JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

I Year - II Semester		L	T	P	C
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APPLIED PHYSICS					

Unit-I: Wave Optics **12hrs**

Interference: Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffraction - Fraunhofer diffraction due to single slit, double slit - N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating(Qualitative).

Polarization: Introduction-Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

Unit Outcomes:

The students will be able to

- **Explain** the need of coherent sources and the conditions for sustained interference(L2)
- **Identify** engineering applications of interference(L3)
- **Analyze** the differences between interference and diffraction with applications(L4)
- **Illustrate** the concept of polarization of light and its applications(L2)
- **Classify** ordinary polarized light and extraordinary polarized light(L2)

Unit-II: Lasers andFiberoptics ***8hrs***

Lasers: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein's coefficients – Population inversion – Lasing action - Pumping mechanisms – Ruby laser – He-Ne laser - Applications of lasers.

Fiber optics: Introduction –Principle of optical fiber- Acceptance Angle - Numerical Aperture - Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers - Applications.

Unit Outcomes:

The students will be able to

- **Understand** the basic concepts of LASER light Sources(L2)
- **Apply** the concepts to learn the types of lasers(L3)
- **Identifies** the Engineering applications of lasers(L2)
- **Explain** the working principle of optical fibers(L2)
- **Classify** optical fibers based on refractive index profile and mode of propagation(L2)
- **Identify** the applications of optical fibers in various fields(L2)

Unit III: Quantum Mechanics, Free Electron Theory andBand theory 10hrs

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory– Equation for electrical conductivity based on quantum free electron theory- Fermi-Dirac distribution- Density of states (3D) - Fermi energy.

Band theory of Solids: Bloch's Theorem (Qualitative) - Kronig - Penney model (Qualitative)- E vs K diagram - v vs K diagram - effective mass of electron – Classification of crystalline solids–concept of hole.

Unit Outcomes:

The students will be able to

- **Explain** the concept of dual nature of matter(L2)
- **Understand** the significance of wave function(L2)
- **Interpret** the concepts of classical and quantum free electron theories(L2)
- **Explain** the importance of K-Pmodel
- **Classify** the materials based on band theory(L2)
- **Apply** the concept of effective mass of electron(L3)

Unit-IV: Dielectric andMagneticMaterials 8hrs

DielectricMaterials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility and Dielectric constant - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field- Clausius- Mossotti equation-Piezoelectricity.

Magnetic Materials: Introduction - Magnetic dipole moment -Magnetization- Magnetic susceptibility and permeability - Origin of permanent magnetic moment - Classificationof
magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials- Eddy currents- Engineering applications.

Unit Outcomes:

The students will be able to

- **Explain** the concept of dielectric constant and polarization in dielectric materials(L2)
- **Summarize** various types of polarization of dielectrics(L2)
- **Interpret** Lorentz field and Claussius- Mosotti relation indielectrics(L2)
- **Classify** the magnetic materials based on susceptibility and their temperature dependence (L2)
- **Explain** the applications of dielectric and magnetic materials(L2)
- **Apply** the concept of magnetism to magnetic data storage devices(L3)

Unit – V: SemiconductorsandSuperconductors ***10hrs***

Semiconductors: Introduction- Intrinsic semiconductors – Density of charge carriers – Electrical conductivity – Fermi level – extrinsic semiconductors – density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation- Hall effect – Hall coefficient –Applications of Hall effect.
Superconductors: Introduction – Properties of superconductors – Meissner effect – Type I and Type II superconductors – BCS theory (Qualitative) – Josephson effects (AC and DC) – SQUIDs – High T_c superconductors – Applications ofsuperconductors.

Unit Outcomes:
The students will be able to

- **Classify** the energy bands of semiconductors(L2)
- **Interpret** the direct and indirect band gap semiconductors(L2)
- **Identify** the type of semiconductor using Hall effect(L2)
- **Identify** applications of semiconductors in electronic devices(L2)
- **Classify** superconductors based on Meissner's effect(L2)
- **Explain** Meissner's effect, BCS theory & Josephson effect in superconductors(L2)

Text books:

1. M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy" A Text book ofEngineering Physics"-S.Chand Publications, 11th Edition2019.
2. Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press(2015).
3. Applied Physics by P.K.Palanisamy SciTechpublications.

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley&Sons
2. Engineering Physics by M.R.Srinivasan, New Age international publishers(2009).
3. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education,2018
4. Engineering Physics - Sanjay D. Jain, D. Sahasrabudhe and Girish, UniversityPress
5. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc GrawHill
6. B.K. Pandey and S. Chaturvedi, Engineering Physics, CengageLearning