NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF PHYSICS

COURSE PLAN – PART I			
Name of the programme and specialization	M.Sc. (Physics) / B.Tech. with Physics Minor		
Course Title	STATISTICAL MECHANICS		
Course Code	PH656 / PHMI14 (Minor)	No. of Credits	4 (3L + 1T)
Course code of Pre-requisite subject (s)	PH653 – Classical Mechanics PH655 – Quantum Mechanics		
Session	~~July~~ / Jan. 2019	Section (if applicable)	-
Name of Faculty	Dr. R. Sankaranarayanan	Department	Physics
Official Email	sankar@nitt.edu	Telephone No.	0431-250-3609
Name of course Coordinator(s) (if applicable)	Dr. M.C. Santhoshkumar		
Official Email	santhoshmc@nitt.edu	Telephone No.	0431-250-3611
Course Type	☑ Core course ☒ Elective		

SYLLABUS (as approved by senate)

Thermodynamics

Preliminaries – first law – ideal gas – Carnot cycle – second law and Clausius theorem – entropy and properties – thermodynamic potentials – Maxwell's relations – chemical potential – real gas – phase transition.

Theory of Ensembles

Postulates: phase space, microstates, density of states, ensemble average – Liouville's theorem – microcanonical ensemble – quantum phase space – canonical ensemble – partition function (N particle) – ideal gas law – thermal wavelength – grand canonical ensemble.

Maxwell-Boltzmann Statistics

Boltzmann system – Maxwell-Boltzmann distribution – Lagrange's multipliers – partition function (single particle) – thermodynamics of gases – velocity distribution – equipartition of energy – paramagnetism – Einstein model of solid.

Bose-Einstein Statistics

Principle of indistinguishability – Bosons – Bose-Einstein distribution – Planck's law of radiation – Stefan's law – Debye's theory of heat capacity – Bose-Einstein condensates.

Fermi-Dirac Statistics

Fermions – Fermi-Dirac distribution – Fermi energy – electron gas in metals – electronic specific heat – thermionic emission – Pauli paramagnetism.

Text Books

1. M. W. Zeemansky and R.H. Dittman, Heat and Thermodynamics, 8th edition, Mc-Graw Hill (2011).
2. K. Haung, Statistical Mechanics, 2nd edition, Wiley India (2010).
3. F.W. Sears and G.L. Salinger, Thermodynamics, Kinetic Theory and Statistical Thermodynamics, 3rd edition, Narosa Publishing House (1998).
4. F. Mandl, Statistical Physics, 2nd edition, Wiley (2002).

Reference Books

1. Enrico Fermi, Thermodynamics, Dover (1956).
2. R.K. Pathria and Paul D. Beale, Statistical Mechanics, 3rd edition, Academic Press (2011).
3. F. Reif, Fundamentals of Statistical and Thermal Physics, International Students edition, Tata McGraw-Hill (1988).
4. S.J. Blundell and K.M. Blundell, Concepts in Thermal Physics, Oxford University Press (2006).
5. L.D. Landau and E.M. Lifshitz, Statistical Physics – Part I, 3rd edition, Elsevier (2010).

COURSE OBJECTIVES

To learn the connection between bulk (macroscopic) state and microscopic state of a system of large number of particles at thermal equilibrium.

Mapping of COs with POs

Course Outcomes (CO)	Progamme Outcomes (PO)
1. Students will be able to understand various properties of matter and radiation in thermal equilibrium through appropriate statistics.	-
2. Students will be prepared to understand solid state physics and technology.	-

COURSE PLAN – PART II

COURSE OVERVIEW

Any system that interacts with surroundings reaches thermal equilibrium asymtotically. If a system is imagined to be made up of very large number of particles, then the bulk or measurable state of the system in equlibrium can be systematically associated with the state of constituent particles in statistical sense. In this frame work, only three kinds of statistics (Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac) are suffecient to uncover the intriguing connection between macroscopic and microscopic behaviour of a system.

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	*Week/Contact Hours*	*Topic*	*Mode of Delivery*
1	10 Hours	Thermodynamics	Chalk & Talk
2	10 Hours	Theory of Ensembles	Chalk & Talk
3	10 Hours	Maxwell-Boltzmann Statistics	Chalk & talk
4	10 Hours	Bose-einstein Statistics	Chalk & Talk

5	10 Hours	Fermi-Dirac Statistics	Chalk & Talk / PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S. No.	*Mode of Assessment*	*Week / Date*	*Duration*	*% Weightage*
1	I Cycle Test	7th week	1 Hour	20
2	II Cycle Test	13th week	1 Hour	20
3	Assignment	15th week	-	10
CPA	Compensation Assessment*	16th week	1 Hour	20
4	Final Assessment*	17th week	3 Hours	50

* mandatory, refer to guidelines on page 4

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

Feedback will be conducted through online (MIS) for self assessment.

COURSE POLICY (including compensation assessment to be specified)

- Those who are absent for any of the cycle tests on genuine grounds shall be given opportunity for compensation assessment. Compensation Assessment shall be conducted before the end semester examination and portions will be the combined portions of I & II Cycle Tests.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION (if any)

Interaction with the course faculty is highly encouraged inside / outside the class room.

FOR APPROVAL		
Sd/- Course Faculty	Sd/- CC-Chairperson	Sd/- HOD

Guidelines

a) The number of assessments for any theory course shall range from 4 to 6.

b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.

c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.