**SACRED HEART COLLEGE (AUTONOMOUS)**

**Department of Physics**

**M.Sc. Physics**

# COURSE PLAN

**Semester 2**

**2014 - 15**

**COURSE PLAN**

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|---|---|---|---|
| PROGRAMME | MASTERS OF PHYSICS | SEMESTER | 2 |
| COURSE CODE AND TITLE | P2PHYT05: MATHEMATICAL METHODS IN PHYSICS – II | CREDIT | 4 |
| Theory HOURS/WEEK | 4 | HOURS/SEM | 72 |
| FACULTY NAME | GEORGEKUTTY JOSEPH | | |

| **COURSE OBJECTIVES** |
|---|
| To explain the concepts of different mathematical methods in physics |
| To solve different physical problems. |
| To summarize the concepts of group theory |
| To apply the concepts of partial differential equations to solve physical problems |

| SESSION | TOPIC | LEARNING RESOURCES | REMARKS |
|---|---|---|---|
| | **MODULE I** | | |
| 1& 2 | Functions of a complex variable - Analytic functions | Lect+ discussion | |
| 3 & 4 | Cauchy-Riemann equation , Problems | Lect+ discussion | |
| 5 & 6 | integration in a complex plane | Lect | |
| 7 & 8 | Cauchy's theorem-deformation of contours, problems | Lect+ discussion | |
| 9 & 10 | Cauchy's integral formula, problems | Lect + discussion | |
| 11 & 12 | Taylor and Laurent expansion-poles | Lect | |
| 13 & 14 | residue and residue theorem, problems | Lect | |
| 15 | Problems | discussion | |
| 16, 17 | Cauchy's Principle value theorem - Evaluation of integrals | Lect | |
| 18 | problems | Lect+ Group Activity | |
| | **MODULE II** | | |
| 19 | Introduction to Fourier series and Fourier integral form | Lect | |
| 20 & 21 | Fourier transform - square wave, full wave rectifier and finite wave train | Lect | |
| 22 | problems | Group discussion | |
| 23 | momentum representation of hydrogen atom ground state and harmonic oscillator | Lect | |
| 24& 25 | Laplace transform –inverse Laplace transform | Lect | |
| 26 | problems | Group discussion | |
| 27, 28& 29 | properties and applications | Lect | |
| 30 | Problems | Group discussion | |
| 31 & 32 | Earth's nutation, LCR circuit | Lect | |
| 33 | wave equation in a dispersive medium | Lect + discussion | |
| 34 | damped, driven oscillator | Lect | |
| 35 | solution of differential equations. | Lect + discussion | |
| 36 | problems | Group discussion | |
| | **MODULE III** | | |
| 37 | Introductory definition and concepts of group | Lect | |
| 38 & 39 | point group, cyclic group, homomorphism and isomorphism | Lect + discussion | |
| 40 | classes, reducible and irreducible representations | Lect + discussion | |
| 41 & 42 | Schur's Lemmas and Great Orthogonality theorem | Lect + discussion | |
| 43 & 44 | Group character table | Lect + discussion | |
| 45& 46 | C2V, C3V and C4V groups | Lect + discussion | |
| 47 | Lie group, concept of generators | Lect + discussion | |
| 48 & 49 | rotation group SO(2), SO(3) | Lect. | |
| 50& 51 | Unitary Group SU(2) and SU(3) | Lect | |

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| 52 & 53 | Homomorphism between SU(2) and SO(3) | Lect | |
| 54 | – Irreducible Representation of SU(2). | Lect + discussion | |
| **MODULE IV** | | | |
| 55 | Characteristics and boundary conditions for partial differential equations | seminar + discussion | |
| 56 & 57 | Nonlinear partial differential equations – separation of variables | seminar + discussion | |
| 58 & 59 | cylindrical and spherical polar coordinates | seminar + discussion | |
| 60 & 61 | Heat equation, Laplace's equation | seminar + discussion | |
| 62 | Poisson's equation | seminar + discussion | |
| 63 & 64 | Nonhomogeneous equation - Green's function | seminar + discussion | |
| 65 & 66 | symmetry of Green's function | seminar + discussion | |
| 67 & 68 | Green's function for Poisson equation | seminar + discussion | |
| 69 & 70 | Laplace equation and Helmholtz equation | seminar + discussion | |
| 71 | Application of Green's function in scattering p Problems | seminar + discussion | |
| 72 | Problems | Group Activity | |

**INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines**

| | Date of completion | Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc) |
|---|---|---|
| 1 | Before 1st Internal | Individual- Graded – 3 sets |
| 2 | Before 2nd Internal | Individual- Graded -3 sets |

**ASSIGNMENTS**– Details & Guidelines – Will be notified prior to the announcement of the assignment – marks will be scaled to 5.

**SEMINARS will be given to each student (20 mins duration) – 5 marks ()**

**Basic Reference:**

1) Mathematical Methods for Physicists, G.B. Arfken&H.J. Weber 4th Edition, Academic Press.
2) Mathematical Physics, H.K Dass& Dr. Rama Verma, S. Chand &Co.

Reference Books:

1. Mathematical methods in Classical andQuantum Physics, T. Dass& S. K. Sharma, Universities Press (2009)

2. Introduction to Mathematical physics,Charlie Harper, PHI

3. Fundamentals of Statistical and Thermal Physics, F. Rief, McGraw Hill (1986).

4. Mathematical Physics, B.D. Gupta, VikasPub.House, New Delhi

5. Elements of Group Theory for Physicists, A.W. Joshi, New Age India 2) Mathematical Physics, Sathyaprakash, Sultan Chand & Sons, New Delhi.

6. Group theory- Schaum's series, Benjamin Baumslag& Bruce Chandler, MGH.

7. Mathematical Physics, B.S Rajput, PragatiPrakashan

**COURSE PLAN**

| | | | |
|---|---|---|---|
| PROGRAMME | MASTERS OF PHYSICS | SEMESTER | 2 |
| COURSE CODE AND TITLE | P2PHYT06: Quantum mechanics - 1 | CREDIT | 4 |
| Theory HOURS/WEEK | 4 | HOURS/SEM | 72 |
| FACULTY NAME | Dr. Jimmy Sebastian | | |

| **COURSE OBJECTIVES** |
|---|
| To define the formalism of Non relativistic Quantum Mechanics. |
| To demonstrate principles of quantum mechanics. |
| To apply the principles of quantum mechanics to specific quantum mechanical systems. |
| To solve specific problems in quantum mechanics |

| Session | Topic | Learning Resources | Remarks |
|---|---|---|---|
| | **MODULE - I** | | |
| 1 | Introduction to Quantum Mechanics | PPT talk and interaction | |
| 2 | Inadequacy of Classical Mechanics | PPT + Demonstration using examples | |
| 3 | Stern - Gerlach experiment leading to vector space concept | Lecture + question answer session. | |
| 4 | Dirac notation for state vectors- ket space, bra space, inner products | Lecture + question answer session. | |
| 5 | Algebraic manipulation of operators – unitary operators, eigenkets and eigenvalues | Lecture + question answer session. | |
| 6 | Hermitian operators - concept of complete set | Lecture + question answer session. | |
| 7 | Representation of an operator by square matrix | Lecture + question answer session. | |
| 8 | Matrix elements of an operator expectation values of Hermitian and anti -Hermitian operators | Lecture + question answer session. | |
| 9 | Generalized uncertainty product - change of basis - orthonormal basis and unitary matrix. | Lecture + question answer session. | |
| 10 | Transformation matrix unitary equivalent observables - eigenkets of position | Lecture + question answer session. | |
| 11 | Infinitesimal operator and its properties – linear momentum as generator of translation. | Lecture + question answer session. | |
| 12 | Canonical commutation relations – properties of wave function in position space and momentum space. | Lecture + question answer session. | |
| 13 | Relations between operator formalism and wave function formalism - momentum operator in position basis. | Lecture + question answer session. | |
| 14 | Momentum space wave function – computation of expectation values x, $x^2$, p and $p^2$ for a Gaussian wave packet. | Lecture + question answer session. | |
| 15 | Problem set discussion and revision. | discussion | |
| | **MODULE - II** | | |

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|---|---|---|---|
| 16 | Time evolution operator and its properties- | Lecture + question answer session. | |
| 17 | Schrodinger equation for the time evolution operator. | Lecture + question answer session. | |
| 18 | Energy eigenkets - time dependence of expectation values | Lecture + question answer session. | |
| 19 | Time energy uncertainty relation | Teacher student interactive session | |
| 20 | Schrodinger picture and Heisenberg picture | Lecture + question answer session. | |
| 21 | Behaviour of state kets and observables in Schrodinger picture and Heisenberg picture. | Lecture + question answer session. | |
| 22 | Heisenberg equation of motion - Ehrenfest's theorem | Lecture + question answer session. | |
| 23 | Time evolution of base kets | Lecture + question answer session. | |
| 24 | Transition amplitude | Lecture + question answer session. | |
| 25 | Simple harmonic Oscillator - 1 | Lecture + question answer session. | |
| 26 | Simple harmonic Oscillator - 2 | Lecture + question answer session. | |
| 27 | Simple harmonic Oscillator - 3 | Lecture + question answer session. | |
| 28 | CIA -1 | Exam | |
| 29 | Pictures in quantum mechanics (Revision) | Lecture + question answer session. | |
| | **MODULE - III** | | |
| 30 | Commutation relation between infinitesimal rotations. | Lecture + question answer session. | |
| 31 | Infinitesimal rotations in quantum mechanics | Lecture + question answer session. | |
| 32 | Fundamental commutation relations of angular momentum | Lecture + question answer session. | |
| 33 | Rotation operator for spin ½ system. | Lecture + question answer session. | |

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| 34 | Pauli two component formalism | Lecture + question answer session. | |
| 35 | Pauli spin matrices | Lecture + question answer session. | |
| 36 | 2x2 matrix representation of rotation operator. | Lecture + question answer session. | |
| 37 | Commutation relations for $J^2$, $J_x$ | Lecture + question answer session. | |
| 38 | Eigenvalues of $J^2$ and $J_x$ | Lecture + question answer session. | |
| 39 | Matrix elements of angular momentum operators | Lecture + question answer session. | |
| 40 | Representation of the rotation operator | Lecture + question answer session. | |
| 41 | Rotation matrix | Lecture + question answer session. | |
| 42 | Properties of the rotation matrix | Lecture + question answer session. | |
| 43 | Orbital angular momentum as a rotation generator | Lecture + question answer session. | |
| 44 | Addition of angular momentum and spin angular momentum. | Lecture + question answer session. | |
| 45 | Addition of spin angular momenta. | Lecture + question answer session. | |
| 46 | Clebsch-Gordon coefficients. | Lecture + question answer | |
| 47 | Clebsch-Gordon coefficients for two spin ½ particles. | Lecture + question answer session. | |
| 48 | Problems on CG coefficients. | Discussion | |
| 49 | Revision of Basics of Quantum Mechanics | Discussion | |
| 50 | Revision of Quantum Dynamics | Discussion | |
| 51 | Revision of angular momentum | Discussion | |
| 52 | Simple Harmonic oscillator – an analysis. | Lecture + question answer session. | |
| | **MODULE - IV** | | |

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|---|---|---|---|
| 53 | Motion in a central potential - 1 | Lecture + question answer session. | |
| 54 | Motion in a central potential - 2 | Lecture + question answer session. | |
| 55 | Motion in a central potential – 3 | Problem solving session. | |
| 56 | Motion in a central potential - 4 | Lecture + question answer session. | |
| 57 | Hydrogen atom problem - 1 | Lecture + question answer session. | |
| 58 | Hydrogen atom problem - 2 | Lecture + question answer session. | |
| 59 | Hydrogen atom problem - 3 | Lecture + question answer session. | |
| 60 | CIA - 2 | Exam | |
| 61 | WKB approximation | Lecture + question answer session. | |
| 62 | WKB approximation -2 | Lecture + question answer session. | |
| 63 | WKB wave function | Lecture + question answer session. | |
| 64 | Validity of the approximation | Lecture + question answer session. | |
| 65 | Variational methods | Lecture + question answer session. | |
| 66 | Variational methods - bound states | Lecture + question answer session. | |
| 67 | Variational methods - harmonic oscillator | Lecture + question answer session. | |
| 68 | Perturbation theory | Lecture + question answer | |
| 69 | Stationary state perturbation theory | Lecture + question answer session. | |
| 70 | Perturbation theory - non degenerate case | Lecture + question answer session. | |

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| 71 | Recap on Approximation methods | Discussion | |
| 72 | Recap on nonrelativistic quantum mechanics. | Discussion | |

**INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines**

| | Date of completion | Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc) |
|---|---|---|
| 1 | Before 1st Internal | Individual- Graded – 3 sets |
| 2 | Before 2nd Internal | Individual- Graded -3 sets |

**ASSIGNMENTS**– Details & Guidelines – Will be notified prior to the announcement of the assignment – marks will be scaled to 5.

**SEMINARS will be given to each student (20 mins duration) – 5 marks (, )**

**Text**

1. Modern Quantum Mechanics, J. J. Sakurai, Pearson Education (Chapter 1)

2. Quantum mechanics, V.K. Thankappan New Age International 1996 (Chapter 4, 8)
3. Quantum Mechanics, G Aruldhas, PHI, 2002, (Chapter 10)

**Reference Books:**

1. A Modern approach to quantum mechanics, John S. Townsend, Viva Books MGH.
2. Quantum Mechanics, Concepts and Applications, N. Zettily, John Wiley & Sons

Quantum Mechanics, L.I. Schiff, Tata McGraw Hill

## COURSE PLAN

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|---|---|---|---|
| PROGRAMME | MASTERS OF PHYSICS | SEMESTER | 2 |
| COURSE CODE AND TITLE | P2PHYT07- Condensed Matter Physics | CREDIT | 4 |
| Theory HOURS/WEEK | 4 | HOURS/SEM | 72 |
| FACULTY NAME | Dr. Sumod S G | | |

| **COURSE OBJECTIVES** |
|---|
| To apply the concept of X-ray diffraction to interpret crystalline structure. |
| To compare different solids using band theory. |
| To analyse various dielectric and magnetic properties of crystals |
| To describe the latest trends in Nanotechnology |

| **SESSION** | **TOPIC** | **LEARNING RESOURCES** | **REMARKS** |
|---|---|---|---|
| | **MODULE I** | | |
| 1 | **Elements of Crystal Structure (6 Hrs)**<br><br>Review of crystal lattice fundamentals | Lect | |
| 2 | and interpretation of Bragg's equation, | Lect | |
| 3 | Ewald construction, the reciprocal lattice, | Lect | |
| 4 | reciprocal lattice to SC, BCC and FCC lattices, properties of reciprocal lattice | Lect | |
| 5 | , diffraction intensity - atomic, geometrical | Lect | |
| 6 | crystal structure factors- physical significance. Elements of Crystal Structure | Lect | |
| 7 | Review of Drude-Lorentz model - | Lect+ Group Activity | |

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| 8 | electrons moving in a one dimensional potential well - three dimensional well - | Lect | |
| 9 | quantum state and degeneracy - | Lect | |
| 10 | density of states - Fermi-Dirac statistics - | Lect | |
| 11 | effect of temperature on Fermi-Dirac distribution - | Lect | |
| 12 | electronic specific heat - | Lect | |
| 13 | electrical conductivity of metals - | Lect | |
| 14 | relaxation time and mean free path - | Lect | |
| 15 | electrical conductivity and Ohm's law | Lect | |
| 16 | - Widemann-Franz-Lorentz law - | Lect | |
| 15 | electrical resistivity of Metals | Lect | |
| 17 | Problems | Lect | |
| 18 | Revision | Lecture+Activity | |
| **MODULE II** | | | |
| 19 | Bloch theorem - | PPT+SEMINAR+class activity | |
| 20 | Kronig-Penney model - | PPT+SEMINAR+class activity | |
| 21 | Brillouin zone construction of Brillouin zone in one and two dimensions – | PPT+SEMINAR+class activity | |
| 22 | extended, reduced and periodic zone scheme of Brillouin zone (qualitative idea only) | Group Activity | |

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|---|---|---|---|
| 23 | - effective mass of electron | PPT+SEMINAR+class activity | |
| 24 | - nearly free electron model – conductors - semiconductors - insulators. | Lect. | |
| 25 | Generation and recombination - | Lect | |
| 26 | minority carrier life-time - | Lect | |
| 27 | mobility of current carriers - | Lect | |
| 28 | drift and | Lect | |
| 29 | diffusion - | Lect. | |
| 30 | general study of excess carrier movement- | Lect | |
| 32 | diffusion length. | Lect | |
| 33 | Derivation of diffusion length | Lect | |
| 34 | Problems | PPT+SEMINAR+class activity | |
| | **MODULE III** | | |
| 35 | Vibrations of crystals with monatomic basis – | Lect | |
| 36 | diatomic lattice – | Lect. | |
| 37 | quantization of elastic waves | Lect | |
| 38 | – phonon momentum. | Lect | |
| 39 | Anharmonicity and thermal expansion - | Lect | |
| 40 | specific heat of a solid - classical model - | Lect | |
| 41 | Einstein model - | Lect. | |

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| 42 | density of states - | Lect | |
| 43 | Debye model | Lect | |
| 44 | - thermal conductivity of solids - | Lect | |
| 45 | thermal conductivity due to electrons | Lect | |
| 46 | and phonons | Lect. | |
| 47 | - thermal resistance of solids. | Lect | |
| 48 | Problems | Lect | |
| 49 | Review of basic terms and relations, | Lect | |
| 50 | ferroelectricity, | Lect | |
| 51 | hysteresis, | Lect. | |
| 52 | dipole theory - | Lect | |
| 53 | Curie-<br><br>Weiss law, | Lect | |
| 54 | classification of ferroelectric materials | Lect | |
| | and piezoelectricity Ferroelectric domain, | Lect | |
| | . antiferroelectricity and ferrielectricity | Lect | |
| | **MODULE IV** | | |
| 56 | Review of basic terms and relations, Quantum theory of paramagnetism - | Lect | |
| 57 | cooling by adiabatic demagnetization – | PPT+SEMINAR+class activity | |
| 58 | Hund’s rule – ferromagnetism - | | |

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| 59 | spontaneous magnetization in ferromagnetic materials - | PPT+SEMINAR+class activity | |
| 60 | Quantum theory of ferromagnetism – | PPT+SEMINAR+class activity | |
| 61 | Weiss molecular field - Curie- Weiss law-spontaneous magnetism | PPT+SEMINAR+class activity | |
| 62 | internal field and exchange interaction – magnetization curve – saturation magnetization - domain model. | Lect. | |
| 63 | Thermodynamics and electrodynamics of superconductors- | Lect | |
| 64 | BCS theory- flux quantization- | Lect | |
| 65 | single particle tunneling- Josephson superconductor tunneling- | Lect | |
| 66 | macroscopic quantum interference | Lect | |
| 67 | Properties of metal, semiconductor, | | |
| 68 | rare gas and molecular nanoclusters-superconducting fullerene- | Lect. | |
| 69 | quantum confined materials-quantum wells, wires, dots and rings- | Lect | |

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| 70 | metamaterials- | Lect | |
| 71 | graphene | Lect | |
| 72 | Problems and Revision | Lect | |

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| 2 | Before 2nd Internal | Individual- Graded -3 sets |

**ASSIGNMENTS**– Details & Guidelines – Will be notified prior to the announcement of the assignment – marks will be scaled to 5.

**SEMINARS will be given to each student (20 mins duration) – 5 marks (, )**

**Basic Reference:**


1. 1. Solid State Physics: Structure and properties of materials, M.A. Wahab, Narosa 2nd Edn. 2010
2. Introduction to Nanotechnology, Charles P Poole and Frank J Owens, Wiley India (Chapter 4, 5, 9)
3. Introduction to Solid State Physics, C. Kittel, 3rd Edn. Wiley India. .
4. Solid State Physics, S.O. Pillai, New Age International 6th Edn. 2010,


**Reference Books:**


1. Solid State Physics, N.W. Ashcroft & N.D. Mermin, Cengage Learning Pub.11th Indian Reprint (2011).
2. Solid State Physics, R.L. Singhal, Kedar Nath Ram Nath & Co (1981)
3. Elementary Solid State Physics, M. Ali Omar, Pearson, 4th Indian Reprint (2004).
4. Solid State Physics, C.M. Kachhava, Tata McGraw-Hill (1990).

5. Elements of Solid State Physics, J. P. Srivastava, PHI (2004)

6. Solid State Physics, Dan Wei, Cengage Learning (2008)

7. Solid State Physics, A.J. Dekker, Macmillan & Co Ltd. (1967)

## COURSE PLAN

| | | | |
|---|---|---|---|
| PROGRAMME | MASTERS OF PHYSICS | SEMESTER | 2 |
| COURSE CODE AND TITLE | P2PHYT08: Thermodynamics and Statistical Mechanics | CREDIT | 3 |
| Theory HOURS/WEEK | 3 | HOURS/SEM | 54 |
| FACULTY NAME | Dr. Roby Cherian | | |

| COURSE OBJECTIVES |
|---|
| To summarize the concepts of thermodynamics and probability. |
| To illustrate the foundations of Statistical mechanics |
| To model the problems related to Canonical and Grand Canonical ensemble |
| To interpret the concepts of Phase Transitions |

| SESSION | TOPIC | LEARNING RESOURCES | REMARKS |
|---|---|---|---|
| | **MODULE I** | | |
| 1 | Fundamental definitions | Lect | |
| 2 | Thermodynamic potentials, Maxwells relations | Lect | |
| 3 | Approach to equilibrium | Lect | |
| 4 | Ideas of Probability- classical and statistical, axioms of probability | Lect | |
| 5 | Independent events – counting the number of events | Lect | |
| 6 | Basic ideas of statistical mechanics | Lect | |
| 7 | Definition of quantum state | Lect | |
| 8 | Model of spins on lattice | Lect | |
| 9 | EOS | Lect | |
| 10 | EOS | Lect | |
| 11 | Problems | Lect+ Group Activity | |

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| **MODULE II** | | | |
| 12 | The second law of thermodynamics | Lect | |
| 13 | Canonical Ensemble – Introduction | Lect | |
| 14 | Partition function | Lect | |
| 15 | Entropy in Canonical ensemble | Lect | |
| 16 | Bridging thermodynamics via Partition function | Lect | |
| 17 | Condition for thermal equilibrium | Lect | |
| 18 | Case study | Lect | |
| 19 | Particle in a box 1D | Lect | |
| 20 | Particle in a box 3D | Lect | |
| 21 | Heat and work | Lect | |
| 22 | Rotational energy levels | Lect | |
| 23 | Vibrational energy levels | Lect | |
| 24 | Equipartition theorem, minimizing free energy | Lect | |
| 25 | Identical particles-symmetric and ant symmetric wavefunctions | Lect | |
| 26 | Bosons, fermions | Lect | |
| 27 | Calculating Z | Lect | |
| 28 | Spins on lattice | PPT+SEMINAR+class activity | |
| **MODULE III** | | | |
| 29 | DOS | PPT+SEMINAR+class activity | |
| 30 | DOS- cont. | PPT+SEMINAR+class activity | |
| 31 | Maxwell speed distribution | PPT+SEMINAR+class activity | |
| 32 | Problems | Group Activity | |
| 33 | Black body radiation | PPT+SEMINAR+class activity | |

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| 34 | Rayleigh jeans theory | PPT+SEMINAR+class activity | |
| 35 | Plancks distribution | PPT+SEMINAR+class activity | |
| 36 | Free energy | PPT+SEMINAR+class activity | |
| 37 | Grand Canonical ensemble | Lect. | |
| 38 | Condition for chemical equilibrium | Lect | |
| 39 | Approach to chemical equilibrium | Lect | |
| 40 | Grand Canonical partition function | Lect | |
| 41 | Grand Potential | Lect | |
| 29 | DOS | PPT+SEMINAR+class activity | |
| 30 | DOS- cont. | PPT+SEMINAR+class activity | |
| 31 | Maxwell speed distribution | PPT+SEMINAR+class activity | |
| 32 | Problems | Group Activity | |
| 33 | Black body radiation | PPT+SEMINAR+class activity | |
| 34 | Rayleigh jeans theory | PPT+SEMINAR+class activity | |
| 35 | Plancks distribution | PPT+SEMINAR+class activity | |
| 36 | Free energy | PPT+SEMINAR+class activity | |
| 37 | Grand Canonical ensemble | Lect. | |
| 38 | Condition for chemical equilibrium | Lect | |
| 39 | Approach to chemical equilibrium | Lect | |
| 40 | Grand Canonical partition function | Lect | |
| 41 | Grand Potential | Lect | |
| **MODULE IV** | | | |
| 42 | Fermi systems | Lect | |

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|---|---|---|---|
| 43 | Bose Systems | Lect | |
| 44 | Examples | PPT+SEMINAR+class activity | |
| 45 | Examples | PPT+SEMINAR+class activity | |
| 46 | Phases- thermodynamic potential | Lect | |
| 47 | 1st order phase transitions | Lect | |
| 48 | Clapeyron equations | Lect | |
| 49 | Phase seperation | Lect | |
| 50 | Phase separation Cont. | Lect | |
| 51 | Problems | Group Activity | |
| 52 | Problems | Group Activity | |
| 53 | Problems | Group Activity | |
| 54 | Problems | Group Activity | |

**INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines**

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|---|---|---|
| 1 | Before 1st Internal | Individual- Graded – Best of 2 sets |
| 2 | Before 2nd Internal | Individual- Graded –Best of 2 sets |

**ASSIGNMENTS**– Details & Guidelines – Will be notified prior to the announcement of the assignment – marks will be scaled to 5.

**SEMINARS will be given to each student (20 mins duration) – 5 marks ()**

**Basic Reference:**

1. Introductory Statistical Mechanics, R. Bowley&M.Sanchez, 2nd Edn. 2007,

Reference Books:

1. Statistical Mechanics, R.K. Pathria, & P.D. Beale, 2nd Edn, B-H (Elsevier) (2004).
2. Introductory Statistical Physics, S.R.A. Salinas, Springer (2000).
3. Fundamentals of Statistical and Thermal Physics, F. Rief, McGraw Hill (1986).
4. Statistical Mechanics, Kerson Huang, John Wiley and Sons (2003).

5. Statistical Mechanics, Satyaprakash& Agarwal, KedarNath Ram Nath Pub. (2004).

6. Problems and solutions on Thermodynamics and Statistical mechanics, Yung Kuo Lim, World Scientific Pub. (1990)

7. Fundamentals of Statistical Mechanics, A.K. Dasgupta, New Central Book Agency Pub. (2005)

8. Statistical Mechanics: a survival guide, A.M. Glazer and J.S. Wark, Oxford University Press. (2001).