Semester: I						
CONDENSED MATTER PHYSICS FOR ENGINEERS **Category: Professional Core Course** **Electrical& Electronics Engineering Stream- (EC, EE, EI &ET)** **(Theory and Practice)**						
Course Code	**:**	22PHY12A		**CIE**	**:**	100+50 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42 L+30P		**SEE Duration**	**:**	3 Hours

Unit-I	**08 Hrs**
Quantum Mechanics: de Broglie Hypothesis and Matter Waves, Phase Velocity and Group Velocity, Heisenberg's Uncertainty Principle and its application. **Wave Mechanics:** Wave Function, Time independent Schrodinger wave equation, Expectation value, Eigen functions and Eigen Values, Motion of a particle in a one-dimensional potential well of infinite depth, Numerical problems.	
Unit – II	**08 Hrs**
Basics of Solid-State Physics: **Electrical Conductivity in Metals:** Quantum free electron theory and failures. Band theory of solids, Fermi energy and Fermi level, density of states, carrier concentration in metals at 0K. **Electrical Conductivity in Semiconductor** Fermi level in intrinsic semiconductors, Expression for concentration of electrons in conduction band (derivation), Law of mass action, Electrical conductivity of a semiconductor (derivation), Extrinsic semiconductors, Variation of fermi level with temperature and doping in extrinsic semiconductor. Hall effect and Hall coefficient (derivation). Numerical.	
Unit –III	**09 Hrs**
Lasers and Optical Fibers: **Lasers**: Characteristics of LASER, Interaction of radiation with matter, requisites of a Laser system. Construction and working of semiconductor laser. Application of Lasers in Defence and Laser Printing. **Optical Fibers:** Propagation mechanism, Numerical aperture derivation, Modes of propagation. Attenuation in fiber, Discussion of block diagram of Point-to-Point communication, Optical fiber sensor. Numerical problems.	
Unit –IV	**08 Hrs**
Semiconductor devices: **Diodes:** Direct and indirect band gap, Band gap engineering, P-N junction diode-forward and reverse bias, diode equation, V-I characteristic, Application: bridge rectifier, breakdown mechanism in diodes: Avalanche & Zener breakdown, Zener diode as voltage regulator. **Transistors:** Bi-junction polar transistor, V-I characteristics in Common Emitter, Common Base and Common Collector configuration, CE configuration as an amplifier. Numerical problems.	
Unit –V	**09 Hrs**
Dielectrics and Transducers: **Dielectric Properties:** Polar and non-polar dielectrics, Types of Polarization, internal fields in solid, Clausius-Mossotti equation (Derivation), solid, liquid and gaseous dielectrics. Application of dielectrics in transformers, Capacitors, Frequency dependency of dielectric constant, Electrical insulation – Dielectric breakdown Numerical problems. **Transducers**: Stress-Strain curve, moduli of elasticity, strain gauge, ultrasonic piezoelectric transducer, temperature transducer – Thermocouples. Numerical problems.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Explain the phenomenon of laser, fundamentals of quantum mechanics applicable to Electronics engineering, basics of semiconducting and dielectric materials.
CO 2	Apply the knowledge of quantum mechanics in laser and semiconductorsin engineering.
CO 3	Develop analytical thinking by solving numerical.
CO 4	Design & develop simulating models and validate with real time experimentation.

Reference Books	
1.	Grob's basic electronics, Mitchel E Schultz, McGrahilledtion, 10thedn, 2007, ISBN 978-0-07-3373874.
2.	A Textbook of Engineering Physics, M. N. Avadhanulu and P G Kshirsagar,, S. Chand publications, 2019, ISBN : 978-93-528-3399-3.
3.	Physics for Degree students, C.L. Arora and Dr. P. S. Hemne,S Chand, revised 2010, ISBN: 978-81-219-33506.
4.	Engineering Physics, R K Gaur and S L Gupta, Dhanpat Rai Publications, 2011, ISBN: 9788189928223.
5.	Solid state electronic devices, Ben G Streetman and Sanjay Kumar Banerjee, 6th edition, PHI learning, 2009, ISBN: 978-81-203-30207.

Laboratory Experiments (EE stream)
1. Wavelength of laser by diffraction.
2. Numerical aperture of an optical fiber.
3. Transistor characteristics.
4. Band gap of thermistor.
5. Hall coefficient experiment.
6. Black box experiment.
7. Four probe experiment.
8. Fermi Energy.
9. Charging & discharging of a capacitor.
10. Photo Diode.
11. Exp Eyes experiment: LCR
12. ExpEyes experiment: Wavelength of LED and I-V characteristics of Zener diode.

CONTINUOUS INTERNAL EVALUATION		
ASSESSMENT AND EVALUATION PATTERN Theory & quizzes questions are to be framed using Bloom's Taxonomy Levels - Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating		
WEIGHTAGE	**CIE (50%)**	**SEE (50%)**
A. QUIZZES: Each quiz is evaluated for 10 marks		
Quiz-I for 10 Marks	**20**	*****
Quiz-II for 10 Marks		
B. TESTS: Each test will be conducted for 50 Marks adding upto 100 marks. Final test marks will be reduced to 40		
Test – I for 50 Marks	**40**	*****
Test – II for 50 Marks		
C. EXPERIENTIAL LEARNING: Experiential Learning comprises of the following components viz Case Study-based Teaching-Learning- **10 Marks;** Sector wise study & consolidation (viz., Engg. Semiconductor Design, Healthcare & Pharmaceutical, FMCG, Automobile, Aerospace and IT/ITeS) – **20 Marks;** and Video based seminar (4-5 minutes per student) – **10 Marks**	**40**	*****
MAXIMUM MARKS FOR THE THRORY (A+B+C)	**100**	**100**
PRACTICALS	**50**	*****
TOTAL MARKS FOR THE COURSE	**150**	**100**