SACRED HEART COLLEGE (AUTONOMOUS)

Department of Physics

M.Sc. Physics

COURSE PLAN

Semester 2

2018 - 19

	Programme Outcome
PO 1	Exercise their critical thinking in creating new knowledge leading to innovation, entrepreneurship and employability.
PO 2	Effectively communicate the knowledge of their study and research in their respective disciplines to their stakeholders and to the society at large.
PO 3	Make choices based on the values upheld by the institution, and have the readiness and know-how to preserve the environment and work towards sustainable growth and development.
PO 4	Develop an ethical view of life and have a broader (global) perspective transcending the provincial outlook.
PO5	Explore new knowledge independently for the development of the nation and the world and are able to engage in a lifelong learning process.

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.

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	Explain the concepts of different mathematical methods in physics	PO1, PSO1,PS03	U
CO 2	Apply to solve different physical problems.	PO1, PSO1, PSO2, PSO4	A
CO 3	Summarize the concepts of group theory	PO1, PSO1,PS03	U
CO 4	Apply the concepts of partial differential equations to solve physical problems	PO1, PSO1, PSO2, PSO4	A

CL* Cognitive Level
U- Understand
A- Apply

CO -PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	0	0	0	0	3	0	3	0
CO 2	2	0	0	0	0	3	1	0	2
CO3	2	0	0	0	0	3	0	1	0
CO4	2	0	0	0	0	3	1	0	1

Mapping Strength
0- No Mapping strength
1- Low
2- Medium
3- High

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
5 & 6	integration in a complex plane	Lect	CO1
7 & 8	Cauchy's theorem-deformation of contours, problems	Lect+ discussion	CO1
9 & 10	Cauchy's integral formula, problems	Lect + discussion	CO1
11 & 12	Taylor and Laurent expansion-poles	Lect	CO1
13 & 14	residue and residue theorem, problems	Lect	CO1
15	Problems	discussion	CO1
16, 17	Cauchy's Principle value theorem - Evaluation of integrals	Lect	CO1
18	problems	Lect+ Group Activity	CO1
MODULE II			
19	Introduction to Fourier series and Fourier integral form	Lect	CO2
20 & 21	Fourier transform - square wave, full wave rectifier and finite wave train	Lect	CO2
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	CO3
38 & 39	point group, cyclic group, homomorphism and isomorphism	Lect + discussion	CO3
40	classes, reducible and irreducible representations	Lect + discussion	CO3
41 & 42	Schur's Lemmas and Great Orthogonality theorem	Lect + discussion	CO3
43 & 44	Group character table	Lect + discussion	CO3
45& 46	C2V, C3V and C4V groups	Lect + discussion	CO3
47	Lie group, concept of generators	Lect + discussion	CO3
48 & 49	rotation group SO(2), SO(3)	Lect.	CO3
50& 51	Unitary Group SU(2) and SU(3)	Lect	CO3

52 & 53	Homomorphism between SU(2) and SO(3)	Lect	CO3
54	– Irreducible Representation of SU(2).	Lect + discussion	CO3
MODULE IV			
55	Characteristics and boundary conditions for partial differential equations	seminar + discussion	CO 4
56 & 57	Nonlinear partial differential equations – separation of variables	seminar + discussion	CO 4
58 & 59	cylindrical and spherical polar coordinates	seminar + discussion	CO 4
60 & 61	Heat equation, Laplace's equation	seminar + discussion	CO 4
62	Poisson's equation	seminar + discussion	CO 4
63 & 64	Nonhomogeneous equation - Green's function	seminar + discussion	CO 4
65 & 66	symmetry of Green's function	seminar + discussion	CO 4
67 & 68	Green's function for Poisson equation	seminar + discussion	CO 4
69 & 70	Laplace equation and Helmholtz equation	seminar + discussion	CO 4
71	Application of Green's function in scattering p Problems	seminar + discussion	CO 4
72	Problems	Group Activity	CO 4

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 (CO4)

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

PROGRAMME	MASTERS OF PHYSICS	SEMESTER	2
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	Define the formalism of Non relativistic Quantum Mechanics.	PO1, PSO1, PS03	R
CO 2	Demonstrate principles of quantum mechanics.	PO1, PO2, PSO1, PSO2, PSO3	U
CO 3	Apply the principles of quantum mechanics to specific quantum mechanical systems.	PO1, PO2, PSO2, PSO3, PSO4	A
CO 4	Solve specific problems in quantum mechanics	PO1, PO2, PSO1, PSO3, PSO4	A

CL* Cognitive LevelR- Remember, U- Understand A-Apply

CO -PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	1	0	0	0	0	1	0	3	0
CO 2	1	2	0	0	0	1	1	3	0
CO 3	3	2	0	0	0	0	1	3	3
CO 4	3	2	0	0	0	3	0	3	3

Mapping Strength

0- No Mapping strength

1- Low

2- Medium

3- High

Session	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+ CO2
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+CO2
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	CO3+CO4

	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+CO2
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
22	Heisenberg equation of motion - Ehrenfest's theorem	Lecture + question answer session.	CO1+CO2
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.	CO3+CO4
26	Simple harmonic Oscillator - 2	Lecture + question answer session.	CO3 + CO4
27	Simple harmonic Oscillator - 3	Lecture + question answer session.	CO3 + CO4
28	CIA -1	Exam	
29	Pictures in quantum mechanics (Revision)	Lecture + question answer session.	CO1+CO2
	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	CO3

		answer session.	
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.	CO3
38	Eigenvalues of J^2 and J_x	Lecture + question answer session.	CO2
39	Matrix elements of angular momentum operators	Lecture + question answer session.	CO3
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.	CO3
44	Addition of angular momentum and spin angular momentum.	Lecture + question answer session.	CO3+CO4
45	Addition of spin angular momenta.	Lecture + question answer session.	CO3+CO4
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	CO3
49	Revision of Basics of Quantum Mechanics	Discussion	CO1+CO2
50	Revision of Quantum Dynamics	Discussion	CO1+CO2
51	Revision of angular momentum	Discussion	CO3
52	Simple Harmonic oscillator – an analysis.	Lecture + question answer session.	CO4

	MODULE - IV		
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.	CO3
58	Hydrogen atom problem - 2	Lecture + question answer session.	CO3
59	Hydrogen atom problem - 3	Lecture + question answer session.	CO3 +CO4
60	CIA - 2	Exam	
61	WKB approximation	Lecture + question answer session.	CO1 + CO2
62	WKB approximation -2	Lecture + question answer session.	CO3
63	WKB wave function	Lecture + question answer session.	CO4
64	Validity of the approximation	Lecture + question answer session.	CO2
65	Variational methods	Lecture + question answer session.	CO1
66	Variational methods - bound states	Lecture + question answer session.	CO3
67	Variational methods - harmonic oscillator	Lecture + question answer session.	CO4
68	Perturbation theory	Lecture + question answer	CO1+CO2
69	Stationary state perturbation theory	Lecture + question answer session.	CO3+CO4
70	Perturbation theory - non degenerate case	Lecture + question	CO3+CO4

		answer session.	
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	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 (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

PROGRAMME	MASTERS OF PHYSICS	SEMESTER	2
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
CO 3	Analyse various dielectric and magnetic properties of crystals	PO1, PSO1, PSO2, PSO4	U/ An
CO 4	Describe the latest trends in Nanotechnology	PO1, PSO1, PSO2, PSO4	U/ An

CL* Cognitive Level

R-Remember

U- Understand

A. Apply

An- Analyze

E- Evaluate

Cr- Create

CO -PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	0	0	0	0	3	0	3	0
CO 2	2	0	0	0	0	3	1	0	3
CO 3	2	0	0	0	0	3	1	0	3
CO 4	2	0	0	0	0	3	1	0	3

Mapping Strength

0- No Mapping strength

1- Low

2- Medium

3- High

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	Lect	CO 3

	movement-		
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 activity	CO 3
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 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 (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.11^{th} 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, 4^{th} 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)

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	Summarizing the concepts of thermodynamics and probability.	PO1, PSO1,PS03	U
CO 2	Illustrating the foundations of Statistical mechanics	PO1, PSO1, PSO2, PSO3	U
CO 3	Modeling the problems related to Canonical and Grand Canonical ensemble	PO1, PSO1, PSO2,PSO 3	A
CO 4	Interpreting the concepts of Phase Transitions	PO1, PSO1, PSO2, PSO3	U

CL* Cognitive Level

R-Remember

U- Understand

A- Apply

An- Analyze

E- Evaluate

Cr- Create

CO -PO/PSO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	2	0	0	0	0	3	0	3	0
CO 2	2	0	0	0	0	3	1	3	0
CO 3	2	0	0	0	0	3	1	3	0
CO 4	2	0	0	0	0	3	1	3	0

Mapping Strength

0- No Mapping strength

1- Low

2- Medium

3- High

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	CO2
7	Definition of quantum state	Lect	CO2
8	Model of spins on lattice	Lect	CO2
9	EOS	Lect	CO2
10	EOS	Lect	CO2
11	Problems	Lect+ Group Activity	CO2
MODULE II			
12	The second law of thermodynamics	Lect	CO2
13	Canonical Ensemble – Introduction	Lect	CO3
14	Partition function	Lect	CO3
15	Entropy in Canonical ensemble	Lect	CO3
16	Bridging thermodynamics via Partition function	Lect	CO3
17	Condition for thermal equilibrium	Lect	CO3
18	Case study	Lect	CO3
19	Particle in a box 1D	Lect	CO3
20	Particle in a box 3D	Lect	CO3
21	Heat and work	Lect	CO3
22	Rotational energy levels	Lect	CO3

23	Vibrational energy levels	Lect	CO3
24	Equipartition theorem, minimizing free energy	Lect	CO3
25	Identical particles-symmetric and ant symmetric wavefunctions	Lect	CO3
26	Bosons, fermions	Lect	CO3
27	Calculating Z	Lect	CO3
28	Spins on lattice	PPT+SEMINAR+class activity	CO3
MODULE III			
29	DOS	PPT+SEMINAR+class activity	CO3
30	DOS- cont.	PPT+SEMINAR+class activity	CO3
31	Maxwell speed distribution	PPT+SEMINAR+class activity	CO3
32	Problems	Group Activity	CO3
33	Black body radiation	PPT+SEMINAR+class activity	CO3
34	Rayleigh jeans theory	PPT+SEMINAR+class activity	CO3
35	Plancks distribution	PPT+SEMINAR+class activity	CO3
36	Free energy	PPT+SEMINAR+class activity	CO3
37	Grand Canonical ensemble	Lect.	CO3
38	Condition for chemical equilibrium	Lect	CO3
39	Approach to chemical equilibrium	Lect	CO3
40	Grand Canonical partition function	Lect	CO3
41	Grand Potential	Lect	CO3
29	DOS	PPT+SEMINAR+class activity	CO3
30	DOS- cont.	PPT+SEMINAR+class activity	CO3

31	Maxwell speed distribution	PPT+SEMINAR+class activity	CO3
32	Problems	Group Activity	CO3
33	Black body radiation	PPT+SEMINAR+class activity	CO3
34	Rayleigh jeans theory	PPT+SEMINAR+class activity	CO3
35	Plancks distribution	PPT+SEMINAR+class activity	CO3
36	Free energy	PPT+SEMINAR+class activity	CO3
37	Grand Canonical ensemble	Lect.	CO3
38	Condition for chemical equilibrium	Lect	CO3
39	Approach to chemical equilibrium	Lect	CO3
40	Grand Canonical partition function	Lect	CO3
41	Grand Potential	Lect	CO3
MODULE IV			
42	Fermi systems	Lect	CO 4
43	Bose Systems	Lect	CO 4
44	Examples	PPT+SEMINAR+class activity	CO 4
45	Examples	PPT+SEMINAR+class activity	CO 4
46	Phases- thermodynamic potential	Lect	CO 4
47	1st order phase transitions	Lect	CO 4
48	Clapeyron equations	Lect	CO 4
49	Phase seperation	Lect	CO 4
50	Phase separation Cont.	Lect	CO 4
51	Problems	Group Activity	CO 4
52	Problems	Group Activity	CO 4
53	Problems	Group Activity	CO 4
54	Problems	Group Activity	CO 4

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 – Best of 2 sets	CO1
2	Before 2nd Internal	Individual- Graded –Best of 2 sets	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 (CO 2)

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).