Lesson Plan

Branch: ECS

Semester: I **Year: 2022-23**

Course Title: Engineering Physics - I	SEE: 2 Hours – Theory
Total Contact Hours: 26 Hours	Duration of SEE: 2 Hrs
SEE Marks: 60 (Theory) + 15 (IA)	
Lesson Plan Author: Dileep Chandra. C	Date:
Checked By:	Date:

Syllabus

Module	Detailed Contents	Hrs.
01	**QUANTUM PHYSICS** **(Prerequisites: Dual nature of radiation, Photoelectric effect Matter waves-wave nature of particles, de-Broglie relation, Davisson-Germer experiment)** De Broglie hypothesis of matter waves; properties of matter waves; wave packet, phase velocity and group velocity; Wave function; Physical interpretation of wave function; Heisenberg uncertainty principle; nonexistence of electron in nucleus; Schrodinger's time dependent wave equation; time independent wave equation; Particle trapped in one dimensional infinite potential well, Quantum Computing.	07
02	**SOLID STATE PHYSICS - CRYSTALLOGRAPHY** **(Prerequisites: Crystal Physics (Unit cell, Space lattice, Crystal structure, Simple Cubic, Body Centered Cubic, Face Centered Cubic, Diamond Structure, Production of X-rays)** Miller indices; interplanar spacing; X-ray diffraction and Bragg's law; Determination of Crystal structure using Bragg's diffractometer;	03
03	**SOLID STATE PHYSICS - SEMICONDUCTORS** **(Prerequisites: Intrinsic and extrinsic semiconductors, Energy bands in conductors, semiconductors and insulators, Semiconductor diode, I-V**	06

	characteristics in forward and reverse bias) Direct & indirect band gap semiconductor; Fermi level; Fermi dirac distribution; Fermi energy level in intrinsic & extrinsic semiconductors; effect of impurity concentration and temperature on fermi level; mobility, current density; Hall Effect; Fermi Level diagram for p-n junction (unbiased, forward bias, reverse bias); Applications of semiconductors: LED, Zener diode, Photovoltaic cell.	
04	**OPTICS-I** **(Prerequisites: Wave front and Huygen's principle, reflection and refraction, Interference by division of wave front, Youngs double slit experiment)** Interference by division of amplitude, Interference in thin film of constant thickness due to reflected and transmitted light; origin of colours in thin film; Wedge shaped film; Newton's rings. Applications of interference - Determination of thickness of very thin wire or foil; determination of refractive index of liquid; wavelength of incident light; radius of curvature of lens; testing of surface flatness; Anti-reflecting films and Highly reflecting film.	**06**
05	**SUPERCONDUCTORS AND SUPERCAPACITORS** (Prerequisites: Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current, Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical resistivity and conductivity temperature dependence of resistance) **Superconductors:** Critical temperature, critical magnetic field, Meissner's effect, Type I and Type II and high Tc superconductors; **Super capacitors:** Principle, construction, types, materials and applications, comparison with capacitor and batteries: Energy density, Power density,	**02**
06	**ENGINEERING MATERIALS AND APPLICATIONS**	**02**

	(Prerequisites: Paramagnetic materials, diamagnetic materials, ferromagnetic materials, crystal physics, Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarisation, capacitors and capacitance) **Liquid crystals:** Nematic, Smectic and cholesteric phases, Liquid crystal display. **Multiferroics:** Type I & Type II multiferroics and applications, Magnetoresistive Oxides: Magnetoresistance, GMR and CMR materials, introduction to spintronics.	

Course Outcomes (CO):

On successful completion of course learner will be able to:

FEC102.1	Illustrate the fundamentals of quantum mechanics and its application.
FEC102.2	Illustrate the knowledge of crystal planes, X-ray diffraction and its application.
FEC102.3	Illustrate the knowledge of Fermi level in semiconductors and applications of semiconductors in electronic devices.
FEC102.4	Illustrate the knowledge of interference in thin films and its various applications.
FEC102.5	Illustrate the basic knowledge of superconductors and supercapacitors.
FEC102.6	Illustrate the knowledge of engineering materials and applications.

CO-PO Mapping: (BL – Blooms Taxonomy, C – Competency, PI – Performance Indicator)

CO	BL	C	PI	PO	Mapping
FEC102.1	3	1.2	1.2.1	1	3
FEC102.2	3	1.2	1.2.1	1	3
FEC102.3	3	1.2	1.2.1	1	3
FEC102.4	3	1.2	1.2.1	1	3
FEC102.5	2	1.2	1.2.1	1	3
FEC102.6	3	1.2	1.2.1	1	3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
FEC102.1	3											
FEC102.2	3											
FEC102.3	3											
FEC102.4	3											
FEC102.5	3											
FEC102.6	3											

CO Measurement Weightages for Tools:

	Class Test	Tutorial	End Semester Exam	Course Exit Survey
FEC102.1	20%	20%	60%	
FEC102.2	20%	20%	60%	
FEC102.3	20%	20%	60%	
FEC102.4	20%	20%	60%	
FEC102.5	---	20%	80%	
FEC102.6	---	---		

Attainment Calculations:

CO1_attainment = [0.8 * (0.6 * ESE + 0.2 * CT + 0.2 * TU) + 0.2 * CES]

CO2_attainment = [0.8 * (0.6 * ESE + 0.2 * CT + 0.2 * TU) + 0.2 * CES]

CO3_attainment = [0.8 * (0.6 * ESE + 0.2 * CT + 0.2 * TU) + 0.2 * CES]

CO4_attainment = [0.8 * (0.6 * ESE + 0.2 * CT + 0.2 * TU) + 0.2 * CES]

CO5_attainment = [0.8 * (0.8 * ESE + 0.2 * TU) + 0.2 * CES]

Lecture Plan:

No of Lect	Sr. No.	Name of the Topic	Planned Date	Executed Date	Mapped CO	Remarks
	Module: 2 SOLIDSTATE PHYSICS - CRYSTALLOGRAPHY (03 hrs)					
1	1	Introduction to crystallography; unit cellS, Diamond Structure	16-11-2022	16-11-2022	CO2 FEC102.2	
2	2	Miller indices of crystallographic planes & directions;	17-11-2022	17-11-2022		
3	3	Interplanar spacing, X-ray diffraction and Bragg's law;	22-11-2022	22-11-2022		
4	4	Determination of Crystal structure using Bragg's diffractometer;	24-11-2022	24-11-2022		
	Module: 3 SOLIDSTATE PHYSICS - SEMICONDUCTORS (06 hrs)					
5	1	Classification of semiconductors (direct & indirect band gap, elemental	30-11-2022	30-11-2022	CO 3 FEC102.3	Lectures taken by Dr. S.S. Rathod
6	2	Conductivity, mobility, current density (drift & diffusion) in semiconductors (n type and p type);	06-12-2022	06-12-2022		
7	3	Fermi Dirac distribution function; Fermi energy level in intrinsic & extrinsic semiconductors;	07-12-2022	07-12-2022		
8	4	effect of impurity concentration and temperature on fermi level;	13-12-2022	13-12-2022		
9	5	Fermi Level diagram for p-n junction (unbiased, forward bais, reverse bias);	13-12-2022	13-12-2022		
10	6	Hall Effect, Numericals	20-12-2022	20-12-2022		
11	7	Applications of semiconductors: Rectifier diode, LED, Zener diode, Photo diode,	20-12-2022	20-12-2022		
	Module 4 OPTICS - I (05 hrs)					
12	1	Interference by division of amplitude, Interference in thin film of constant thickness due to reflected and transmitted light;	25/11/2022	25/11/2022	CO4 FEC102.4	
13	2	Wedge shaped film; Newton's rings	29/11/2022	29/11/2022		
14	3	Numericals on Wedge shaped film; Newton's rings	1/12/2022	1/12/2022		
15	4	Applications of interference- Determination of thickness of very thin wire or foil; determination of refractive index of liquid; wavelength of incident light;	2/12/2022	2/12/2022		
16	5	Applications of interference- radius of curvature of lens; testing of surface flatness; Anti-reflecting films and Highly reflecting film.	6/12/2022	6/12/2022		
	Module 1 QUANTUM MECHANICS (07 hrs)					

17	1	Introduction, Wave particle duality; de Broglie wavelength; experimental verification of de Broglie theory;	9/12/2022	9/12/2022	CO1 FEC102.1	
18	2	properties of matter waves; wave packet, phase velocity and group velocity;	13/12/2022	13/12/2022		
19	3	Wave function; Physical interpretation of wave function;	14/12/2022	14/12/2022		
20	4	Heisenberg's uncertainty principle; Electron diffraction experiment, Applications of uncertainty principle;	15/12/2022	15/12/2022		
21	5	Schrodinger's time dependent wave equation; time independent wave equation;	16/12/2022	16/12/2022		
22	6	Motion of free particle; Particle trapped in one dimensional infinite potential well.	27/12/2022	27/12/2022		
23	7	Numerical problems	29/12/2022	29/12/2022		
	Module 5 SUPERCONDUCTORS & SUPER CAPACITORS (03 Hrs)					
24	1	Superconductors: Critical temperature, critical magnetic field, Meissner's effect	30-12-2022	30-12-2022	CO5 FEC102.5	
25	2	Type I and Type II and high Tc superconductors;	03-01-2023	17-01-2023		
26	3	Supercapacitors: Principle, construction, types, materials and applications, comparison with capacitor and batteries: Energy density, Power density	05-01-2023	19/1/2023		
	Module 6 ENGINEERING MATERIALS & APPLICATIONS (02Hrs)					
27	1	Liquid crystals: Nematic, Smectic and cholesteric phases, Liquid crystal display. Multiferroics: Type I & Type II multiferroics and applications,			CO6 FEC102.6	excluded
28	2	Magnetoresistive Oxides: Magnetoresistance, GMR and CMR materials, introduction to spintronics				

Reference Books:

1. A text book of Engineering Physics-Avadhanulu & Kshirsagar, S. Chand
2. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
3. Fundamentals of optics by Jenkins and White, McGrawHill
4. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
5. Modern Engineering Physics – Vasudeva, S.Chand
6. Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
7. A text book of Engineering Physics-Avadhanulu & Kshirsagar, S. Chand
8. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
9. Fundamentals of optics by Jenkins and White, McGrawHill
10. Solid State Electronic Devices- B. G. Streetman, Prentice Hall Publisher
11. Modern Engineering Physics – Vasudeva, S.Chand

12. Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
13. A Text Book of Engineering Physics, S. O. Pillai, New Age International Publishers.
14. Introduction to Solid State Physics- C. Kittle, John Wiley& Sons publisher
15. Ultracapacitors: The future of energy storage- R.P Deshpande, McGraw Hill
16. Advanced functional materials – Ashutosh Tiwari, Lokman Uzun, Scrivener Publishing

Evaluation Scheme
CIE Scheme
Internal Assessment: 15 (Average of two tests)

Internal Assessment Scheme

Module		Lecture Hours	No. of questions in			No. of questions in SEE
			Test 1	Test 2	Test 3*	
1	SOLIDSTATE PHYSICS - CRYSTALLOGRAPHY	4	7	----	--	
2	SOLIDSTATE PHYSICS - SEMICONDUCTORS	6	8	----	--	
3	OPTICS - I	5	---	8	--	
4	QUANTUM MECHANICS	7	----	7	----	
5	SUPERCONDUCTORS & SUPER CAPACITORS	3	----	----	--	
6	ENGINEERING MATERIALS & APPLICATIONS				--	

Note: Four to six questions will be set in the Test paper

Verified by:

Programme Coordinator Subject Expert