
8	Determination of velocity of sound and compressibility of liquid using Ultrasonic interferometer.	Ultrasonic interferometer	3
9	Determination of thickness using interference of light - Airwedge	Microscope Air wedge Sodium vapour lamp	6 6 6
10	Project – Bio implant materials		
11	Determination of SHG of crystals/materials		
12	Determine the crystal structure of a crystal using the XRD pattern		

Course Designer

S.No	Name of the Faculty	Email ID
1	Dr.M.Priya	priyam@saveetha.ac.in

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SUB. CODE	COURSE TITLE	Branch	AGRICULTURAL ENGINEERING			
19PH203	ENGINEERING PHYSICS	Category	L	T	P	Credit
		BS	2	0	2	3

Preamble

This subject connects basic science and engineering for agricultural productivity.

Prerequisite

Nil

Course Outcomes

At the end of the course, the students should be able to

CO1	Understand the concept of classical and quantum electron theories and energy band structures and to analyze the electrical properties of different materials.	Understand & Analyze
CO2	Understand the basic concepts & applications of laser in 2D and 3D printing and analyze the difference in 2D and 3D printing	Understand & Analyze
CO3	Get the knowledge on advanced physical concepts of quantum theory and apply the knowledge in real life applications.	Understand & Apply
CO4	Gain the knowledge on magnetic properties of materials and understand their applications in data storage	Understand
CO5	Gain knowledge on superconducting properties of materials and learn the applications of Super conductors	Understand

Mapping of COs with POs and PSOs

1 – LOW, 2 – MEDIUM, 3 – STRONG

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	3	2	2	3	3	3	-	-	2	1	-	-
CO2	1	1	-	1	1	2	2	3	3	-	-	2	1	1	
CO3	1	2	-	2	1	2	2	3	2	-	-	3	-	1	-
CO4	3	1	-	3	2	2	1	2	2	-	-	2	-	-	-
CO5	2	1	-	1	1	1	1	1	3	-	-	2	1	-	-

SYLLABUS

UNIT-I SEMICONDUCTING MATERIALS **9**

Distinction between metals. insulators and semiconductors. Intrinsic and extrinsic semiconductors, law of mass action. Determination of energy gap in semiconductors. Donors and acceptor levels.

To determine the good & Bad conductor using lees disc method

To determine the energy band gap in a semiconductor using a p-n Junction diode

Determination of VI characteristics of solar cell and to determine the efficiency with distance of light source

UNIT II –LASER 9

Spontaneous and stimulated emission, Einstein A and B coefficients. Population inversion, He-Ne and Ruby lasers. Ammonia and Ruby Masers, Holography-Note. Optical fiber. Physical structure. basic theory. Mode type, input output characteristics of optical fiber and applications. Illumination: laws of illumination, luminous flux,luminous intensity, candle power, brightness.
Determine (i) the wave length of the given light source and (ii) determine the Numerical Aperture of given optical fibre.
Determine (i) the wavelength of the given laser light source using grating (ii) the size of the given micro particles in the form of powder using the given laser source.
Construction of Hologram with mobile

UNIT-III QUANTUM MECHANICS 9
Wave particle quality, de-Broglie concept, uncertainty principle. Wave function. Time dependent and time independent Schrodinger wave equation, Qualitative explanation of Zeeman effect, Stark effect and Paschan Back effect, Raman spectroscopy. Statement of Bloch's function. Bands III solids, velocity of Bloch's electron and effective mass.
Determination of Dispersive power of a prism using spectrometer
Determination of wavelength of spectral lines using grating

UNIT- IV MAGNETIC MATERIALS 9
Dia, Para and ferromagnetism-classification. Langevin theory of dia and paramagnetism. Adiabatic demagnetization. Weiss molecular field theory and ferromagnetism. Curie-Weiss law.
To obtain hysteresis curve (B-H curve) on a C.R.O. and to determine related magnetic quantities

UNIT- V SUPERCONDUCTING MATERIALS 9
Superconductivity, critical magnetic field. Meissner effect. Isotope effect. Type-I and II superconductors, Josephson's effect DC and AC, Squids. Introduction to high T_c superconductors.
To find the low resistance using Carey Foster bridge without calibrating the bridge wire

TOTAL: 45 PERIODS

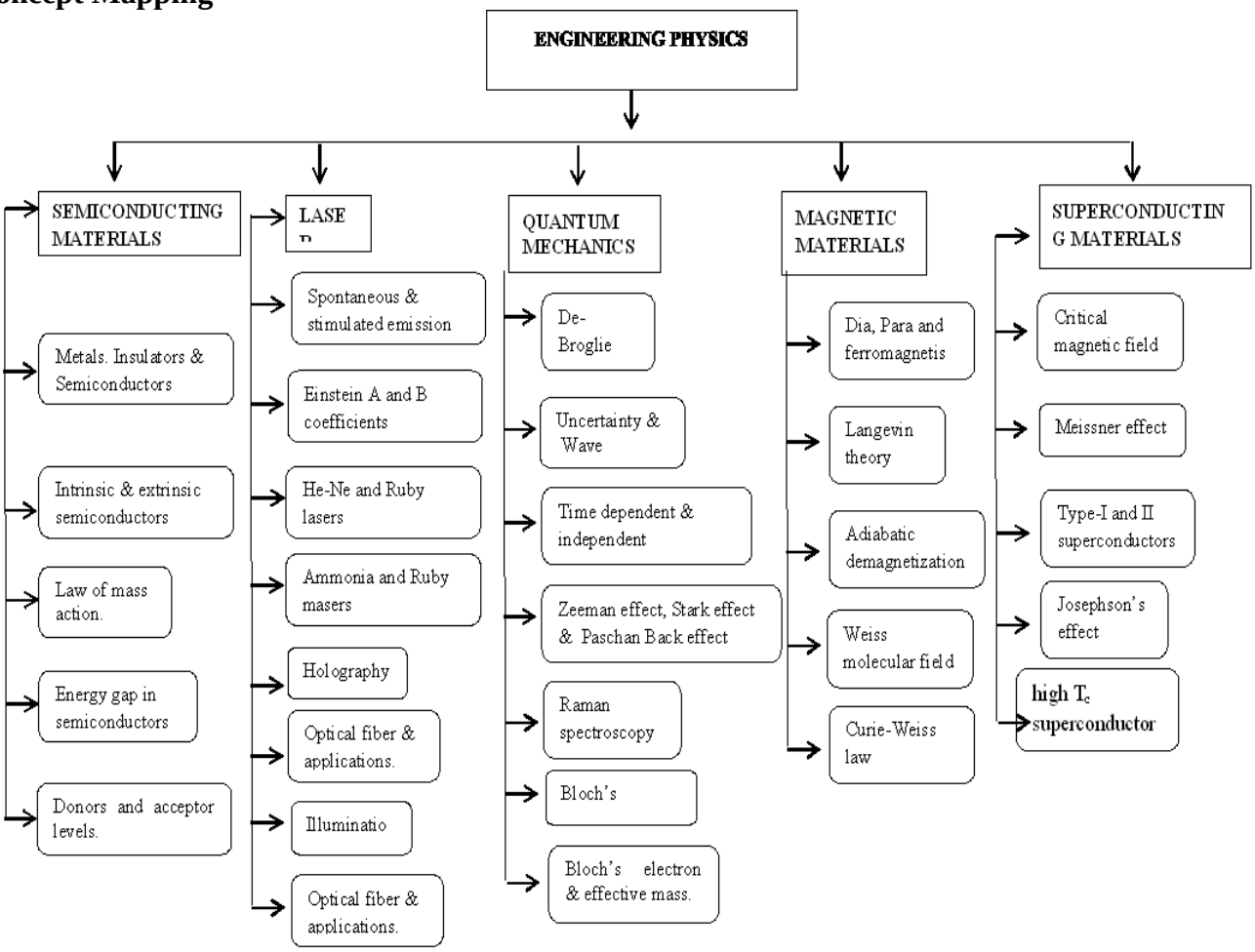
Text Books

1. Saxena B S and Gupta R C. Solid State Physics. Pragati Prakasam, Meeruth.
2. Vasudeva D N. Fundamentals of Magnetism and Electricity. S. Chand and Co., New Delhi

Reference Books

3. Gupta S L, Kumar V Sharma R C. Elements of Spectroscopy. Pragati Prakasam, Meeruth. 162 163
4. Srivastava B N. Essentials of Quantum Mechanics. Pragati Prakasam, Meeruth.
5. Brijlal and Subrahmanyam. Text Book of optics. S. Chand and Co., New Delhi.
6. Sarkar Subir Kumar. Optical State Physics and Fiber Optics. S. Chand and Co., New Delhi.
7. Vasudeva D N. Fundamentals of Magnetism and Electricity. S. Chand and Co., New Delhi

Concept Mapping



LIST OF EQUIPMENTS: For strength of Thirty Students

Sl.No.	Name of the Experiment	Equipment Required	Number Required
1	To determine the good & Bad conductor using lees disc method	Lees Chamber Heating coil Thermometer	6 6 6
2	To determine the energy band gap in a semiconductor using a p-n Junction diode	Heating coil Junction diode Measuring Device Thermometer Beaker	6 6 6 6 6
3	Determination of VI characteristics of solar cell and to determine the efficiency with distance of light source	Solar cell with probes Multimeter Scale	6 6 6

4	Determination of wave length of the given light source and hence to determine the Numerical Aperture of given optical fibre.	Laser Source Fibre Optic Kit	6 6
5	Determination of the wavelength of the given laser light source using grating and to determine the size of the given micro particles in the form of powder using the given laser source	Laser Source Glass plate with Lycopodium Powder	6 6
6	Construction of hologram using mobile	https://www.youtube.com/watch?v=sLyT8tWDz6M	
7	Determination of Dispersive power of a prism using spectrometer	Spectrometer Light source Prism	6 6 6
8	Determination of wavelength of spectral lines using grating	Spectrometer Light source Grating	6 6 6
9	To obtain hysteresis curve (B-H curve) on a C.R.O. and to determine related magnetic quantities	BH curve kit	6
10	Measurement of unknown Resistance using Carey-Foster's Bridge	An unknown resistance A known resistance(variable) A galvanometer A very high resistance of the order of 15000Ω to protect the galvanometer. A dry cell A plug key g)A meter bridge with jockey A sorting plate A copper strip	6 each

Course Designers

Name of the Faculty	Email ID
Dr. Priya.M	priyam@saveetha.ac.in

SUB. CODE	COURSE TITLE	Branch	CHEMICAL ENGINEERING			
19PH204	PHYSICS FOR CHEMICAL ENGINEERING	Category	L	T	P	Credit
		BS	3	0	2	4

Preamble

Chemical Physics integrates the principles of physics and engineering in chemical field. It encompasses the application of the basic principles of physics and engineering to the development of chemical technology.

Prerequisite

Nil

Course outcome

At the end of the course, the students should be able to

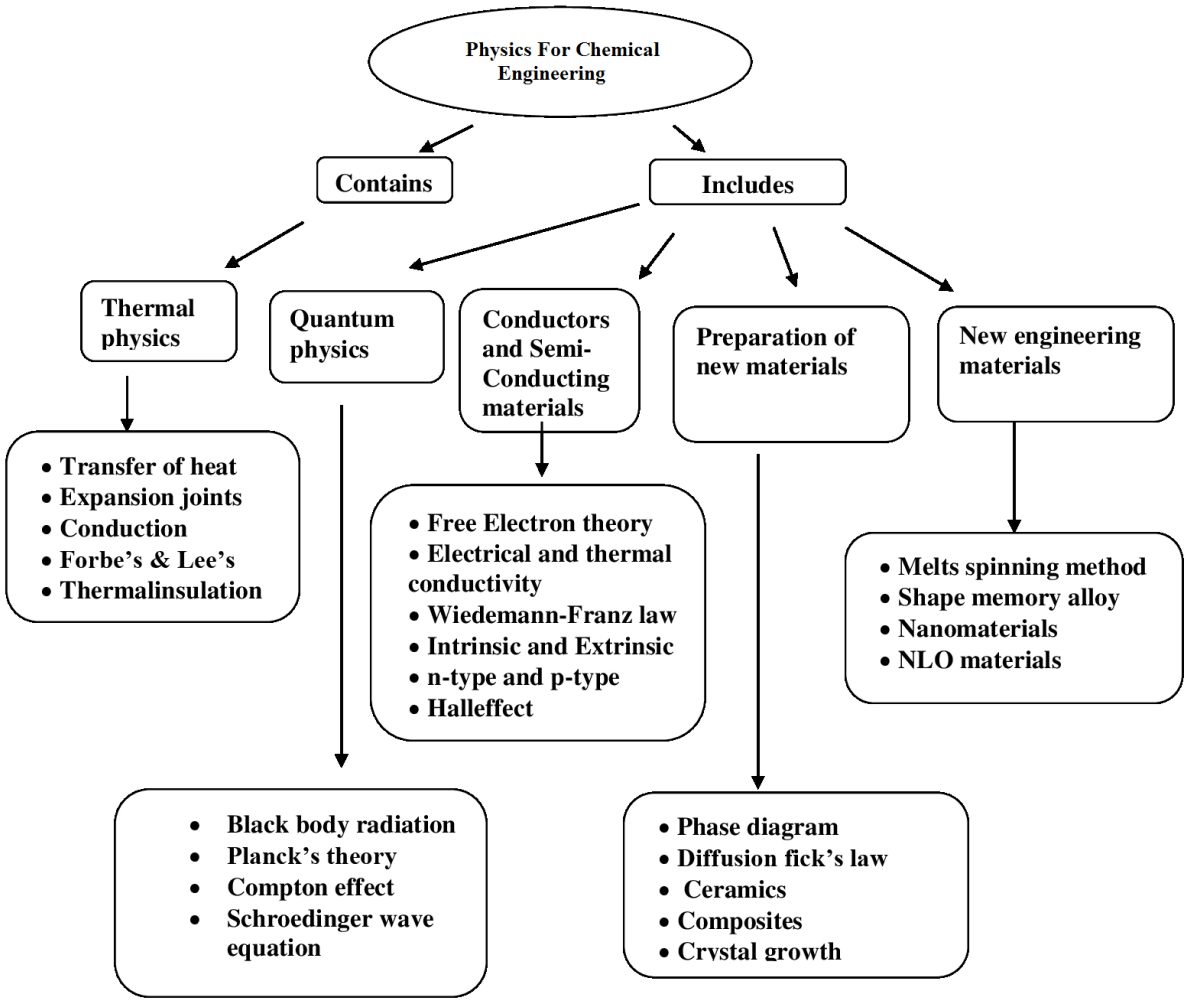
CO1	Understand the thermal properties of various materials and apply the concept in the field of engineering.	Analyze
CO2	Get the knowledge on advanced physics concepts of quantum theory.	Understand
CO3	Analyze the electrical and thermal properties of conducting and semiconducting materials in turn evaluate their measurement.	Evaluate
CO4	Understand the various methods of preparation of materials such as ceramics and crystals.	Understand
CO5	Gain knowledge on the properties and performance of new engineering materials.	Apply

Mapping of COs with POs and PSOs

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	1	-	1	-	-	-	-	1	1	
CO2	1	1	-	-	-	1	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	1	-	-	-	-	-	-	1	1	-
CO4	3	3	-	-	-	2	-	-	2	1	-	2	-	2	-
CO5	3	3	-	-	-	2	-	1	1	1	-	-	1	-	-

1 – LOW, 2 – MEDIUM, 3 - STRONG

Concept Map



Syllabus

UNIT I - THERMAL PHYSICS **15**

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints – bimetallic strips – thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity – Forbe's and Lee's disc method: theory and experiment- – conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

Determination of Thermal conductivity of bad conductor-Lee's disc method.
Determination of Thermal Conductivity of Good Conductor – Forbe's Method
Comparison of thermal conductivity of different materials

UNIT II QUANTUM PHYSICS **15**

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Introduction to Schrödinger's wave equation, time independent and time dependent equations

Determination of crystalline size using LASER Light
Determination of wavelength of light
Determination of parameters of an optical fibre

UNIT -III CONDUCTORS AND SEMICONDUCTING MATERIALS 15

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures -– Fermi- Dirac statistics – Density of energy states –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 – Hall effect and devices.

Determination of bandgap of a Semiconductor

UNIT –IV PREPARATION OF MATERIALS 15

Phases - Phase rule – binary systems – tie line rule – lever rule – phase diagram – invariant reactions – diffusion Fick's law - Introduction to Ceramics and its applications - Ceramic Fibres - Fibre reinforced Plastics – Fibre reinforced Metal-Composites - crystal growth – Czochralski, Bridgman, Solution methods - Sol-gel method.

Preparation of crystal by solution method.
Estimation of Phase using simulation using https://www.thermocalc.com/products-services/software/thermo-calc/ or http://www.calphad.com/thermo_calc.html

UNIT -V NEW ENGINEERING MATERIALS 15

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials – Birefringence-optical Kerr effect – Classification of Biomaterials and its applications.

Characterization of NLO materials

TOTAL: 75 PERIODS

Text Books

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2015.
2. Palanisamy, P.K., Materials Science, Scitech., 2003.

References

1. Raghavan. V. Materials Science and Engineering, Prentice Hall of India, 2002.
2. Kumar,J, MoorthyBabu. S and Vasudevan. S., Engineering Physics, Vijay Nicole Imprints, 2006.
3. Raghavan, V., Physical Metallurgy, Prentice Hall of India, 2002
4. Calister, W.D., Materials Science and Engineering an Introduction, John Wiley, 2003.
5. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2012
6. Pandey, B.K. & Chaturvedi. S. "Engineering Physics". Cengage Learning India, 2012

LIST OF EQUIPMENTS: For the strength of Thirty Students

Sl.No	Name of the Experiment	Equipment Required	Number Required
1	Determination of Thermal conductivity of bad conductor-Lee's disc method.	Lee's disc apparatus Thermometer Hot plate Bad Conductor disc	5 10 5 6
2	Determination of Thermal Conductivity of Good Conductor – Forbe's Method	Forbe's Instrument Thermometers Heating element Conducting rod	6 12 6 6
3	Comparison of thermal conductivity of different materials	Lees disc Heater Materials of different thermal conductivity Thermometer	6 6 6 6
4	Determination of Particle Size	Laser Light Glass plate with lycopodium powder Screen	6 6 6
5	*Determination of wavelength of light*	Laser Light Grating element Screen	6 6 6
6	*Determination of parameters of an optical fibre*	Laser Light Optical fibre Screen	6 6 6
7	Determination of bandgap of a semiconductor	Heating coil Band gap setup Thermometer Semiconductor diode Oil Beaker	5 5 5 5 1 litre 5
8	Preparation of crystal by solution method	Beaker chemicals	10 Required quantity
		Distilled water	5 litres
9	Characterization of NLO materials	Mercury vapour lamp Polarizing glass NLO materials	5 5 Required quantity

Course Designers

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1.	Ms. S. Varalakshmi	varalakshmi@saveetha.ac.in
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SAVEETHA ENGINEERING COLLEGE
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SUB. CODE	COURSE TITLE	Branch	COMPUTER SCIENCE ENGINEERING			
19PH205	COMPUTATIONAL PHYSICS	Category	L	T	P	Credit
		BS	3	0	2	4

Preamble

Computational Physics integrates the principles of physics and engineering in the field of computer science. It encompasses the application of basic principles of physics and engineering for the development of new devices in computer technology.

Prerequisite

Nil

Course Outcomes

At the end of the course, the students should be able to

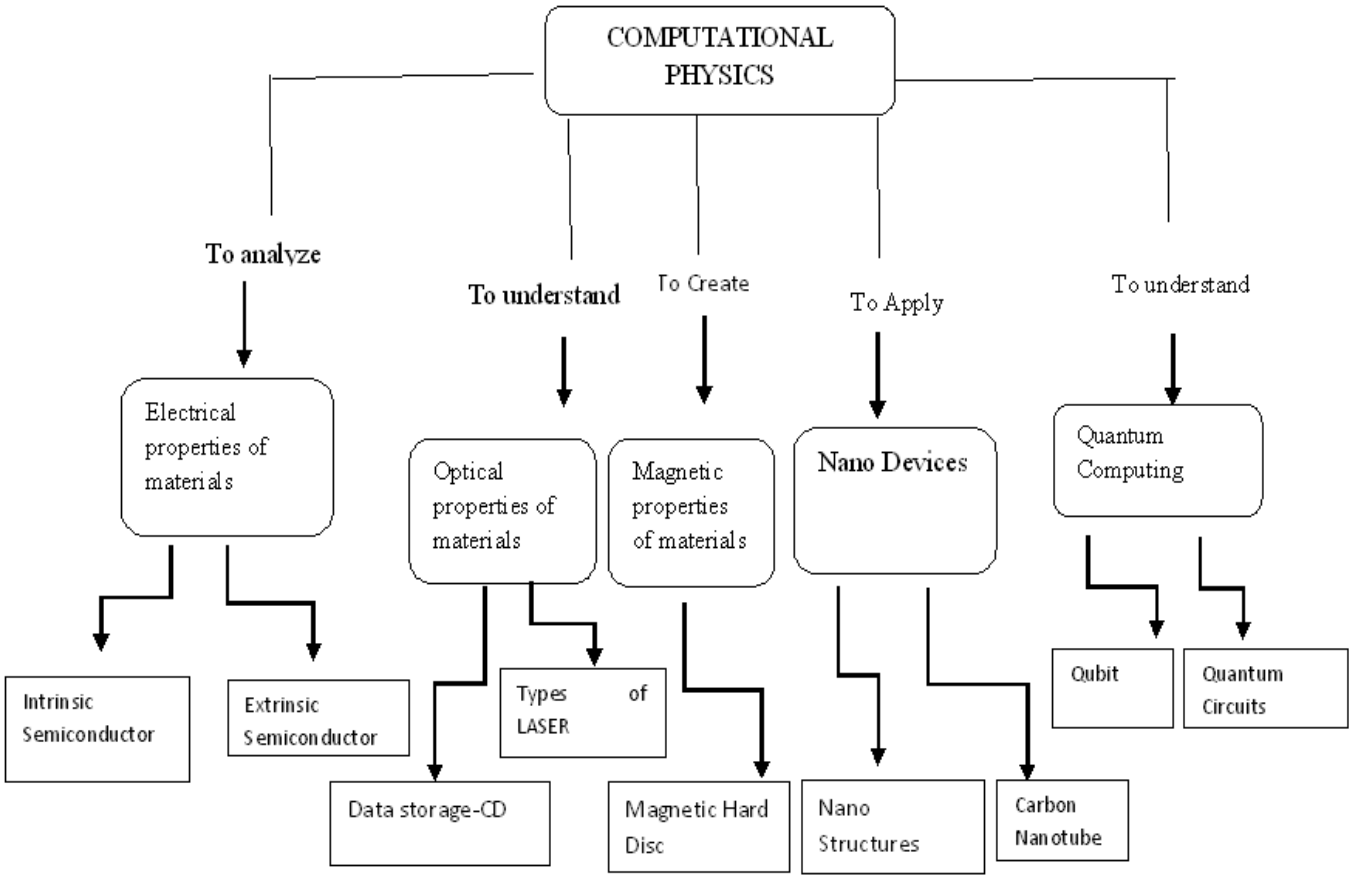
CO1	Understand the concept of classical and quantum electron theories and energy band structures and analyze the electrical properties of different materials.	Analyze
CO2	Understand the concept of optical properties of materials and also the working of laser.	Understand
CO3	Gain knowledge on magnetic properties of materials and understand their applications in data storage thereby able to create new storage devices.	Apply
CO4	Get knowledge on the basics of quantum structures and their applications in carbon nano tube devices.	Apply
CO5	Understand the basics of quantum computing and the design of quantum circuits.	Understand

Mapping of COs with POs and PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	1	-	2	3	-	3	3	2	1
CO2	3	3	3	2	-	-	3	-	2	3	-	2	2	2	1
CO3	3	3	3	3	-	-	2	-	2	3	-	3	3	2	1
CO4	3	3	3	3	-	-	1	-	2	3	-	3	3	2	1
CO5	3	3	3	3	-	-	3	-	2	3	-	2	3	2	1

1 – LOW, 2 – MEDIUM, 3 - STRONG

CONCEPT MAP



SYLLABUS

UNIT- I ELECTRICAL PROPERTIES OF MATERIALS 15

Classical free electron theory – Expression for electrical conductivity – Thermal conductivity expression – Wiedemann-Franz law –Fermi- Dirac statistics – Density of energy states – Energy bands in solids – Intrinsic Semiconductor- Carrier concentration in intrinsic semiconductor-Extrinsic Semiconductor- carrier Concentration in N-type & P-type semiconductors- Hall effect and devices.

Determination of bandgap of a semiconductor.

UNIT-II OPTICAL PROPERTIES OF MATERIALS AND LASER 15

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 P-N diode – solar cell – LED – Organic LED – Laser diodes – Optical data storage techniques. Principle of laser-population inversion, conditions of lasing action, Solid state laser: Nd:YAG Laser- Gas laser: CO_2 laser.

Determination of wavelength of LASER

Determination of crystalline size using Laser

Determination of physical parameters of an optical fiber.

Determination of wavelength of mercury spectrum – spectrometer grating

Determination of optical parameters of a glass prism

UNIT-III MAGNETIC PROPERTIES OF MATERIALS 15

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility – Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – anti ferromagnetism – ferrimagnetism – Ferromagnetism: origin and exchange interaction- saturation magnetization and Curie temperature – Domain Theory- M versus H behavior- – Hard and soft magnetic materials – examples and uses-– Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor).

Determination of Magnetic Properties by B-H Curve Plot

UNIT-IV NANO DEVICES 15

Electron density in bulk material – Size dependence of Fermi energy – Quantum confinement – Quantum structures – Density of states in quantum well, quantum wire and quantum dot structure – Band gap of nanomaterials – Tunneling: single electron phenomena and single electron transistor –

Quantum dot laser. Conductivity of metallic nanowires – Ballistic transport – Quantum resistance and conductance- Carbon nanotubes: Properties and applications.

Preparation of nano materials by Hydrothermal method.

UNIT-V QUANTUM COMPUTING **15**

Introduction to Quantum Computation-Quantum bits, Bloch sphere representation of a qubit, multiple qubits- Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits.

TOTAL: 75 PERIODS

Text Books

1. Kittel, C. ―Introduction to Solid State Physics. Wiley.
2. Hanson, G.W. ―Fundamentals of Nanoelectronics. Pearson Education, 2009.

References

1. B.B. Laud, Lasers and Nonlinear Optics, 3rd Ed, New Age Int.Pub.2011.
2. Rogers, B., Adams, J. &Pennathur, S. ―Nanotechnology: Understanding Small Systems. CRC Press, 2014.
3. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific.
4. Garcia, N. & Damask, A. Physics for Computer Science Students. Springer-Verlag, 2012.

LIST OF EQUIPMENTS: For the strength of Thirty Students

Sl.No.	Name of the Experiment	Equipment Required	Number required
1	Determination of bandgap of a semiconductor	Band gap kit	5
2	Determination of wavelength of LASER	Laser Light Diffraction grating element Screen	6 6 6
3	Determination of crystalline size using Laser	Laser Light Glass with particles sprayed Screen	6 6 6
4	Determination of physical parameters of an optical fiber	Laser Light Optical fibre Optical bench	6 6 6
5	Determination of wavelength of mercury spectrum – spectrometer grating	Spectrometer Grating Mercury Lamp	6 6 1
6	Determination of optical parameters of a glass prism	Mercury Lamp Prism	6 6

		Spectrometer	6
7	Determination of Magnetic Properties by B-H Curve Plot	BH curve kit	6
8	Preparation of nano materials by hydrothermal method	Chemicals Glass beakers Measuring jar magnetic stirrer	Required amount 5 5 3

Course Designers

S.No	Name of the Faculty	Email ID
1	Ms. C. Saveetha	saveetha@saveetha.ac.in

SUB. CODE	COURSE TITLE	Branch	INFORMATION TECHNOLOGY			
19PH206	PHYSICS FOR INFORMATION TECHNOLOGY	Category	L	T	P	Credit
		BS	3	0	2	4

Preamble

The Physics of Information Technology explores the familiar devices that we use to collect, transform, transmit, and interact with electronic information. Understanding how such devices work, and how they can be improved, requires deep insight into the character of physical law as well as engineering practice.

Prerequisite

NIL

Course Outcomes

At the end of the course, the students should be able to

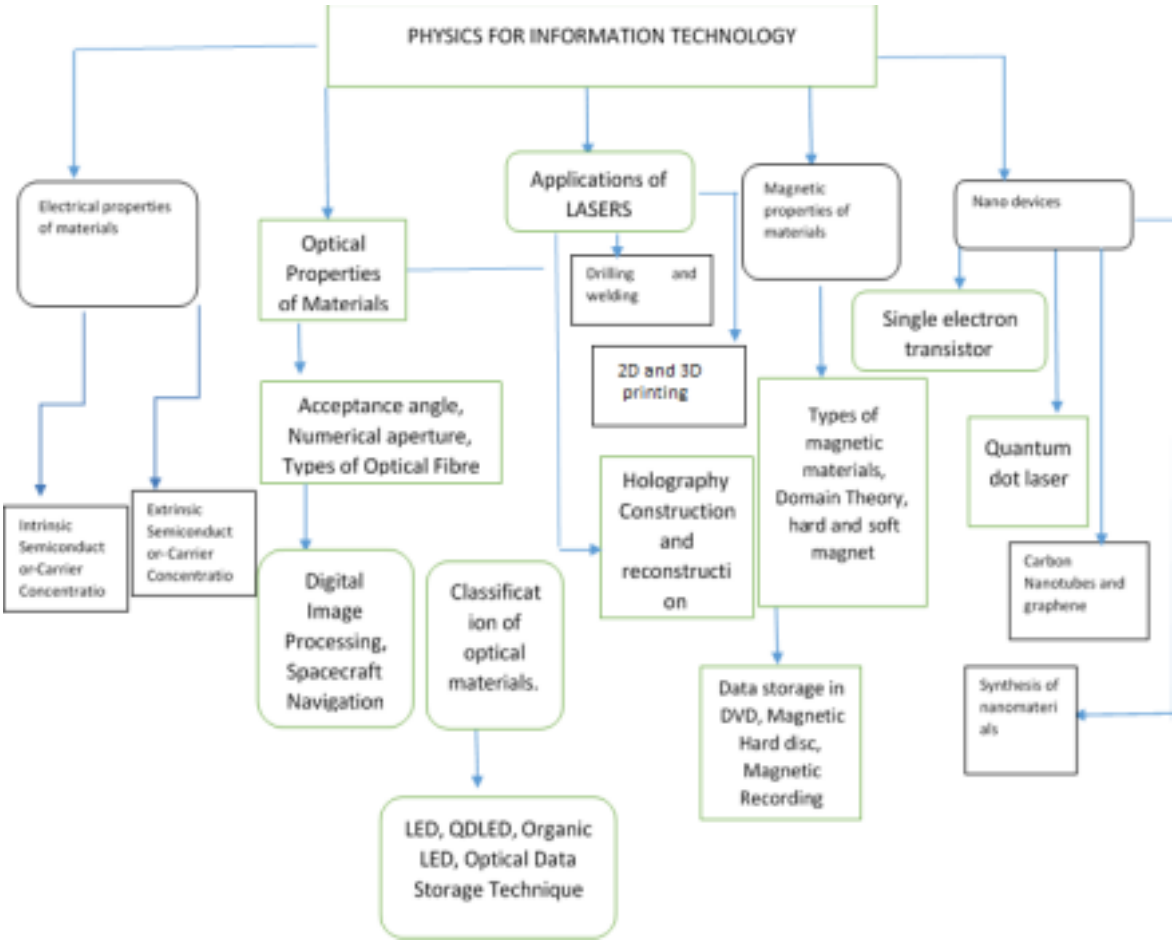
CO1	Understand the concept of carrier concentration in Intrinsic and Extrinsic semiconductor which is the basis of all information technology devices.	Understand
CO2	Remember the concept of optical properties of materials and digital image processing.	Remember
CO3	Apply the concepts of laser and thereby apply it in 2D and 3D printing.	Apply
CO4	Get knowledge on magnetic properties of materials and understand their applications in data storage thereby able to create new storage devices.	Understand
CO5	Understand the basics of quantum structures and their applications in electronics.	Understand

Mapping of COs with POs and PSOs

COURSE OUTCOMES	PROGRAM OUTCOMES												PROGRAM SPECIFIC OBJECTIVES	
	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	1	2	3	-	-	-	-	-	1	-	1	1	2	1
CO2	1	2	-	2	1	1	-	-	1	-	2	1	2	1
CO3	1	2	3	-	3	3	-	-	1	2	1	1	2	1
CO4	2	-	-	-	1	1	-	-	-	-	2	1	1	1
CO5	3	2	3		1	1	1	-	1	-	3	1	1	1

1 – LOW, 2 – MEDIUM, 3 - STRONG

CONCEPT MAP



SYLLABUS

UNIT- 1 SEMICONDUCTOR PHYSICS 15

Electrical conductivity – Thermal conductivity-Fermi- Dirac statistics (Definition) — Energy bands in solids – Intrinsic Semiconductor- Carrier concentration in intrinsic semiconductor Extrinsic Semiconductor- carrier Concentration in N-type & P-type semiconductors (concept only)
Determination of band gap of a semiconductor.

UNIT-II FIBRE OPTICS AND OPTICAL MATERIALS 15

Introduction and importance of Fibre Optics Technology, Numerical aperture and acceptance angle (definition)-Types of optical fibre-Applications- Digital Image Processing-Components Image processing for spacecraft navigation. Classification of optical materials – carrier generation and recombination processes –Incandescence - Luminescence: LED – Organic LED QDLED–Optical data storage techniques.

Determination of acceptance angle in an optical fiber.
Determination of thickness using interference of light - Airwedge
Dispersive power of a prism using spectrometer
Determination of wavelength of spectral lines using grating

UNIT-III APPLICATIONS OF LASER 15

Applications of Laser – Laser welding, cutting and drilling -Laser in Barcode Scanners Holography: Basic principles of holography-–Principle of Recording, construction and reconstruction of images- Hands on Training - Laser 2D and 3D Printing.

Determination of wavelength and crystalline size using laser.

UNIT-IV MEMORY STORAGE MATERIALS 15

Introduction to magnetic materials – Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – anti ferromagnetism – ferrimagnetism – Ferromagnetism: – Domain Theory- M versus H behavior – Hard and soft magnetic materials – examples and uses-– Magnetic principle in computer data storage - Magnetic hard disc (GMR sensor)-

Determination of B-H ratio of magnetic materials

UNIT-V NANO DEVICES 15

Introduction to nanomaterials- Band gap of nanomaterials – Tunneling: single electron phenomena and single electron transistor – Quantum dot laser- Ballistic transport – High thermal conductivity materials-Carbon nanotubes and Graphene: Properties and applications. Quantum Computing-Quantum qubits-Single qubit gates- Multiple qubit gates-Quantum circuits (Concept only).

Find Bandgap of nano materials by comsol Physics

TOTAL: 75 PERIODS

Text Books

1. Jasprit Singh, Semiconductor Devices- Basic Principles, Wiley 2012.
2. Kasap, S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.

References

1. B.B. Laud, Lasers and Nonlinear Optics, 3rd Ed, New Age Int.Pub.2011. 2. K. Thyagarajan, and A.K. Ghatak, Lasers Theory and Applications, 2nd Ed, PlenumPress, 1986.
3. Rogers, B., Adams, J. &Pennathur, S. ―Nanotechnology: Understanding Small Systems, CRC Press, 2014.
4. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.
5. Quantum computation and quantum information, 10th Anniversary Edition, Michael A. Nielsen & Isaac L. Chuang, 2010

LIST OF EQUIPMENTS: For the strength of Thirty Students

Sl.No	Name of the Experiment	Equipment Required	Number Required
1	Determination of band gap of a semiconductor	Band gap measurement kit	8
2	Determination of acceptance angle in an optical fiber.	Fibre optic kit	6
		Fibre optic power meter	6
		Transmitter and receiver	6
		Numerical aperture zig	6
		Optical fibre cable	6
3	Determination of thickness using interference of light - Airwedge	Microscope Air wedge Sodium vapour lamp	6 6 6
4	Dispersive power of a prism using spectrometer	Spectrometer Prism	6 6
5	Determination of wavelength of spectral lines using grating	Spectrometer Mercury lamb Grating element	6 6 6

6	Determination of wavelength, and particle size using Laser	Laser source	8
		Optical bench	8
		Slider holder	8
7	B-H-Curve plot	BH kit	6
8	Preparation of nanomaterials by hydrothermal method	Beaker (100 ml)	6
		Magnetic stirrer	6
		Magnetic Pedal	6
		Double distilled water	20 litre
		Chemicals	100 gms
		Spatula	6
		Autoclave (100 ml)	6
		Furnace	1

Course Designers

S.No	Name of the Faculty	Email ID
1	Dr. Baby Suganthi A.R.	babysuganthi@saveetha.ac.in

SUB. CODE	COURSE TITLE	Branch	ELECTRICAL AND ELECTRONICS ENGINEERING			
19PH207	MATERIALS FOR ELECTRONICS	Category	L	T	P	Credit
		BS	3	0	0	3

Preambles

The course work aims in imparting fundamental knowledge of materials science required for electrical engineers. The course work will introduce engineers to different types of conductors, semiconductors and dielectrics. The current magnetic materials, optical materials, solar cell materials, superconductors and smart materials will be discussed.

Prerequisite

NIL

Course Outcomes

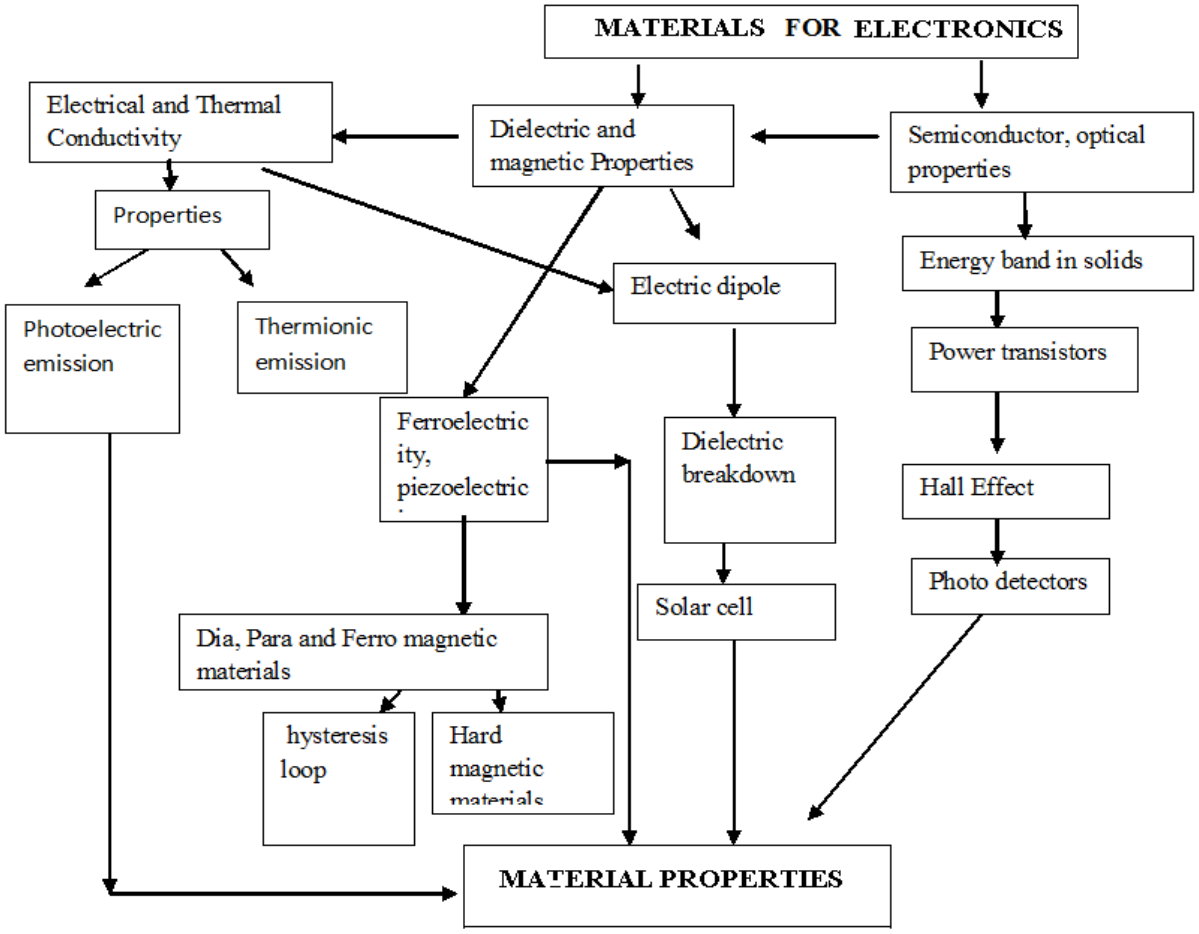
At the end of the course, the students should be able to

CO1	Acquire knowledge and understanding of fundamental principles of modern physics relevant to problems of Electrical and Electronics Engineering.	Understand
CO2	Acquire knowledge of basic principles of material science and its applications	Remember
CO3	Acquire knowledge of the basic materials, magnetic and dielectric properties.	Remember
CO4	Apply principles of quantum and statistical physics to understand properties of materials	Apply
CO5	Acquire knowledge of new emerging areas of science and Technology like optical materials.	Analyze

Mapping of COs with POs and PSOs

Course Outcome	Program Outcomes												Program Specific Objectives	
CO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO 1	3	3	3	-	-	1	-	1	-	1	1	1	2	-
CO 2	1	1	-	-	-	1	-	-	-	1	1	1	2	-
CO 3	3	3	1	-	-	1	-	-	-	1	1	1	2	-
CO 4	3	3	-	2	-	2	-	-	-	1	1	1	2	-
CO 5	3	3	-	-	-	2	-	1	-	1	1	1	2	-

CONCEPT MAP



SYLLABUS

UNIT -1 ELECTRICAL AND THERMAL CONDUCTIVITY OF METAL 9

Introduction, Free electron theory of solids, Drude and Lorenz free electron theory, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, energy levels of a molecule, Electrical conductivity of metal, advantages and disadvantage of classical free electron theory, classical emission of electrons from metals, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.

UNIT –II DIELECTRIC PROPERTIES 9

Introduction, Properties of dielectric materials, electric dipole, dipole moment, permittivity, dielectric constant, polarization, electrical susceptibility, polarization process in dielectrics, Lorentz method to find internal field, clausius-mosotti relation, dielectric loss, significance of the loss tangent, factors affecting dielectric loss, dielectric breakdown, dielectric insulating materials, ferroelectricity, piezoelectricity.

UNIT –III MAGNETIC PROPERTIES OF MATERIALS 9

Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, comparison of Dia, Para and Ferro magnetic materials, magnetization curve, the hysteresis loop , factors affecting permeability and hysteresis loss, soft magnetic materials, hard magnetic materials.

UNIT -IV SEMICONDUCTORS 9

Introduction, Energy band in solids, conductors, semiconductors and insulators, Types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, drift and diffusion current, the Einstein relation, Hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials, Power transistors.

UNIT -V OPTICAL PROPERTIES OF MATERIALS 9

Introduction, Classification of Optical materials, Absorption and emission of light in metals, absorption and emission of light in insulators, absorption and emission of light in semiconductors, carrier generation and recombination processes, Excitons, Photo current in P-N junction diode, Solar cell, photo detectors.

TOTAL: 45 PERIODS

Text Books

1. C.S.Indulkar and S. Thiruvengadam, S., "An Introduction to Electrical Engineering.
2. Kenneth G. Budinski, "Engineering Materials: Prentice Hall of India, New Delhi.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

References

1. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.
2. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, 1994.
3. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.

4.Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.

Course Designer

S.No.	Name of the Faculty	Email ID
1	Dr. S. Suresh	sureshs@saveetha.ac.in
2	Dr. Priya.M	priyam@saveetha.ac.in

SUB. CODE	COURSE TITLE	Branch	BIOMEDICAL ENGINEERING/ MEDICAL ELECTRONICS ENGINEERING			
19PH208	MEDICAL PHYSICS	Category	L	T	P	Credit
		BS	3	0	0	3

Preamble

Medical Physics integrates principles of physics and engineering in medical field. It encompasses the application of the basic principles of physics and engineering to the development of medical devices and technology.

Common to Bio Medical Engineering & Medical Electronics Engineering

Prerequisite

Nil

Course outcome

At the end of the course, the students should be able to

CO1	Understand the basics of radioactivity and hence the imaging and also become aware of various radiation units.	Understand
CO2	Identify the major medical imaging methods of medical field using the interactions of radiations such as X and gamma rays with matter.	Remember
CO3	Recognize the fundamental concepts of light and sound and their role in medicine.	Remember
CO4	Employ instruments for personnel monitoring and describe scintillation monitors for X and gamma radiations and discuss about positron emission computed tomography (PET).	Apply
CO5	Discuss various Instruments for personnel monitoring.	Analyze

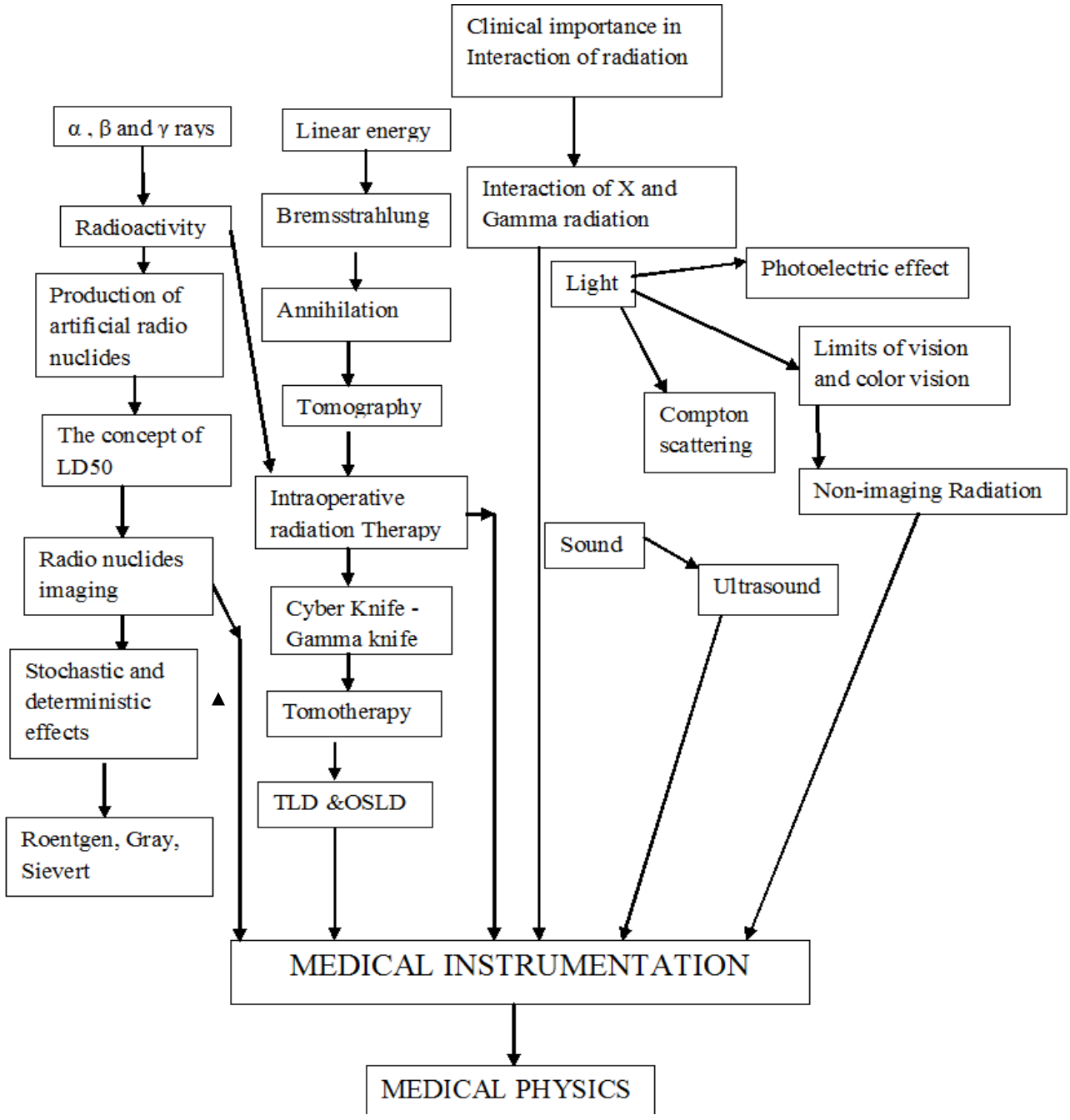
Mapping of COs with POs and PSOs

Course Outcomes	Program Outcomes												Program Specific Outcomes/ Bio Med		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	-	-	-	1	-	1	1	1	-	1	-	-	-
CO2	3	3	-	-	-	1	-	1	1	1	-	1	1		1
CO3	3	3	-	-	-	1	-	1	1	1	-	1	1	-	-
CO4	1	1	-	-	-	2	-	1	1	1	-	1	2	-	2
CO5	3	3	-	-	-	2	-	1	1	1	-	1	2	-	2

1 – LOW, 2 – MEDIUM, 3 - STRONG

Course Outcomes	Program Outcomes												Program Specific Outcomes/ Med Ele	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	1	-	1	1	1	-	1	-	1
CO2	3	3	-	-	-	1	-	1	1	1	-	1	1	2
CO3	3	3	-	-	-	1	-	1	1	1	-	1	1	1
CO4	1	1	-	-	-	2	-	1	1	1	-	1	2	2
CO5	3	3	-	-	-	2	-	1	1	1	-	1	2	2

Concept Map



SYLLABUS

UNIT –I BASIC RADIATION PHYSICS AND RADIO DIAGNOSIS 9

Radioactivity- Radioactive elements and radio isotopes in medicine- General properties of α, β and γ rays - natural and artificial radioactivity. Production of artificial radio nuclides- Radio nuclides imaging.- Acute radiation effects – The concept of LD50 –Stochastic and deterministic effects – Different radiation units- Roentgen, Gray, Sievert.

UNIT -II INTERACTION OF RADIATION WITH MATTER 9

Interaction of charged particles with matter- specific ionization - Linear energy transfer range – Bremsstrahlung – Annihilation – Interaction of X and Gamma radiation with matter – Photoelectric effect – Compton scattering – Pair production - Attenuation of gamma Radiation - Interaction of neutron with matter and their clinical significance.

UNIT -III ELECTROMAGNETIC SPECTRUM AND SOUND IN MEDICINE 9

Light – Intensity of light - Limits of vision and color vision – Sound – Normal sound levels – Ultrasound fundamentals – Generation of ultrasound – Interaction of ultrasound with materials- Reflection and refraction – Absorption and scattering – Non-ionizing electromagnetic radiation tissue as a leaky dielectric – Relaxation processes

UNIT -IV PRINCIPLES OF RADIATION DETECTION AND RADIO THERAPY EQUIPMENTS 9

Principles of Radiation Detection and measurement – Basic Principles of radiation detection – Gas filled detectors – ionization chamber – Theory and design– Scintillation detectors – Semiconductor detectors – Chemical systems – Radiographic and Radiochromic films – Thermo luminescent Dosimeters (TLD) – Optically stimulated Luminescence dosimeters (OSLD) – Radio photo luminescent dosimeters. Superficial X-ray therapy units - Gamma knife - cyber knife - Intra operative radiation therapy units- Tomotherapy- Principles and applications of SPECT, PET(elementary ideas).

UNIT - V RADIATION MEASURING & MONITORING INSTRUMENTS 9

Instruments for personnel monitoring – TLD badge readers – PM film densitometers – Glass dosimeter readers – Digital pocket dosimeter using solid state – Teletector – contamination monitors for alpha, beta and gamma radiation – Hand and Foot monitors – Laundry and Portal Monitors – Scintillation monitors for X and gamma radiations

TOTAL: 45 PERIODS

Text Books

1. B.H Brown , PV Law ford, R H Small wood , D R Hose , D C Barber , "Medical Physics and Biomedical Engineering", CRC Press, 1999.
2. Gopal B.Saha "Physics and Radiobiology of Nuclear Medicine" Springer, 3rd ed, 2006.
3. R. Murugaesan, "Optics and spectroscopy", S. Chand and Company, 10th edition, 2010.

References

1.H. E. Jones, J. R. Cunningham, The Physics of Radiology, Charles C. Thomas, New York, 2002.
2.Essentials of Nuclear Medicine Imaging. F A Mettler,MJ Guibertau,Saunders, 2005.
3. Eugene Hecht, "Optics" Addison Wesley Publishing Co, 5th Edition, 2010.
4.Medical Physics: Imaging, Jean A. Pope, Heinemann Publishers, 2012.
5.F.M.Khan,The Physics of Radiation Therapy,Third Edition,Lippincott Williams and Wilkins,U.S.A.,2003.

Course Designers

Name of the Faculty	Email ID

Dr. K. Sreevani	sreevani@saveetha.ac.in

SAVEETHA ENGINEERING COLLEGE
AUTONOMOUS
NAAC A GRADE
Affiliated to Anna University | Approved by AICTE

SUB CODE	COURSE TITLE	Branch	CIVIL ENGINEERING			
19PH209	PHYSICS FOR CIVIL ENGINEERING	Category	L	T	P	Credit
		BS	3	0	2	4

Preamble

Physics for Civil Engineering will enable students to understand about the basics in structural design and provides a firm foundation for the pursuit of graduate studies in engineering.

Prerequisite

Basics of Engineering Physics

Course Outcomes

At the end of the course, the students should be able to

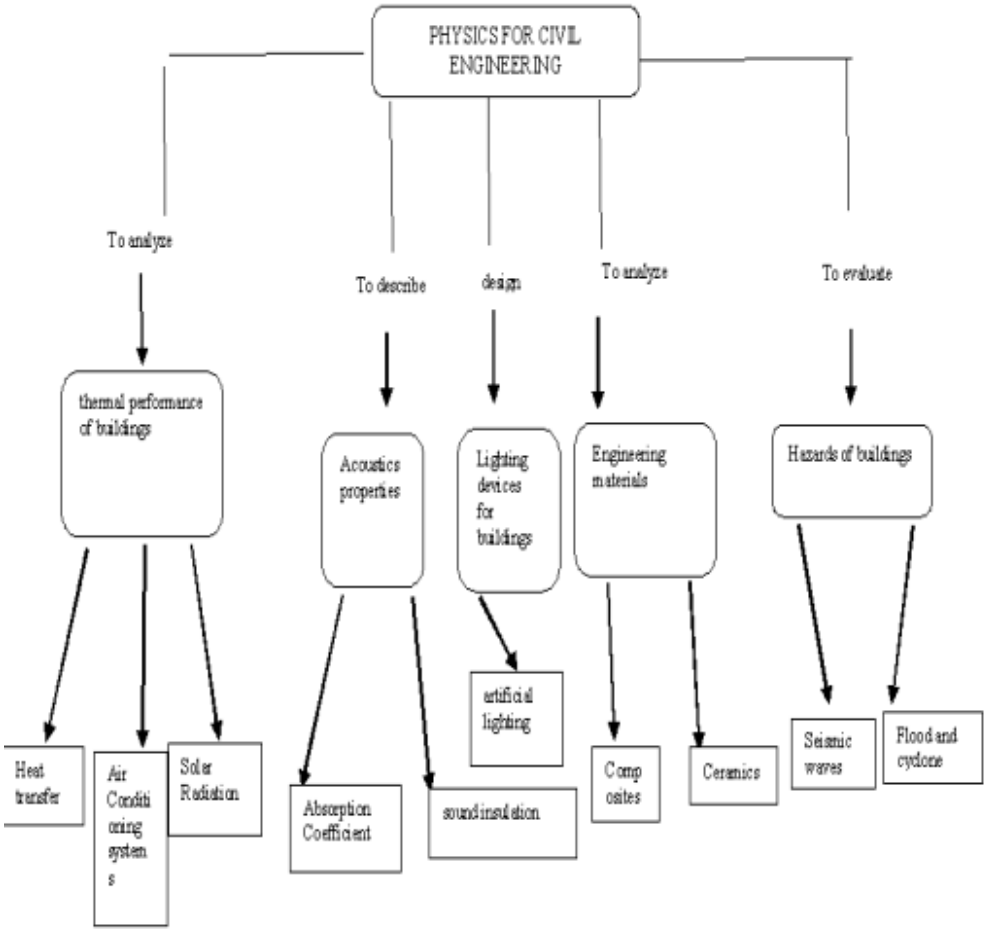
CO1	Understand the basics of thermal performance of buildings and measurements apply the principles and analyze the various aspects of air conditioning.	Apply
CO2	Remember the basics in acoustics and noise, understand the various acoustic properties of buildings	Understand
CO3	Analyze the various lighting designs for buildings	Analyze
CO4	Understand the properties and Performance of engineering materials. gain experience in designing engineering materials	Apply
CO5	Understand all facts of hazards of buildings and analyze the safety measures to be followed	Analyze

Mapping of COs with POs and PSOs

CO	Program Outcomes												Program Specific Outcomes	
CO	P01	P02	P03	P04	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	1	1	-	-	3	-	2	1	1	1
CO2	1	1	1	-	1	-	-	-	-	-	3	-	1	1
CO3	1	1	1	-	1	-	-	-	-	-	2	1		1
CO4	1	1	1	-	2	-	-	-	-	-	3	1	1	1
CO5	1	1	1	-	2	3	-	-	-	-	3	1		1

1 – LOW, 2 – MEDIUM, 3 - STRONG

Concept Map



SYLLABUS

UNIT -I THERMAL PERFORMANCE OF BUILDINGS 15

Heat transfer , thermal insulation and its benefits - heat gain and heat loss estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, and indices of thermal comfort, climate and design of solar radiation, shading devices - central heating. Principles of natural ventilation & measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C.Systems.

Determination of thermal conductivity by Lee's disc method
Determination of thermal conductivity by Forbe's method

UNIT -II ACOUSTICS 15

Classification of sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Methods of sound absorptions - noise and its measurements, impact of noise , sound insulation and its measurements,

Determination of Velocity of Sound.

UNIT -III LIGHTING DESIGN 15

Spectral quantities – relationship between luminescence and radiant quantities – hemispherical reflectance and transmittance – photometry: cosines law, inverse square law. Vision – photobic, mesophic, scotopic visions. Colour – luminous efficiency function - Visual field glare, colour - day light calculations - measurement of day-light and use of models and artificial skies, principles of artificial lighting.

Dispersive power of a prism using spectrometer
Determination of wavelength of spectral lines using grating
Determination of wavelength and crystalline size using laser.

UNIT -IV MODERN ENGINEERING MATERIALS 15

Composites - definition and classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fibres - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics

Determination of Young's Modulus of the material non- uniform bending.
Determination of Young's Modulus of the material uniform bending
Comparison of Rigidity Modulus of the different materials.

UNIT -V HAZARDS AND SAFETY MEASURES 15

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures. *CASE STUDY*

TOTAL: 75 Periods

Text Books

1. Budinski, K.G. &Budinski, M.K. "Engineering Materials Properties and Selection", Prentice Hall, 2009
2. Severns, W.H. & Fellows, J.R. "Air conditioning and Refrigeration", John Wiley and Sons, London, 1988
3. Stevens, W.R., "Building Physics: Lighting: Seeing in the Artificial Environment, Pergaman Press, 2013.

References

1. Gaur R.K. and Gupta S.L., Engineering Physics. DhanpatRai publishers, 2012.
2. Shearer, P.M. "Introduction to Seismology", Cambridge University Press, 1999.
3. Reiter, L. "Earthquake hazard analysis - Issues and insights", Columbia University Press, 1991.
4. Alexander, D. "Natural disaster", Springer (1993).

LIST OF EQUIPMENTS: For a strength of Thirty Students

Sl.No.	Name of the Experiment	Equipment Required	Number Required
1	Determination of thermal conductivity of bad conductor – Lee's disc method.	Lee's Disc Kit	5

2	Determination of thermal conductivity of good conductor – Forbe's method.	Forbe's Equipment	5
3	Determination of Velocity of Sound.	Ultrasonic Interferometer	5 sets
4	Dispersive power of a prism using spectrometer grating	Spectrometer Prism	2 5
5	Determination of wavelength of spectral lines using grating	Spectrometer Grating element	2 5
6	Determination of wavelength and crystalline size using laser.	Laser Kit	5
7	Determination of Young's Modulus of the material non- uniform bending	Young's Modulus Kit	5
8	Determination of Young's Modulus of the material uniform bending	Young's Modulus Kit	5
9	Comparison of Rigidity Modulus of the different materials.	Torsion Pendulum set Different wires made of different materials	5 Required quantity
10	CASE STUDY		

Course Designer

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1	Ms. L. Sangeetha	sangeethal@saveetha.ac.in

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SUB. CODE	COURSE TITLE	L	T	P	Credit
19PH210	SOLID STATE PHYSICS COMMON TO ECE & EIE	3	0	2	4

Preamble

The course work will introduce electronic engineers to different types of conductors, semiconductors and dielectrics materials. The current magnetic materials, optical materials, Solar cell materials, superconductors and smart materials will be discussed.

Prerequisite

Basics of Engineering Physics

Course outcome

At the end of the course, the students should be able to

CO1	Understand the concept of electrical properties of metals.	Understand
CO2	Analyze the properties of semiconducting materials and apply the basic principles of semiconductor physics in the engineering field.	Analyze
CO3	Analyze the various properties of magnetic and dielectric properties	Analyze
CO4	Acquire the knowledge of optical properties of different materials.	Understand
CO5	Apply the principles of nanotechnology in the field of new emerging areas of engineering field.	Apply

Mapping of COs with POs and PSOs (ECE)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	1	1	-	-	2	1	1	1	-	-	-
CO2	3	3	2	-	1	1	-	-	2	1	1	1	1	-	1
CO3	3	3	3	-	1	1	-	-	2	1	1	2	-	-	1
CO4	3	3	2	-	1	1	-	-	2	1	2	2	-	-	-
CO5	3	3	2	-	1	1	-	-	2	1	1	1	-	-	1

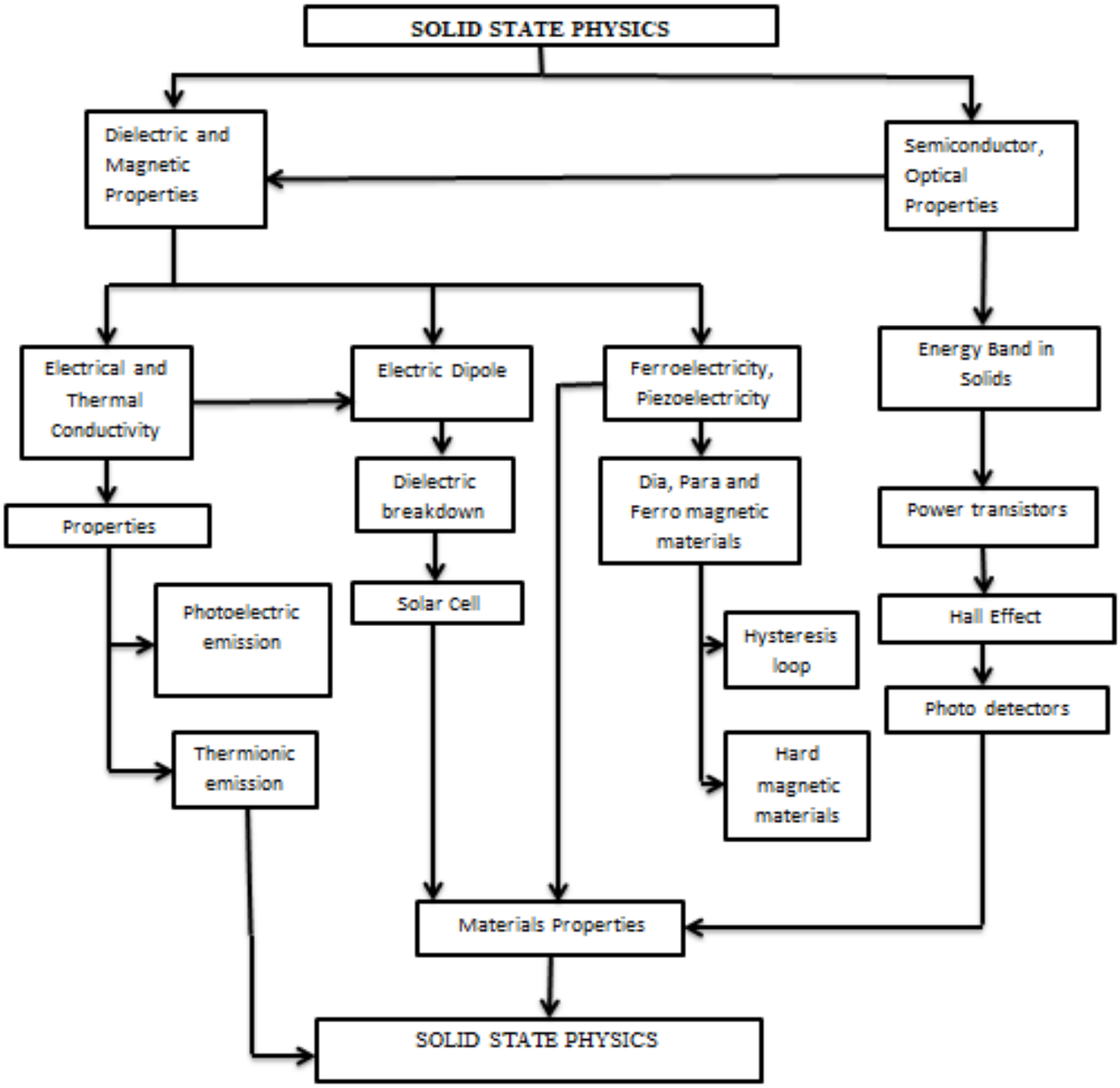
1 – LOW, 2 – MEDIUM, 3 - STRONG

Mapping of COs with POs and PSOs (EIE)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	1	1	-	-	2	1	1	1	1	-
CO2	3	3	2	-	1	1	-	-	2	1	1	1	1	-
CO3	3	3	3	-	1	1	-	-	2	1	1	2	1	-
CO4	3	3	2	-	1	1	-	-	2	1	2	2	1	-
CO5	3	3	2	-	1	1	-	-	2	1	1	1	1	1

1 – LOW, 2 – MEDIUM, 3 - STRONG

Concept Map



SYLLABUS

UNIT - I ELECTRICAL & THERMAL PROPERTIES OF MATERIALS 15

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch theorem – metals and insulators - Energy bands in solids

Determination of thermal conductivity by Lee's disc method,
Determination of thermal conductivity by Forbe's method
Comparison of conductivity of different materials using lees disc

UNIT- II SEMICONDUCTOR PHYSICS **15**

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Einstein's relation – Hall Effect and devices – Zener and avalanche breakdown in p-n junctions - Tunnel diode - Schottky diode, Rectifier uses, Transistor as an amplifier.

To determine the energy band gap in a semiconductor using a p-n Junction diode
Determination of VI characteristics of solar cell and to determine the efficiency with distance of light source

UNIT - III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS **15**

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – B-H curve (hysteresis loop)- Domain Theory. Dielectric materials- Internal field – Clausius-Mosotti relation- dielectric breakdown.

B-H Curve – Hysteresis Loop

UNIT - IV OPTICAL PROPERTIES OF MATERIALS **15**

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 P-N diode – solar cell – LED – Organic LED – Laser diodes – Optical data storage techniques, Photo diode, construction, working and characterizations-applications.

Determine (i) the wave length of the given light source and (ii) determine the Numerical Aperture of given optical fibre.
Determine (i) the wavelength of the given laser light source using grating (ii) the size of the given micro particles in the form of powder using the given laser source.
Dispersive power of a prism using spectrometer
Determination of wavelength of spectral lines using grating
Formation of interference by air wedge
Construction of Hologram with mobile

UNIT -V NANOELECTRONIC DEVICES **15**

Introduction to nanoelectronic devices – quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures –Zener -Bloch oscillations – resonant tunneling – quantum interference effects – Coulomb blockade effects -Single electron phenomena and Single electron Transistor – magnetic semiconductors– spintronics - Carbon nanotubes: Properties and applications.

TOTAL: 75 PERIODS

Text Books

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

References

1. Charles Kittel, Introduction to Solid State Physics, Wiley; 8 th edition 2004.
2. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
3. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.
4. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014.

LIST OF EQUIPMENTS: For a strength of Thirty Students

Sl..No.	Name of the Experiment	Equipment Required	Number required
1	Determination of thermal conductivity by Lee's disc method,	Lees Chamber Heating coil Thermometer	6 6 6
2	Determination of thermal conductivity by Forbe's method	An unknown resistance A known resistance(variable) A galvanometer A very high resistance of the order of 15000Ω to protect the galvanometer. A dry cell A plug key g)A meter bridge with jockey A sorting plate A copper strip	6 each
3	Comparison of conductivity of different materials using lees disc	Lees Chamber Heating coil Thermometer Different materials	6 6 6 6 sets
4	Determination of band gap – PN Junction diode.	Heating coil Junction diode Measuring Device Thermometer Beaker	6 6 6 6 6
5	V-I characteristics of Photo diode	Solar cell with probes Multimeter Scale	6 6 6
6	B-H Curve – Hysteresis Loop	Kit	5
7	Determine (i) the wave length of the given light source and (ii) determine the Numerical Aperture of given optical fibre.	Laser Source Fibre Optic Kit	6 6
8	Determine (i) the wavelength of the given laser light source using grating (ii) the size of the given micro particles in the form of powder using the given laser source.	Laser Source Glass plate with Lycopodium Powder	6 6
9	Dispersive power of a prism using spectrometer	Spectrometer Prism Mercury vapor lamp	6 6 6
10	Determination of wavelength of spectral lines using grating	Spectrometer Grating element Mercury vapor lamp	6 6 6
11	Formation of interference by ai rwedge	Air wedge Travelling microscope	6 6
12	Construction of Hologram with mobile	https://www.youtube.com/watch?v=sLyT8tWDz6M	

Course Designers

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Department	PHYSICS	**Branch**	MECHANICAL ENGINEERING			
19PH211	**MATERIALS SCIENCE**	**Category**	**L**	**T**	**P**	**Credit**
		BS	**3**	**0**	**2**	**4**

Preambles

The course work aims at imparting the fundamental knowledge on Phase diagram and Phase transformation, Heat transfer, Strengthening Mechanism in metals, Magnetic and Dielectric properties of materials, New Engineering materials preparation methods and their Characterization pertaining to mechanical engineers.

Prerequisite

Fundamentals of Engineering Physics

Course Outcomes

At the end of the course, the students should be able to

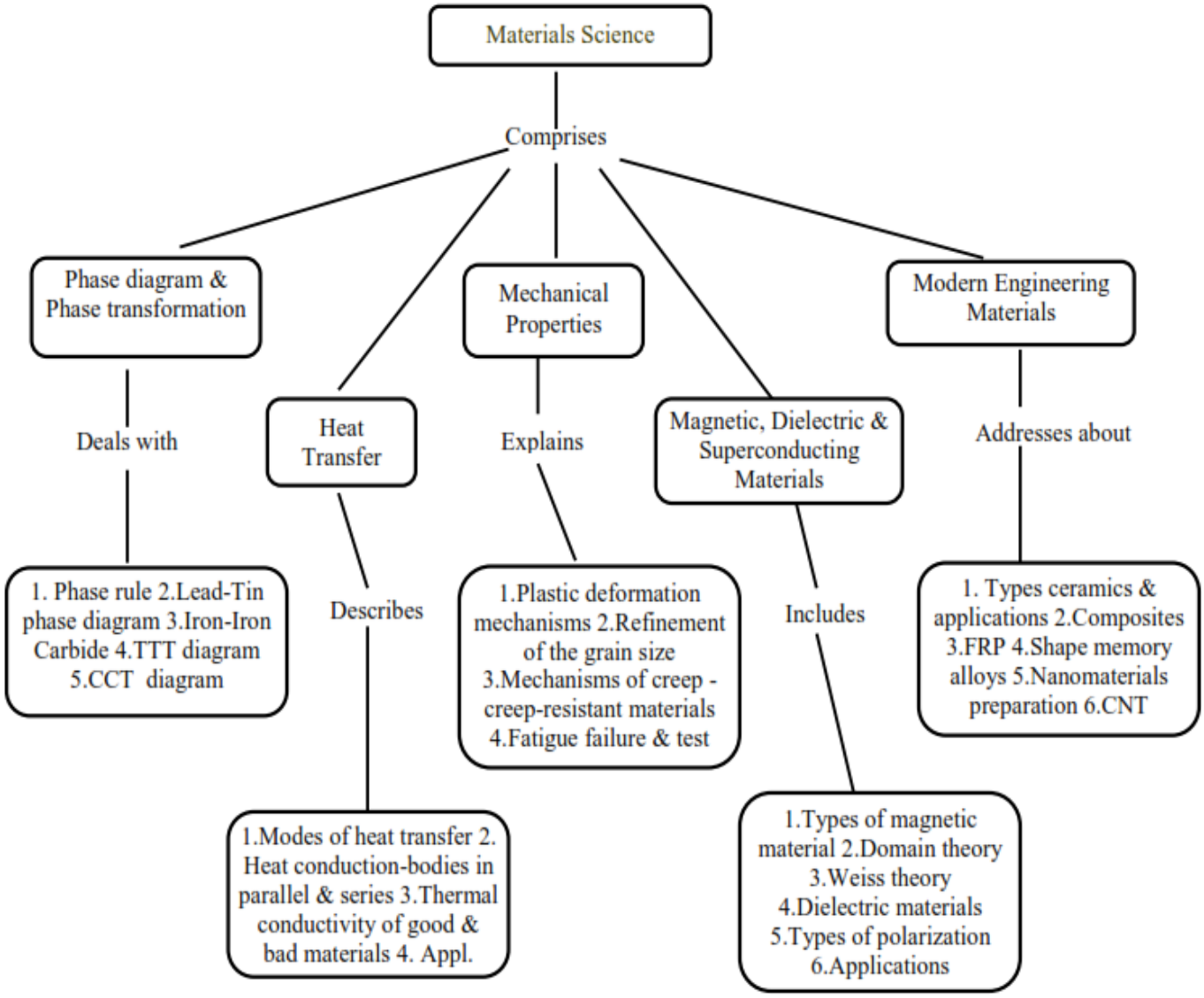
CO1	Distinguish the different phase diagram and phase transformation of materials	Understand
CO2	Determine modes of heat transfer and their heat transfer properties	Apply
CO3	Compare the strengthening mechanism of different materials and test them for hardness	Understand & Apply
CO4	Explain magnetic and dielectric materials and their properties	Understand
CO5	Select with justification of suitable new materials for mechanical engineers	Apply

Mapping of COs with POs and PSOs

Course Outcome	**Program Outcomes**												**Program Specific Objectives**		
CO s	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	2	-	-	-	-	-	-	-	-	-	-	1	1	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO 3	3	3	2	-	-	-	-	-	2	1	-	1	1	-	1
CO 4	3	3	3	1	3	1	1	-	3	2	-	1	1	-	-
CO 5	3	3	3	-	3	2	1	-	3	3	-	2	1	-	1

1 – LOW, 2 – MEDIUM, 3 - STRONG

CONCEPT MAP



SYLLABUS

UNIT – I PHASE DIAGRAMS AND PHASE TRANSFORMATION 15

Phase, Gibbs's Phase rule, Solubility and Solid Solutions - Iso-morphous alloy system -Binary Eutectic alloy system (Lead-Tin System), Eutectoid and Peritectic system, Iron-Iron carbide phase diagram- Invariant reactions, Evolution of Microstructure, Phase Transformation- Temperature-Time-Transformation (TTT) Diagram - Steels, Cast Irons and Stainless steels – types and applications .

UNIT - II HEAT TRANSFER 15

Modes of heat transfer - thermal conductivity - heat capacity and diffusivity - rectilinear flow of heat - conduction through bodies in series and parallel - determination of thermal conductivity: good conductor: Forbe's method - bad conductor: Lee's disc method -applications of heat transfer: formation of ice in ponds - conductivity of earth's crust and age of earth - practical applications.

Determination of thermal conductivity by Lee's disc method
Determination of thermal conductivity by Forbe's method

UNIT- III MECHANICAL PROPERTIES 15

Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

Determination of Young's Modulus of the material non- uniform bending.
Determination of Young's Modulus of the material uniform bending
Comparison of Rigidity Modulus of the different materials.
Testing of Material Hardness- Rockwell
Testing of Material Hardness- Brinell

UNIT –IV MAGNETIC AND DIELECTRIC MATERIALS 15

Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – anti ferromagnetism –Ferromagnetism – domain theory — hysteresis – Weiss molecular field theory – hard and soft magnetic materials – Applications: Data storage - Dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization - dielectric loss and breakdown– Ferroelectric materials - Applications: Electrets microphones, Energy harvesters.

B-H Curve – Hysteresis Loop

UNIT -V MODERN ENGINEERING MATERIALS 15

Ceramics – types and applications , processing of fiber reinforced plastics – metallic glasses: types , glass forming ability of alloys, melt spinning process, applications - shape memory alloys: shape memory effect, pseudoelastic effect, NiTi alloy, applications – nanomaterials: preparation -bottom up approach- and top down approach- ball milling- carbon nanotubes: properties and applications

Preparation of Nano Materials by Solution Method
Preparation of nano materials by hydrothermal method.

Text Books

1. Balasubramaniam, R , Callister's Materials Science and Engineering. Wiley India Pvt. Ltd., 2014.
2. Callister.W.D , Materials Science and Engineering: An Introduction, 8th ed.,Wiley & Sons 2010.

References

1. Raghavan, V, Materials Science and Engineering : A First course. PHI Learning, 2015
2. Askeland, D, Materials Science and Engineering, Brooks/Cole, 2010
3. Smith, W.F., Hashemi, J. & Prakash, R, Materials Science and Engineering, Tata McGraw Hill Education Pvt. Ltd., 2014.
4. Wahab, M.A., Solid State Physics: Structure and Properties of Materials. Narosa Publishing House, 2009.
5. Incropera, F.P, Dewitt, D.P , Fundamentals of Heat and Mass Transfer, 7th ed., Wiley & Sons 2011.

LIST OF EQUIPMENTS: For a strength of Thirty Students

Sl.No.	Name of The Experiment	Equipment Required	Number Required
1.	Determination of thermal conductivity of bad conductor – Lee's disc method.	Heating Coil Boiler Thermometers Bad conductors Lees Disc	6 6 6 6 6
2.	Determination of thermal conductivity of good conductor – Forbe's method.	Good Conductor Thermometer Forbes equipment	6 6 6
3.	Determination of Young's Modulus of the material non- uniform bending	Meter scale Microscope Knife edge Slotted weights	6 6 6 6
4.	Determination of Young's Modulus of the material uniform bending	Meter scale Microscope Knife edge Slotted weights	6 6 6 6
5.	Comparison of Rigidity Modulus of the different materials	Torsion pendulum Steel wire Stop watch Slotted weights	6 6 6 6
6.	Testing of Material Hardness- Rockwell	Rockwell machine Materials to be tested	1
7.	Brinell hardness testing method	Hardness testing machine Materials to be tested	1
8.	B-H Curve – Hysteresis Loop	B-H Kit	5
9.	Preparation of Nano Materials by Solution Method	Mortar Magnetic stirrer Chemicals, Glass wares,	1 Necessary quantity
10.	Preparation of nano materials by hydrothermal method.	Chemicals, Glass wares,	Necessary quantity

Course Designers

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SUB CODE	COURSE TITLE	BRANCH	ELECTRICAL AND ELECTRONICS ENGINEERING			
19PH212	BASICS OF SOLID STATE DEVICES	Category	L	T	P	Credit
		BS	3	0	2	4

Preamble

The course work aims in imparting fundamental knowledge of solid state devices required for electrical engineers.. The current solid state devices, diode, transistors, multi junction devices, opto-electronic devices will be discussed.

Prerequisite

NIL

Course Outcomes

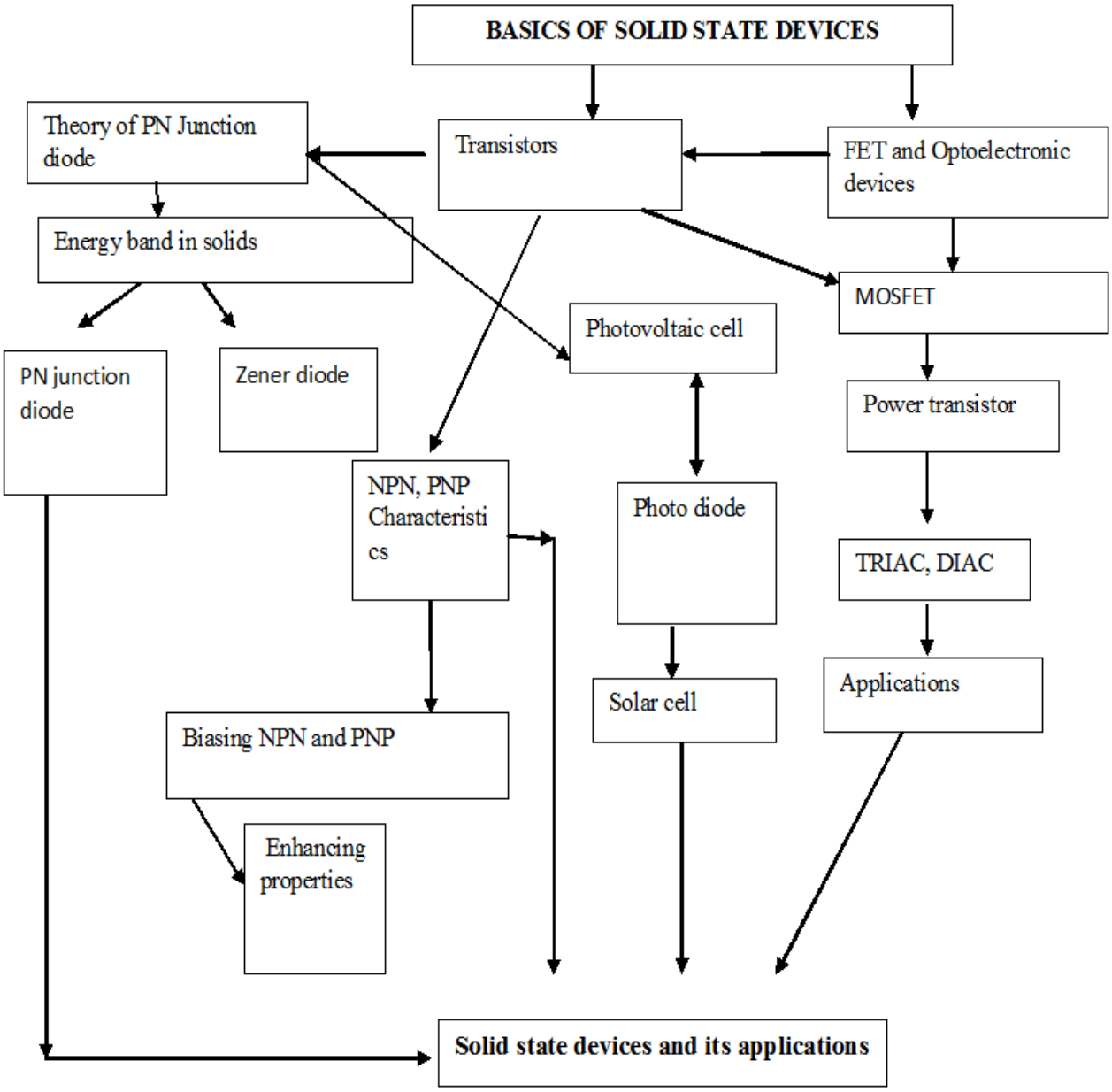
At the end of the course, the student should be able to:

CO1	Understand the fundamental principles of solid state physics relevant to problems of Electrical and Electronics Engineering.	Understand
CO2	Describe the basic principles of PN junction diode and its applications	Remember
CO3	Explain the concepts of transistors and its applications	Understand
CO4	Apply principles of quantum to understand properties of multi junction transistors	Apply
CO5	Discover new emerging areas of science and technology like opto-electronic devices.	Apply

Mapping of COs with POs and PSOs

Course Outcome	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	3	3	3	1	-	1	-	1	1	-	1	1	2	-
CO2	1	1	2	1	-	1	-		1	-	1	1	2	-
CO3	3	3	1	2	-	1	-		1	-	1	1	1	-
CO4	3	2	2	2	-	2	-		1	-	1	1	1	-
CO5	3	3	2	1	-	1	-	1	1	-	1	1	1	-

Concept Mapping



SYLLABUS

UNIT 1 - THEORY OF PN JUNCTION **15**

Semiconductor physics theory of energy bands in crystals- Distinction between conductors, Insulators and Semiconductors - continuity equation– Intrinsic and Extrinsic semiconductors -n type semiconductor- p type semiconductors- charge on n-type and p- type semiconductors-majority and minority carrier.
Determination of band gap of Semiconductor – PN Junction diode
Study V-I characteristics of PN junction diode.

UNIT 2 - DIODE **15**

PN Junction diode – Biasing of PN junction – V-I characteristics of junction diode – Rectifiers – Half wave – Full wave and bridge rectifiers – Zener diode – V-I Characteristics of Zener diode – PIN diode- Characteristics of PIN diode - Tunnel diode - Backward diode - Breakdown voltage avalanche Breakdown.
Study V-I characteristics of Zener diode.

UNIT -3 – TRANSISTORS **15**

Introduction to BJT-Construction-Transistor Biasing-Operation of NPN-PNP Transistor-Transistor types – CB, CE and CC configurations-D.C. operating point and load line – Drawing a D.C. Load line – Q-Point and maximum undistorted output – Factors affecting stability of Q-point – Stability factor – Condition for Proper biasing of a Transistor - Method of Biasing: Base bias – Base bias with emitter feedback – Base bias with collector feedback – Voltage divider bias – Emitter bias – Bias Compensation.
Study V-I characteristics of BJT.

UNIT 4 - MULTIJUCTION DEVICES **15**

JFET: Construction, Operation and Characteristics; Comparison between FET and BJT, MOSFET: Types; construction, Working and Characteristics, SCR: Construction, Operation and V-I characteristics; Applications, TRIAC: Construction, Operation and V-I characteristics; Applications, UJT: Construction, Operation and V-I characteristics; Applications, DIAC: Construction and V-I characteristics
Study V-I characteristics of FET
Study V-I characteristics of UJT.

UNIT 5 - OPTO-ELECTRONIC DEVICES **15**

Photo electric theory – Kinetic energy of emitted electrons – Photo emissive cell – Photo multiplier – Photo diode – Photo transistor - Photo field effect transistor – Photovoltaic cells – Photo resistive devices – Photo potentiometric device – LED - LCD- LDR – Photo transistor- Laser and Maser.
Determination of wavelength of the given semiconductor laser source.
Determination of size of the particle using LASER
Determination of Numerical aperture of an optical fibre using LASER
V-I characteristic of Photo diode and study the LDR characteristics

TOTAL: 75 PERIODS

Text Books

1. V.K. Mehta, Rohit Mehta, Principles of Electronics, S.Chand and Company Ltd., 2005.
2. R.S.Sedha, A Text Book of Applied Electronics, S.Chand and Company Ltd., 2010.
3. Theraja B.L., The fundamentals of solid state physics, Sultan Chand& Co., Delhi, 2002.

References

1. Kasap, S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
2. Garcia, N. & Damask, A. Physics for Computer Science Students. Springer-Verlag, 2012.
3. Mani. P, Physics for electronics engineering, shri dhanam publisher, 2017
4. Millman&Halkias, Electronics devices and Circuits, McGraw-Hill, 1967.
5. Theraja B.L., The fundamentals of solid state physics, Sultan Chand& Co., Delhi, 2002.

LIST OF EQUIPMENTS

S.NO	EXPERIMENT NAME	NAME OF THE EQUIPMENT	NUMBER REQUIRED (each)
1	Study V-I characteristics of PN junction diode.	IN4001,Voltmeter, Ammeter, Power supply, wires, multimeter	6
2	Determination of band gap of Semiconductor – PN Junction diode.	Regulated power supply, voltmeter, micro ammeter, resistor, diode heating system, thermometer, beaker etc.	6
3	Study V-I characteristics of Zener diode.	Regulated power supply, voltmeter, micro ammeter, resistor, Zener diode heating system, thermometer, beaker etc.	6
4	Study V-I characteristics of BJT.	Regulated power system, voltmeter, BJT, micro ammeter, resistor, photo diode	6
5	Determination of wavelength of the given semiconductor laser source. Study V-I characteristics of FET.	Regulated power system, voltmeter, FET, micro ammeter, resistor, photo diode	6
6.	V-I characteristic of Photo diode and study the LDR characteristics	LDR, Photodiode, Regulated power system, voltmeter,	6
7.	Determination of wavelength of the given semiconductor laser source.	Diode laser, grating , screen, meter scale,	6
8.	Determination of size of the particle using LASER	Diode laser, grating , screen, meter scale,	6
9	Determination of Numerical aperture of an optical fibre using LASER	Diode laser, grating , screen, meter scale,	6
10	Study V-I characteristics of UJT.	Regulated power system, voltmeter, UJT, micro ammeter, resistor, photo diode	6

Course Designer

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SUB. CODE	COURSE TITLE	Branch	ELECTRICAL AND ELECTRONICS ENGINEERING			
19PH213	NANO SCIENCE FOR ELECTRICAL ENGINEERS	Category	L	T	P	Credit
		BS	3	0	0	3

Preamble

The course work aims in imparting fundamental knowledge of nanomaterials required for electrical and electronic engineers. To elucidate on advantages of nanotechnology based applications in each industry.

Prerequisite

NIL

Course Outcomes

At the end of the course, the students should be able to

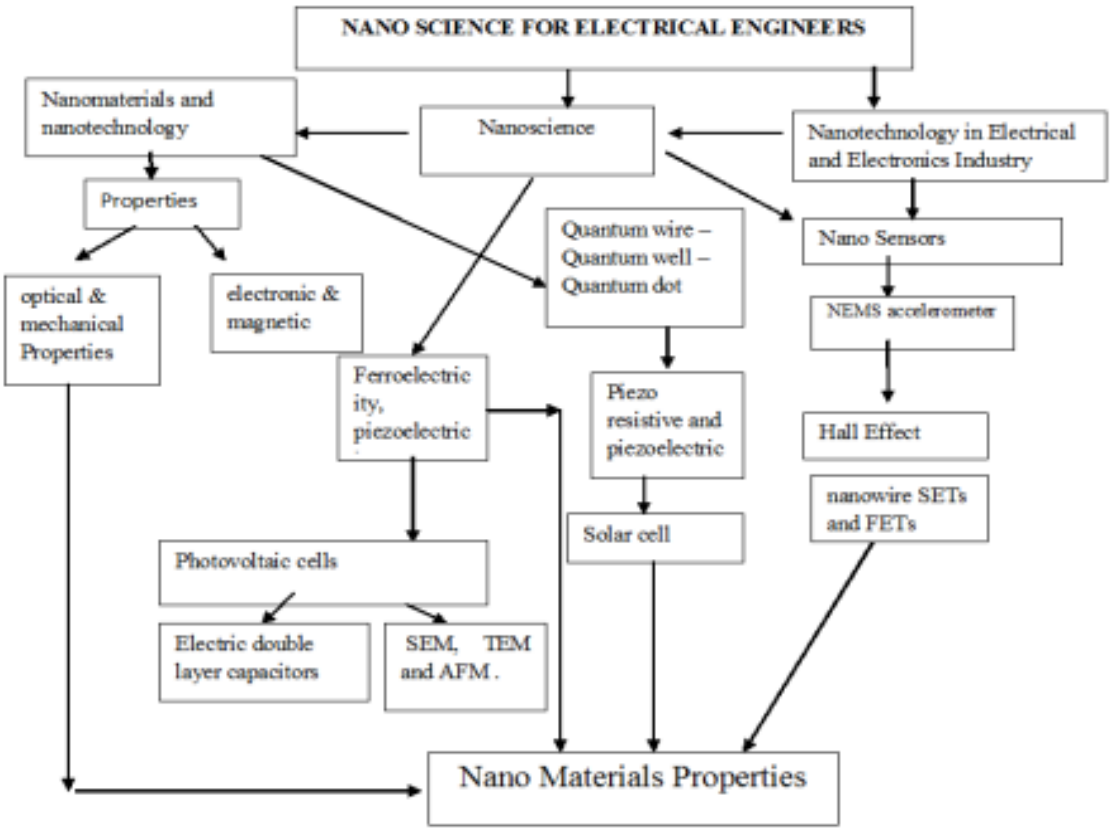
CO1	Acquire knowledge and understanding of fundamental principles of nano physics relevant to problems of Electrical and Electronics Engineering.	Understand
CO2	Acquire knowledge of basic principles of nano science and its applications	Remember
CO3	Acquire knowledge of the basic nano materials and properties.	Remember
CO4	Apply principles of quantum dot, wire to understand properties of materials	Apply
CO5	Acquire knowledge of new emerging areas of science and technology like nano materials.	Analyze

Mapping of COs with POs and PSOs

Course Outcomes	Program Outcomes												Program Specific Objectives	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO 1	3	3	-	3	-	1	-	1	-	1	1	1	2	-
CO 2	1	1	-	-	-	1	-	-	-	1	1	1	2	-
CO 3	3	3	-	2	-	1	-	2	-	1	1	1	2	-
CO 4	3	3	-	-	-	2	-	-	-	1	1	1	2	-
CO 5	3	1	-	3	-	2	-	1	-	1	1	1	2	-

1 – LOW, 2 – MEDIUM, 3 - STRONG

CONCEPT MAP



SYLLABUS

UNIT I - NANOSCIENCE **9**

Introduction and scientific revolutions Time and length scale in structures, Definition of a nanosystem, Dimensionality and size dependent phenomena, Surface to volume ratio. Fraction of surface atoms and surface energy, Surface stress and surface defects, Properties at nanoscale, optical & mechanical Properties at nanoscale – electronic & magnetic Properties.

UNIT II - NANOMATERIALS AND NANOTECHNOLOGY **9**

Basic concepts of Nano science and technology – Quantum wire – Quantum well – Quantum dot – Properties and technological advantages of Nano materials – Carbon Nanotubes and applications – Material processing by Sol – Gel method, Chemical Vapour deposition and Physical Vapour deposition – Microwave Synthesis of materials – Principles of SEM, TEM and AFM

UNIT III - NANOTECHNOLOGY IN ELECTRICAL AND ELECTRONICS INDUSTRY **9**

Nano electrical and electronic devices, advantageous, Data storage and memory, Micro and Nano electro mechanical systems, Lasers, lighting and displays, Batteries, Fuel cells, Photovoltaic cells, Electric double layer capacitors, Nanoparticle coatings for electrical products

UNIT IV- NANOELECTRONIC DEVICES **9**

Coulomb blockade, Tunnel junction excited by a current source, Performance of the single electron transistor. SET technology and Field effect transistors, Carbon nanotube transistors (FETs and SETs), Semiconductor nanowire SETs and FETs, Molecular SETs and molecular electronics, Quantum dot cellular automata

UNIT V - NANO SENSORS **9**

Resistive sensors: Types, working principles , Capacitive sensors: Types, working principles, Inductive transducers: Types, working principle, Nano sensor: Parameters and characteristics, Necessity of nano scale measurements, classification of nanosensors, Magneto resistance Nano sensor, Hall effect, NEMS accelerometer, silicon nanowire accelerometer, Optical displacement nano sensor, magneto motive displacement nano sensor, Piezoresistive and piezoelectric displacement nanosensor, Carbon nanowire on diamond resistive temperature nanosensor.

TOTAL: 45 PERIODS

Text Books

1. Mark A.R., Daniel Ratner, "Nanotechnology: A Gentle Introduction to the Next Big Idea", Pearson Education, India, 2003.
2. Bharat Bhushan, "Handbook of Nanotechnology", Springer, Barnes & Noble, 2004. 3. Mark A.R., Daniel Ratner, "Nanotechnology: A Gentle Introduction to the Next Big Idea", Pearson Education, India, 2003.

References

1. Karl Goser, Peter GlÖsekötter, Jan Dienstuhl, “Nanoelectronics and Nanosystems”, Springer, 2004.
2. Vinod Kumar Khanna., “Nanosensors: Physical, Chemical and Biological”, CRC press, 2012.
3. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996. 4. N John Dinardo, “Nanoscale Characterisation of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.
5. G Timp, “Nanotechnology”, AIP press/Springer, 1999.
6. Akhlesh Lakhtakia, “The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

Course Designer

S.No	Name of the Faculty	Email ID
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19PH214	PHYSICS FOR QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

PREAMBLE

The course work will introduce quantum physics concepts and their applications in quantum computing.

PREREQUISITE

Nil

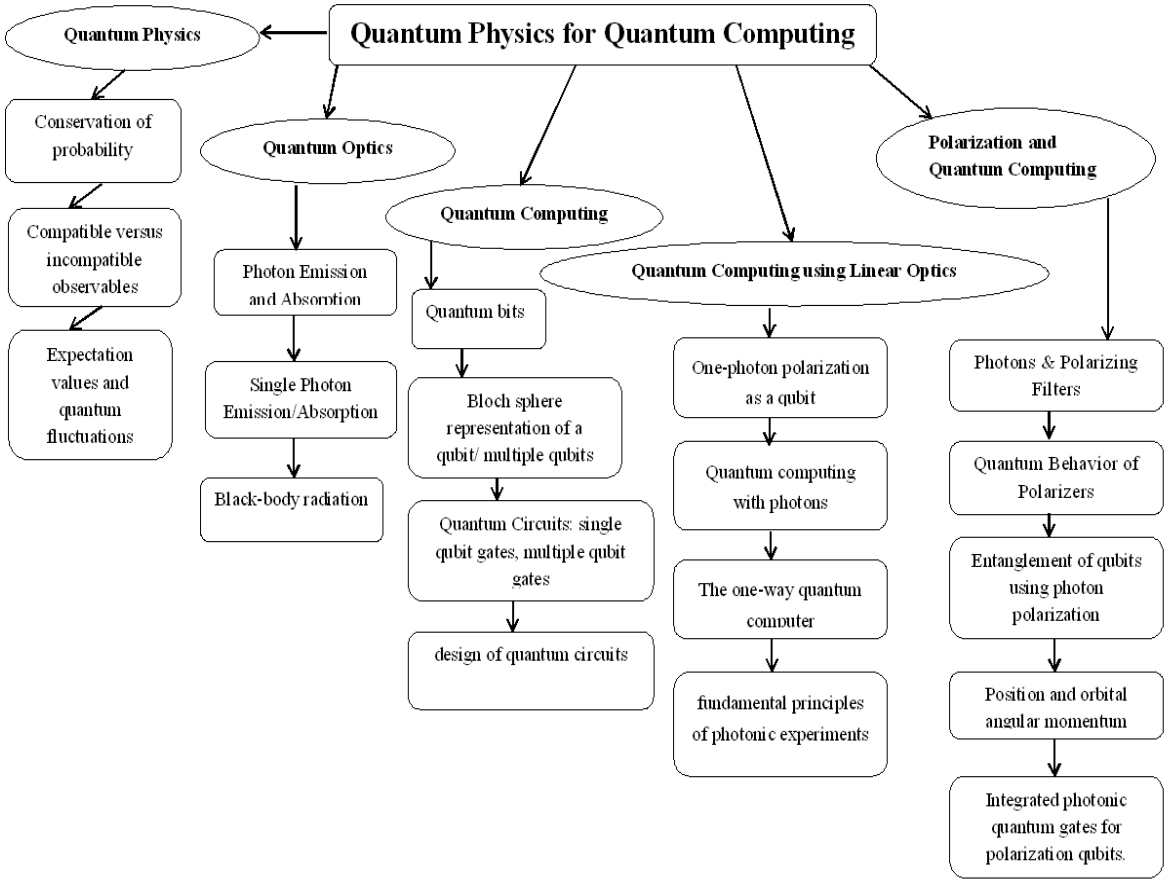
COURSE OUTCOMES

At the end of this course, the learner can able to		
CO1	Understand the basic concepts of quantum physics applicable to quantum computing	Understand
CO2	Visualize the general properties of quantum optics and their effects	Understand
CO3	Interpret on the various terms related to quantum computing	Understand
CO4	Identify the application of linear optics in quantum computing	Analyze
CO5	Appraise the effect of polarization and its applications in overlapping of information	Evaluate

MAPPING OF COs WITH POs & PSOs

COURSE OUTCOMES	PROGRAMME OUTCOMES												PROGRAMME SPECIFIC OUTCOMES			
	PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	1	1	1	-	1	1	-	2	2	2	2	2	2	-	2
CO2	2	2	2	2	-	2	2	2	2	2	2	2	2	2	-	2
CO3	2	2	2	2	-	2	1	1	1	1	2	1	1	1	-	2
CO4	2	2	2	2	-	2	1	2	2	2	2	2	2	2	-	2
CO5	2	2	2	2	1	2	2	2	2	2	2	2	2	2	-	2
1. LOW 2.MODERATE 3. SUBSTANTIAL																

CONCEPT MAP



SYLLABUS		
UNIT-I	**Quantum Physics**	**9**
Introduction to Quantum Physics - The Principles of Quantum Physics- Conservation of probability- Compatible versus incompatible observables- Expectation values and quantum fluctuations		
UNIT-II	**Quantum Optics**	**9**
Quantum Optics -Photon Emission and Absorption -Setting up the general problem of photon emission/absorption - Single Photon Emission/Absorption - Absorption and emission of photons in a cavity- Black-body radiation		
UNIT-III	**Quantum Computing**	**9**

Quantum Computing - Introduction to Quantum Computation-Quantum bits, Bloch sphere representation of a qubit, multiple qubits- Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits		
UNIT-IV	**Quantum Computing using Linear Optics**	**9**
Quantum Computing using Linear Optics- One-photon polarization as a qubit- Quantum computing with photons: introduction to the circuit model, the one-way quantum computer, and the fundamental principles of photonic experiments		
UNIT-V	**Polarization and Quantum Computing**	**9**
Polarization & Quantum Computing – Photons & Polarizing Filters -Filters Change Polarization - Quantum Behavior of Polarizers - Loss of Information - Polarization and qubit information - Entanglement of qubits using photon polarization, position and orbital angular momentum -Integrated photonic quantum gates for polarization qubits.		
TOTAL: 45 PERIODS		

LIST OF EQUIPMENTS NEEDED FOR A BATCH OF THIRTY STUDENTS

SLNO	DESCRIPTION	QTY

TEXT BOOKS

1	Quantum Physics For Beginners by Zbigniew Ficek , Taylor & Francis, April 2016
2	Quantum Physics,What Everyone Needs to Know by Michael G. Raymer, (Audio Book)

REFERENCES

1	https://www.udemy.com/course/quantum-physics-for-quantum-computing-superposition-and-entanglement/
2	https://analyticsindiamag.com/7-ingredients-of-quantum-mechanics-youll-need-to-ace-quantum-computing/

SUB. CODE	COURSE TITLE	L	T	P	Credit
19PH215	PHYSICS OF SOLID STATE MATERIALS	3	0	2	4

Preamble

The course work will introduce electronic engineers to different types of conductors, semiconductors and dielectrics materials. The current magnetic materials, optical materials, Solar cell materials, superconductors and smart materials will be discussed.

Course outcome

At the end of the course, the students should be able to

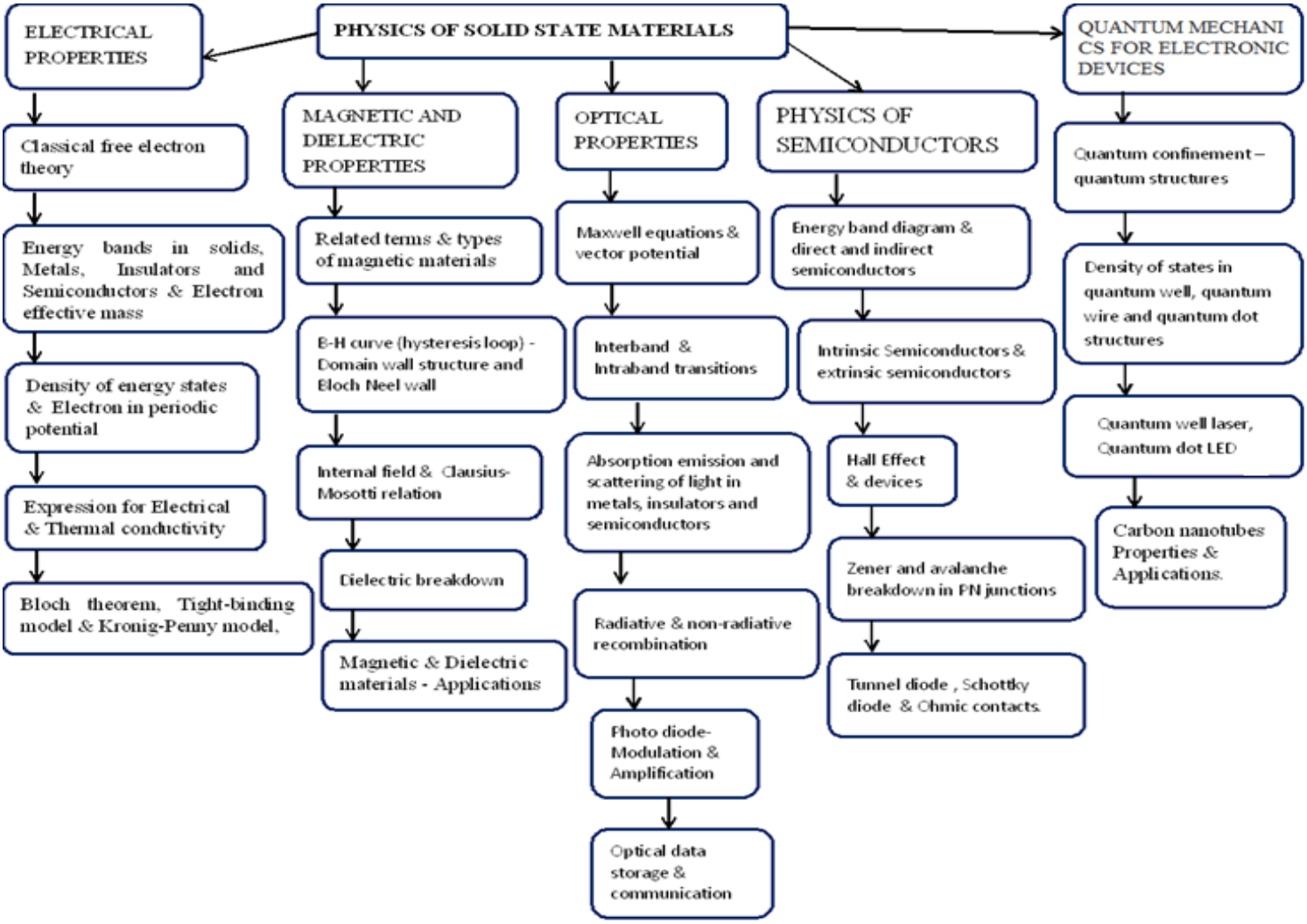
CO1	Comprehend and describe the structure of materials and explain the bands in solids.	Understand
CO2	Analyze the various properties of magnetic and dielectric properties	Analyze
CO3	Acquire the knowledge of optical properties of different materials and analyse the applications of opto electronic devices	Understand
CO4	Understand the direct and indirect semiconductor, analyze the properties of semiconducting materials and apply the basic principles of semiconductor physics in the engineering devices.	Analyze
CO5	Apply the principles of nanoscience in the field of communication and study different types of nanoelectronic devices.	Apply

Mapping of COs with POs and PSOs (ECE)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	1	1	-	-	2	1	1	1	-	-	-
CO2	3	3	2	-	1	1	-	-	2	1	1	1	1	-	1
CO3	3	3	3	-	1	1	-	-	2	1	1	2	-	-	1
CO4	3	3	2	-	1	1	-	-	2	1	2	2	-	-	-
CO5	3	3	2	-	1	1	-	-	2	1	1	1	-	-	1

1 – LOW, 2 – MEDIUM, 3 - STRONG

Concept Map



SYLLABUS

UNIT - I ELECTRICAL PROPERTIES **15**

Classical free electron theory - Energy bands in solids-Metals, Insulators and Semiconductors, Electron effective mass, concept of holes. -Expression for electrical conductivity – Thermal conductivity, expression - Wiedemann-Franz law – Success and failures - Fermi- Dirac statistics – Density of energy states – Electron in periodic potential: Bloch theorem – Tight-binding model, Kronig-Penny model,

Determination of thermal conductivity by Lee's disc method,
Determination of thermal conductivity by Forbe's method
Comparison of conductivity of different materials using Lee's disc method.

UNIT – II MAGNETIC AND DIELECTRIC PROPERTIES **12**

Magnetism in materials – magnetic field and induction – magnetization - magnetic permeability and susceptibility–types of magnetic materials – B-H curve (hysteresis loop) - Domain wall structure and Bloch Neel wall, Dielectric materials- Internal field – Clausius- Mosotti relation-dielectric breakdown, application of magnetic materials and dielectric materials.

B-H Curve – Hysteresis Loop

UNIT - III OPTICAL PROPERTIES **21**

Maxwell equations and vector potential-Interband & Intraband transitions-Classification of optical materials – Carrier generation – Charge injection and radiative recombination-non-radiative recombinations-Auger process, Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) –solar cell – LED – Organic LED – Laser diodes – Optical data storage techniques- Photo diode-Modulation and Amplification devices- Optical communication systems

Determine (i) the wave length of the given light source and (ii) determine the Numerical Aperture of given optical fibre.

Determine (i) the wavelength of the given laser light source using grating (ii) the size of the given micro particles in the form of powder using the given laser source.

Dispersive power of a prism using spectrometer

Determination of wavelength of spectral lines using grating

Formation of interference by air wedge

Construction of Hologram with mobile

UNIT- IV PHYSICS OF SEMICONDUCTORS **15**

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Einstein's relation – Hall Effect and devices – PN junction-Zener and avalanche breakdown in PN junctions - Tunnel diode - Schottky diode- Ohmic contacts.

To determine the energy band gap in a semiconductor using a p-n Junction diode

Determination of VI characteristics of solar cell and to determine the efficiency with distance of light source

UNIT -V QUANTUM MECHANICS FOR ELECTRONIC DEVICES **12**

Introduction to nanoelectronic devices – quantum confinement – quantum structures - Density of states in quantum well, quantum wire and quantum dot structures– Quantum well laser, Quantum dot LED, Carbon nanotubes: Properties and applications.

TOTAL: 75 PERIODS

Text Books

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Umesh K Mishra & Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.
3. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials". Narosa Publishing House, 2009.

References

1. Charles Kittel, Introduction to Solid State Physics, Wiley; 8 th edition 2004.
2. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
3. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.
4. Rogers, B., Adams, J. & Pennathur, S. "Nanotechnology: Understanding Small Systems". CRC Press, 2014.

LIST OF EQUIPMENTS: For a strength of Thirty Students

Sl..No.	Name of the Experiment	Equipment Required	Number required
1	Determination of thermal conductivity by Lee's disc method,	Lees Chamber Heating coil Thermometer	6 6 6
2	Determination of thermal conductivity by Forbe's method	An unknown resistance A known resistance(variable) A galvanometer A very high resistance of the order of 15000Ω to protect the galvanometer. A dry cell A plug key g)A meter bridge with jockey A sorting plate A copper strip	6 each
3	Comparison of conductivity of different materials using lees disc	Lees Chamber Heating coil Thermometer Different materials	6 6 6 6 sets
4	Determination of band gap – PN Junction diode.	Heating coil Junction diode Measuring Device Thermometer Beaker	6 6 6 6 6
5	V-I characteristics of Photo diode	Solar cell with probes Multimeter Scale	6 6 6
6	B-H Curve – Hysteresis Loop	Kit	5
7	Determine (i) the wave length of the given light source and (ii) determine the Numerical Aperture of given optical fibre.	Laser Source Fibre Optic Kit	6 6
8	Determine (i) the wavelength of the given laser light source using grating (ii) the size of the given micro particles in the form of powder using the given laser source.	Laser Source Glass plate with Lycopodium Powder	6 6
9	Dispersive power of a prism using spectrometer	Spectrometer Prism Mercury vapor lamp	6 6 6
10	Determination of wavelength of spectral lines using grating	Spectrometer Grating element Mercury vapor lamp	6 6 6
11	Formation of interference by air wedge	Air wedge Travelling microscope	6 6
12	Construction of Hologram with mobile	https://www.youtube.com/watch?v=sLyT8tWDz6M	

Course Designers

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