SACRED HEART COLLEGE (AUTONOMOUS)

Department of Physics

MASTER OF SCIENCE IN PHYSICS WITH ELECTRONICS

Course plan

Academic Year 2018-19

Semester Two

Programme outcomes for the Postgraduate Students of Sacred Heart College, Kochi at the end of the programme,

PO 1	The students are capable of exercising their critical thinking in creating new knowledge leading to innovation, entrepreneurship and employability.
PO 2	The students are able to effectively communicate the knowledge of their study and research in their respective disciplines to their employers and to the society at large.
PO 3	The students are able to make choices based on the values upheld by the college, and have the readiness and know-how to preserve environment and work towards sustainable growth and development.
PO 4	The students possess an ethical view of life, and have a broader (global) perspective transcending the provincial outlook.
PO 5	The students possess a passion for exploring new knowledge independently for the development of the nation and the world and are able to engage in a lifelong learning process.

Programme Specific Outcomes of MSc Physics

At the end of M.Sc. Physics Programme, the student should be able to:

PROGRAM SPECIFIC OUTCOMES	
PSO 1	Develop the skills of critical analysis and problem-solving required in the application of principles of Physics.
PSO 2	Acquire a working knowledge of experimental and computational techniques and instrumentation required to work independently in research or industrial environments.
PSO 3	Demonstrate a strong capability of organizing and presenting acquired knowledge both in oral and written platforms.
PSO 4	Compete for current employment opportunities successfully.

Course Structure

Course Code	Title Of The Course	No. Hrs./Week	Credits	Total Hrs./Sem
16P2PHYT05	MATHEMATICAL METHODS IN PHYSICS – II	4	4	72
16P2PHYT06	QUANTUM MECHANICS - I	4	4	72
16P2PHYT07	CONDENSED MATTER PHYSICS	4	4	72
16P2PHYT08	THERMODYNAMICS AND STATISTICAL MECHANICS	3	3	54

Course I

COURSE PLAN

PROGRAMME	MASTERS OF PHYSICS	SEMESTER	2
COURSE CODE AND TITLE	16P2PHYT05: MATHEMATICAL METHODS IN PHYSICS – II	CREDIT	4
Theory HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	NAVYA S L		

	COURSE OUTCOMES	PO/ PSO	CL
CO 1	Understand the concepts of different mathematical methods in physics	PO1, PSO1,PS03	U/A
CO 2	Apply to solve different physical problems.	PO1, PSO1, PSO2, PSO4	U/An

CL* Cognitive Level

SESSION	TOPIC	LEARNING RESOURCES	COURSE OUTCOME
MODULE I			
1 & 2	Functions of a complex variable - Analytic functions	Lect + discussion	CO1
3 & 4	Cauchy-Riemann equation , Problems	Lect + discussion	CO1, CO2
5 & 6	integration in a complex plane	Lect	CO1
7 & 8	Cauchy’s theorem-deformation of contours, problems	Lect + discussion	CO1, CO2
9 & 10	Cauchy’s integral formula, problems	Lect + discussion	CO1, CO2
11 & 12	Taylor and Laurent expansion-poles	Lect	CO1
13 & 14	residue and residue theorem, problems	Lect	CO1, CO2
15	Problems	discussion	CO1, CO2
16, 17	Cauchy’s Principle value theorem - Evaluation of integrals	Lect	CO1
18	problems	Lect+ Group Activity	CO1, CO2
MODULE II			
19	Introduction to Fourier series and Fourier integral form	Lect	CO1
20 & 21	Fourier transform - square wave, full wave rectifier and finite wave train	Lect	CO1
22	problems	Group discussion	CO2
23	momentum representation of hydrogen atom ground state and harmonic oscillator	Lect	CO2
24 & 25	Laplace transform –inverse Laplace transform	Lect	CO2
26	problems	Group discussion	CO2

27, 28 & 29	properties and applications	Lect	CO2
30	Problems	Group discussion	CO2
31 & 32	Earth’s nutation, LCR circuit	Lect	CO2
33	wave equation in a dispersive medium	Lect + discussion	CO2
34	damped, driven oscillator	Lect	CO2
35	solution of differential equations.	Lect + discussion	CO2
36	problems	Group discussion	CO2
MODULE III			
37	Introductory definition and concepts of group	Lect	CO1
38 & 39	point group, cyclic group, homomorphism and isomorphism	Lect + discussion	CO1
40	classes, reducible and irreducible representations	Lect + discussion	CO 1
41 & 42	Schur’s Lemmas and Great Orthogonality theorem	Lect + discussion	CO 1
43 & 44	Group character table	Lect + discussion	CO1, CO2
45 & 46	C2V, C3V and C4V groups	Lect + discussion	CO 1
47	Lie group, concept of generators	Lect + discussion	CO 1
48 & 49	rotation group SO(2), SO(3)	Lect.	CO 1
50 & 51	Unitary Group SU(2) and SU(3)	Lect	CO 1
52 & 53	Homomorphism between SU(2) and SO(3)	Lect	CO 1
54	– Irreducible Representation of SU(2).	Lect + discussion	CO 1, CO2
MODULE IV			
55	Characteristics and boundary conditions for partial differential equations	seminar + discussion	CO 2
56 & 57	Nonlinear partial differential equations – separation of variables	seminar + discussion	CO 2
58 & 59	cylindrical and spherical polar coordinates	seminar + discussion	CO 2
60 & 61	Heat equation, Laplace’s equation	seminar + discussion	CO 2
62	Poisson’s equation	seminar + discussion	CO 2
63 & 64	Nonhomogeneous equation - Green’s function	seminar + discussion	CO 2
65 & 66	symmetry of Green’s function	seminar + discussion	CO 2
67 & 68	Green’s function for Poisson equation	seminar + discussion	CO 2
69 & 70	Laplace equation and Helmholtz equation	seminar + discussion	CO 2
71	Application of Green’s function in scattering p Problems	seminar + discussion	CO 2
72	Problems	Group Activity	CO 2

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)	Course Outcome
1	Before 1st Internal	Individual- Graded – 3 sets	CO1,CO2
2	Before 2nd Internal	Individual- Graded -3 sets	CO1, CO2

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 (CO1, CO2)

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 and Quantum 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, Vikas Pub.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, Pragati Prakashan

Course II

COURSE PLAN

PROGRAMME	MASTERS OF PHYSICS	SEMESTER	1
COURSE CODE AND TITLE	16P2PHYT06: **Quantum mechanics - 1**	CREDIT	4
Theory HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	Dr. Jimmy Sebastian		

	COURSE OUTCOMES	**PO/ PSO**	**CL**
CO 1	Understand the fundamental concepts of Non relativistic Quantum Mechanics	PO1, PSO1,PS03	U/A
CO 2	Apply quantum mechanics to physical systems.	PO1, PSO1, PSO2, PSO4	U/An

CL* Cognitive Level

Sessions	**Topic**	**Learning Resources**	**Course Outcome**
	MODULE - I		
1	Introduction to Quantum Mechanics	PPT talk and interaction	CO1
2	Inadequacy of Classical Mechanics	PPT + Demonstration using examples	CO1
3	Stern - Gerlach experiment leading to vector space concept	Lecture + question answer session.	CO2
4	Dirac notation for state vectors- ket space, bra space, inner products	Lecture + question answer session.	CO1
5	Algebraic manipulation of operators – unitary operators, eigenkets and eigenvalues –	Lecture + question answer session.	CO1
6	Hermitian operators - concept of complete set-	Lecture + question answer session.	CO1
7	Representation of an operator by square matrix –	Lecture + question answer session.	CO1
8	Matrix elements of an operator expectation values of Hermitian and anti -Hermitian operators	Lecture + question answer session.	CO1+CO2

9	Generalized uncertainty product - change of basis - orthonormal basis and unitary matrix.	Lecture + question answer session.	CO1
10	Transformation matrix unitary equivalent observables - eigenkets of position	Lecture + question answer session.	CO1
11	Infinitesimal operator and its properties – linear momentum as generator of translation.	Lecture + question answer session.	CO1
12	Canonical commutation relations – properties of wave function in position space and momentum space.	Lecture + question answer session.	CO1
13	Relations between operator formalism and wave function formalism - momentum operator in position basis.	Lecture + question answer session.	CO1
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.	CO1+CO2
15	Problem set discussion and revision.	discussion	CO2
	MODULE - II		
16	Time evolution operator and its properties-	Lecture + question answer session.	CO1
17	Schrodinger equation for the time evolution operator.	Lecture + question answer session.	CO1
18	Energy eigenkets - time dependence of expectation values	Lecture + question answer session.	CO1
19	Time energy uncertainty relation	Teacher student interactive session	CO1
20	Schrodinger picture and Heisenberg picture	Lecture + question answer session.	CO1
21	Behaviour of state kets and observables in Schrodinger picture and Heisenberg picture.	Lecture + question answer session.	CO1+CO2
22	Heisenberg equation of motion - Ehrenfest’s theorem	Lecture + question answer session.	CO1
23	Time evolution of base kets	Lecture + question answer session.	CO1

24	Transition amplitude	Lecture + question answer session.	CO1
25	Simple harmonic Oscillator - 1	Lecture + question answer session.	CO1
26	Simple harmonic Oscillator - 2	Lecture + question answer session.	CO2
27	Simple harmonic Oscillator - 3	Lecture + question answer session.	CO2
28	CIA -1	Exam	
29	Pictures in quantum mechanics (Revision)	Lecture + question answer session.	CO1
	MODULE - III		
30	Commutation relation between infinitesimal rotations.	Lecture + question answer session.	CO1
31	Infinitesimal rotations in quantum mechanics	Lecture + question answer session.	CO1
32	Fundamental commutation relations of angular momentum	Lecture + question answer session.	CO1+CO2
33	Rotation operator for spin ½ system.	Lecture + question answer session.	CO1
34	Pauli two component formalism	Lecture + question answer session.	CO1
35	Pauli spin matrices	Lecture + question answer session.	CO1
36	2x2 matrix representation of rotation operator.	Lecture + question answer session.	CO1
37	Commutation relations for J^2, J_x	Lecture + question answer session.	CO1+CO2
38	Eigenvalues of J^2 and J_x	Lecture + question answer session.	CO1+CO2
39	Matrix elements of angular momentum operators	Lecture + question answer session.	CO1
40	Representation of the rotation operator	Lecture + question answer session.	CO1

41	Rotation matrix	Lecture + question answer session.	CO2
42	Properties of the rotation matrix	Lecture + question answer session.	CO1
43	Orbital angular momentum as a rotation generator	Lecture + question answer session.	CO1
44	Addition of angular momentum and spin angular momentum.	Lecture + question answer session.	CO1+CO2
45	Addition of spin angular momenta.	Lecture + question answer session.	CO1+CO2
46	Clebsch-Gordon coefficients.	Lecture + question answer	CO2
47	Clebsch-Gordon coefficients for two spin ½ particles.	Lecture + question answer session.	CO2
48	Problems on CG coefficients.	Discussion	CO2
49	Revision of Basics of Quantum Mechanics	Discussion	CO1+CO2
50	Revision of Quantum Dynamics	Discussion	CO1
51	Revision of angular momentum	Discussion	CO1
52	Simple Harmonic oscillator – an analysis.	Lecture + question answer session.	CO2
	MODULE - III		
53	Motion in a central potential - 1	Lecture + question answer session.	CO2
54	Motion in a central potential - 2	Lecture + question answer session.	CO2
55	Motion in a central potential – 3	Problem solving session.	CO2
56	Motion in a central potential - 4	Lecture + question answer session.	CO2
57	Hydrogen atom problem - 1	Lecture + question answer session.	CO2
58	Hydrogen atom problem - 2	Lecture + question answer session.	CO2

59	Hydrogen atom problem - 3	Lecture + question answer session.	CO2
60	CIA - 2	Exam	
61	WKB approximation	Lecture + question answer session.	CO1+CO2
62	WKB approximation -2	Lecture + question answer session.	CO2
63	WKB wave function	Lecture + question answer session.	CO1+CO2
64	Validity of the approximation	Lecture + question answer session.	CO1
65	Variational methods	Lecture + question answer session.	CO1
66	Variational methods - bound states	Lecture + question answer session.	CO1+CO2
67	Variational methods - harmonic oscillator	Lecture + question answer session.	CO2
68	Perturbation theory	Lecture + question answer	CO1+CO2
69	Stationary state perturbation theory	Lecture + question answer session.	CO1+CO2
70	Perturbation theory - non degenerate case	Lecture + question answer session.	CO1+CO2
71	Recap on Approximation methods	Discussion	CO1+Co2
72	Recap on nonrelativistic quantum mechanics.	Discussion	CO1+CO2

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)	Course Outcome
1	Before 1st Internal	Individual- Graded – 3 sets	CO1,CO2

2	Before 2nd Internal	Individual- Graded -3 sets	CO1, CO2

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 (CO1, CO2)

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 III

COURSE PLAN

PROGRAMME	MASTERS OF PHYSICS	SEMESTER	1
COURSE CODE AND TITLE	16P2PHYT07- CONDENSED MATTER PHYSICS	CREDIT	4
Theory HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	Dr. Sumod SG		

	COURSE OUTCOMES	PO/ PSO	CL
CO 1	Apply the concept of X-ray diffraction to interpret crystalline structure.	PO1, PSO1,PS03	U/A
CO 2	Compare different solids using band theory.	PO1, PSO1, PSO2, PSO4	U/An

CL* Cognitive Level

SESSION	TOPIC	LEARNING RESOURCES	COURSE OUTCOME
	MODULE I		
1	**Elements of Crystal Structure (6 Hrs)** Review of crystal lattice fundamentals	Lect	CO1
2	and interpretation of Bragg's equation,	Lect	CO1
3	Ewald construction, the reciprocal lattice,	Lect	CO1
4	reciprocal lattice to SC, BCC and FCC lattices, properties of reciprocal lattice	Lect	CO1
5	, diffraction intensity - atomic, geometrical	Lect	CO1
6	crystal structure factors- physical significance. Elements of Crystal Structure	Lect	CO1
7	Review of Drude-Lorentz model -	Lect+ Group Activity	CO1
8	electrons moving in a one dimensional potential well - three dimensional well -	Lect	
9	quantum state and degeneracy -	Lect	CO2
10	density of states - Fermi-Dirac statistics -	Lect	CO2
11	effect of temperature on Fermi-Dirac distribution -	Lect	CO2
12	electronic specific heat -	Lect	CO2
13	electrical conductivity of metals -	Lect	CO2
14	relaxation time and mean free path -	Lect	CO2
15	electrical conductivity and Ohm's law	Lect	CO2
16	- Widemann-Franz-Lorentz law -	Lect	CO2
15	electrical resistivity of Metals	Lect	CO2
17	Problems	Lect	CO2
18	Revision	Lecture+Activity	CO2
	MODULE II		
19	Bloch theorem -	PPT+SEMINAR+class activity	CO2
20	Kronig-Penney model -	PPT+SEMINAR+class activity	CO2
21	Brillouin zone construction of Brillouin zone in one and two dimensions –	PPT+SEMINAR+class activity	CO2
22	extended, reduced and periodic zone scheme of Brillouin zone (qualitative idea only)	Group Activity	CO 3
23	- effective mass of electron	PPT+SEMINAR+class activity	CO 3
24	- nearly free electron model – conductors - semiconductors - insulators.	Lect.	CO 3

25	Generation and recombination -	Lect	CO 3
26	minority carrier life-time -	Lect	CO 3
27	mobility of current carriers -	Lect	CO 3
28	drift and	Lect	CO 3
29	diffusion -	Lect.	CO 3
30	general study of excess carrier movement-	Lect	CO 3
32	diffusion length.	Lect	CO 3
33	Derivation of diffusion length	Lect	CO 3
34	Problems	PPT+SEMINAR+class activity	CO 3
	MODULE III		
35	Vibrations of crystals with monatomic basis –	Lect	CO 3
36	diatomic lattice –	Lect.	CO 3
37	quantization of elastic waves	Lect	
38	– phonon momentum.	Lect	CO 3
39	Anharmonicity and thermal expansion -	Lect	CO 3
40	specific heat of a solid - classical model -	Lect	CO 3
41	Einstein model -	Lect.	CO 3
42	density of states -	Lect	CO 3
43	Debye model	Lect	CO 3
44	- thermal conductivity of solids -	Lect	CO 3
45	thermal conductivity due to electrons	Lect	CO 3
46	and phonons	Lect.	CO 3
47	- thermal resistance of solids.	Lect	CO 3
48	Problems	Lect	CO 3
49	Review of basic terms and relations,	Lect	CO 3
50	ferroelectricity,	Lect	CO 3
51	hysteresis,	Lect.	CO 3
52	dipole theory -	Lect	CO 3
53	Curie- Weiss law,	Lect	CO 3
54	classification of ferroelectric materials	Lect	CO 3
	and piezoelectricity Ferroelectric domain,	Lect	CO 3
	. antiferroelectricity and ferrielectricity	Lect	CO 3
	MODULE IV		
56	Review of basic terms and relations, Quantum theory of paramagnetism -	Lect	CO 3
57	cooling by adiabatic demagnetization –	PPT+SEMINAR+class	CO 3

		activity	
58	Hund's rule – ferromagnetism -		
59	spontaneous magnetization in ferromagnetic materials -	PPT+SEMINAR+class activity	CO 3
60	Quantum theory of ferromagnetism –	PPT+SEMINAR+class activity	CO 3
61	Weiss molecular field - Curie- Weiss law- spontaneous magnetism	PPT+SEMINAR+class activity	CO 3
62	internal field and exchange interaction – magnetization curve – saturation magnetization - domain model.	Lect.	CO 3
63	Thermodynamics and electrodynamics of superconductors-	Lect	CO 3
64	BCS theory- flux quantization-	Lect	CO 3
65	single particle tunneling- Josephson superconductor tunneling-	Lect	CO 3
66	macroscopic quantum interference	Lect	CO 3
67	Properties of metal, semiconductor,		CO 3
68	rare gas and molecular nanoclusters- superconducting fullerene-	Lect.	CO 3
69	quantum confined materials-quantum wells, wires, dots and rings-	Lect	CO 3
70	metamaterials-	Lect	CO 3
71	graphene	Lect	CO 3
72	Problems and Revision	Lect	CO 3

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of	Topic of Assignment & Nature of assignment	Course

	completion	(Individual/Group – Written/Presentation – Graded or Non-graded etc)	Outcome
1	Before 1st Internal	Individual- Graded – 3 sets	CO1,CO2
2	Before 2nd Internal	Individual- Graded -3 sets	CO3, CO4

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 (CO3, CO4)

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 IV

COURSE PLAN

PROGRAMME	MASTERS OF PHYSICS	SEMESTER	2
COURSE CODE AND TITLE	16P2PHYT08: Thermodynamics and Statistical Mechanics	CREDIT	3
Theory HOURS/WEEK	3	HOURS/SEM	54
FACULTY NAME	Dr. Roby Cherian		

	COURSE OUTCOMES	PO/ PSO	CL
CO 1	Understand the concepts of thermodynamics and probability.	PO1, PSO1,PS03	U/A
CO 2	Apply to the problems related to classical mechanics & thermodynamics using statistical mechanics	PO1, PSO1, PSO2, PSO4	U/An

CL* Cognitive Level

SESSION	TOPIC	LEARNING RESOURCES	COURSE OUTCOME
	MODULE I		
1	Fundamental definitions	Lect	CO1
2	Thermodynamic potentials, Maxwells relations	Lect	CO1
3	Approach to equilibrium	Lect	CO1
4	Ideas of Probability- classical and statistical, axioms of probability	Lect	CO1
5	Independent events – counting the number of events	Lect	CO1
6	Basic ideas of statistical mechanics	Lect	CO1
7	Definition of quantum state	Lect	CO1
8	Model of spins on lattice	Lect	CO1
9	EOS	Lect	CO1
10	EOS	Lect	CO1
11	Problems	Lect+ Group Activity	CO1
	MODULE II		
12	The second law of thermodynamics	Lect	CO1
13	Canonical Ensemble – Introduction	Lect	CO2
14	Partition function	Lect	CO2
15	Entropy in Canonical ensemble	Lect	CO2
16	Bridging thermodynamics via Partition function	Lect	CO2
17	Condition for thermal equilibrium	Lect	CO2

18	Case study	Lect	CO2
19	Particle in a box 1D	Lect	CO2
20	Particle in a box 3D	Lect	CO2
21	Heat and work	Lect	CO2
22	Rotational energy levels	Lect	CO2
23	Vibrational energy levels	Lect	CO2
24	Equipartition theorem, minimizing free energy	Lect	CO2
25	Identical particles-symmetric and ant symmetric wavefunctions	Lect	CO2
26	Bosons, fermions	Lect	CO2
27	Calculating Z	Lect	CO2
28	Spins on lattice	PPT+SEMINAR+class activity	CO2
	MODULE III		
29	DOS	PPT+SEMINAR+class activity	CO 2
30	DOS- cont.	PPT+SEMINAR+class activity	CO 2
31	Maxwell speed distribution	PPT+SEMINAR+class activity	CO 2
32	Problems	Group Activity	CO 2
33	Black body radiation	PPT+SEMINAR+class activity	CO 2
34	Rayleigh jeans theory	PPT+SEMINAR+class activity	CO 2
35	Plancks distribution	PPT+SEMINAR+class activity	CO 2
36	Free energy	PPT+SEMINAR+class activity	CO 2
37	Grand Canonical ensemble	Lect.	CO 2
38	Condition for chemical equilibrium	Lect	CO 2
39	Approach to chemical equilibrium	Lect	CO 2
40	Grand Canonical partition function	Lect	CO 2
41	Grand Potential	Lect	CO 2
29	DOS	PPT+SEMINAR+class activity	CO 2
30	DOS- cont.	PPT+SEMINAR+class activity	CO 2
31	Maxwell speed distribution	PPT+SEMINAR+class activity	CO 2
32	Problems	Group Activity	CO 2
33	Black body radiation	PPT+SEMINAR+class activity	CO 2
34	Rayleigh jeans theory	PPT+SEMINAR+class activity	CO 2
35	Plancks distribution	PPT+SEMINAR+class activity	CO 2
36	Free energy	PPT+SEMINAR+class activity	CO 2
37	Grand Canonical ensemble	Lect.	CO 2

38	Condition for chemical equilibrium	Lect	CO 2
39	Approach to chemical equilibrium	Lect	CO 2
40	Grand Canonical partition function	Lect	CO 2
41	Grand Potential	Lect	CO 2
MODULE IV			
42	Fermi systems	Lect	CO 2
43	Bose Systems	Lect	CO 2
44	Examples	PPT+SEMINAR+class activity	CO 2
45	Examples	PPT+SEMINAR+class activity	CO 2
46	Phases- thermodynamic potential	Lect	CO 2
47	1st order phase transitions	Lect	CO 2
48	Clapeyron equations	Lect	CO 2
49	Phase seperation	Lect	CO 2
50	Phase separation Cont.	Lect	CO 2
51	Problems	Group Activity	CO 2
52	Problems	Group Activity	CO 2
53	Problems	Group Activity	CO 2
54	Problems	Group Activity	CO 2

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)	Course Outcome
1	Before 1st Internal	Individual- Graded – 3 sets	CO1,CO2
2	Before 2nd Internal	Individual- Graded -3 sets	CO3, CO4

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 (CO2)

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, Kedar Nath 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).