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|------------------------------|--------------------------------------------------------------|
| <b>Branch Name:</b>          | Physics                                                      |
| <b>Program Code:</b>         | SC105                                                        |
| <b>Course Name:</b>          | Physics 602                                                  |
| <b>Course Code:</b>          | 2SC1050602                                                   |
| <b>Pre-requisite Course:</b> | Basic knowledge of statistical, solid state and Fibre Optics |

### Course Objectives:

- To develop an actual understanding of the Statistical Mechanics.
- To know the basic concept of Fiber optics.
- To understand the concept of Solid State Physics.

### Teaching and Examination Scheme:

| Teaching Scheme<br>(Hours per week) |                 |                  |        | Evaluation Scheme (Marks) |                          |                          |                          |                  |
|-------------------------------------|-----------------|------------------|--------|---------------------------|--------------------------|--------------------------|--------------------------|------------------|
| Lecture<br>(L)                      | Tutorial<br>(T) | Practical<br>(P) | Credit | Theory (Marks)            |                          | Practical (Marks)        |                          | Total<br>(Marks) |
|                                     |                 |                  |        | University<br>Assessment  | Continuous<br>Assessment | University<br>Assessment | Continuous<br>Assessment |                  |
| 3                                   | --              | --               | 3      | 70                        | 30                       | --                       | --                       | 100              |

| Sr.<br>No | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Total<br>Hours | Weight<br>(%) |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------|
| 1         | <b>STATISTICAL MECHANICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 15             | 33            |
|           | <b>(a) Some Application of Statistical Mechanics</b><br>Thermodynamics, Reversible and Irreversible processes, The Laws of Thermodynamics (i) Zeros (ii) First Law (iii) Second Law, Statistical interpretation of the basics thermodynamic variables, Thermodynamic functions in terms of grand partition function, Ideal gas, Gibbs's Paradox Inclusive Sackur-Tetrode equation, The equipartition theorem.<br><b>(b) Electrodynamics</b><br>Total internal reflections, EM waves in isotropic linear conducting media – Reflection at conducting surface. Wave Guides and Resonant Cavities: Bounded waves – TE, TM, TEM modes, Rectangular wave guides –Circular cylindrical wave guides – Resonant cavities, Q of a cavity Dielectric wave guides (Optical fiber): H E Modes. |                |               |
| 2         | <b>SOLID STATE PHYSICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 15             | 33            |
|           | <b>Superconductivity :</b><br>Phenomena without observable Quantization, Zero resistance and persistent currents, Perfect Diamagnetisms : Meissner Effect, London Equation, Critical Field : Type I and Type II super conductors, BCS Theory : A qualitative approach, Cooper pair formation, BCS ground state, Important predictions of the BCS theory and comparison with experiments, Critical temperature, Ginzburg-Landau Theory, Magnetic flux Quantization , Coherence Length, Type-II superconductivity, Josephson tunnelling, Applications.                                                                                                                                                                                                                               |                |               |
| 3         | <b>HOLOGRAPHY AND FIBER OPTICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 15             | 34            |
|           | <b>(a) Holography</b><br>Introduction, Principle of Holography, Theory, Important properties of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                |               |

|  |                                                                                                                                                                                                                                                                                                                                                                |  |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
|  | Hologram, Advances, Applications.<br><b>(b) Fiber Optics</b><br>Introduction, Optical Fiber, Critical angle of Propagation, Modes of Propagation, Acceptance angle, Fraction of refractive index, Numerical aperture, Types of optical fiber, Normalized frequency, Pulse dispersion, Attenuation, Applications, Fiber optic Communication system, Advantages. |  |  |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|

### Subject Contents:

### Reference Books:

1. Fundamentals of Statistical Mechanics by B. B. Laud, New AGE Int.Pub.Copyright 1998
2. Elements of Solid State Physics by J.P. Srivastava, PHI New Delhi 2003
3. A textbook of Optics by Dr.N.Subrahmanyam, Brijlal and Dr.M.N. Avadhanulu, S. Chand & Co.
4. Statistical Mechanics and Properties of Matter, by E.S.R.Gopal Pub. McMillan Company of India Ltd.
5. Statistical Mechanics by B. K. Agarwal- Melvin Eisner. New Age Int. Pub.
6. Solid State Physics by C. Kittel. John Willy and Sons.
7. Solid State Physics by Saxena. Pragati Prakashan.
8. Solid State Physics by C. M. Kachhawa.

### List of Open Source Software/learning website:

1. <https://www.youtube.com/watch?v=D-9M3GWOBrw>
2. <https://www.youtube.com/watch?v=fat1DXqtqPE&list=PL7VfLVol-8kq-w4Xu0kKLAMSubIBATTyF>
3. <https://www.youtube.com/watch?v=OCwQrjaHDBk>

### Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

| CLO  | Description                                             | Bloom's Taxonomy Level |
|------|---------------------------------------------------------|------------------------|
| CLO1 | Describe the Some Application of Statistical Mechanics. | 1 Remembering          |
| CLO2 | Discuss the Total internal reflections                  | 2 Understanding        |
| CLO3 | Applications of Super conductor various fields.         | 3 Applying             |
| CLO4 | Explain wave guides.                                    | 4 Analyzing            |
| CLO5 | Justify the Important properties of Hologram.           | 5 Evaluating           |
| CLO6 | Design a Fiber optic Communication system.              | 6 creating             |

### Mapping of CLOs with POs & PSOs

| Course Learning Outcomes | Programme Outcomes (POs) |     |     |     |     |     |     |     |     | Programme Specific Outcome (PSOs) |      |
|--------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----------------------------------|------|
|                          | PO1                      | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PSO1                              | PSO2 |
| CLO1                     | M                        |     |     |     |     |     |     |     |     | H                                 |      |
| CLO2                     |                          |     | H   |     |     |     |     |     |     |                                   |      |
| CLO3                     |                          |     |     |     | L   |     |     |     |     | H                                 |      |
| CLO4                     |                          |     |     |     |     |     | H   |     |     |                                   |      |
| CLO5                     |                          |     |     |     |     |     |     |     | M   |                                   |      |
| CLO6                     |                          |     |     |     |     | H   |     |     |     | H                                 |      |

H: High, M: Medium, L: Low