RKUNIVERSITY

SYLLABUS

Course Title	**STATISTICAL MECHANICS**
Course Code	MPH201
Course Credit	Lecture : 04
	Tutorial : 00
	Practical : 00
	Total : 04

Detailed Syllabus:

Sr. No	Name of chapter & Details	Session Allotted
	SECTION-I	
1	**Basic concept of Probability** Introduction to statistical mechanics, Probability & its rules, continuous random variable, Binomial distribution, random walk problem.	**09**
2	**Macroscopic state & microscopic state** Macroscopic state, microscopic state, phase space, μ-space, G-space, Postulate of equal a priori probabilities, Liouville's theorem.	**10**
3	**Ensemble** Microcanonical ensemble, canonical ensemble, Alternative method for the derivation of canonical distribution, Grand canonical ensemble, alternative derivation of grand canonical ensemble, problems.	**09**
	SECTION-II	
4	**Some applications of statistical mechanics related to classical mechanics** Rotating bodies, the probability distribution for angular momenta and angular velocities of rotation of molecules, problems.	**06**
5	**Some applications of statistical mechanics related tothermodynamics** Energy and work, pressure, entropy, Halmholtz free energy, Physical interpretation of α, chemical potential, ideal gas, Gibbs paradox, Equipartition theorem, the statistic of paramagnetism, problems.	**12**
6	**Quantum Statistical Mechanics** Postulate of Quantum Statistical mechanics, Density matrix, Ideal Bose systems: Basic concepts and thermodynamic behavior of an ideal Bose gas, Bose- Einstein condensation, discussion of gas of photons (the radiation fields) and phonons (the Debyefield), problems	**10**

Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.

3. Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to buildan appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

After Successful completion of the above course, students will be able to:

Recall concepts of probability.

Identify micro entities of the Nature.

Solve problem related to classical mechanics & thermodynamics using statistical mechanics.

Text book:

1. Fundamental of Statistical Mechanics by B. B. Laud, New Edge International
2. Statistical Mechanics by Gupta Kumar, Pragati Prakashan

Reference Books:

1. Statistical Mechanics by R.K. Pathria (Butterworth-Heinemann, Oxford).
2. Statistical Mechanics by K. Huang (Wiley Eastern, New Delhi).
3. Statistical Mechanics by B.K. Agarwal and M. Eisner (Wiley Eastern, New Delhi).
4. Elementary Statistical Physics by C. Kittel (Wiley, New York).
5. Statistical Mechanics by S.K. Sinha (Tata McGraw Hill, New Delhi).
6. Statistical Mechanics by ESR Gopal

RKUNIVERSITY	SYLLABUS

Course Title	**ATOMIC & MOLECULAR PHYSICS**	
Course Code	MPH202	
Course Credit	Lecture	: 04
	Tutorial	: 00
	Practical	: 00
	Total	: 04

Detailed Syllabus:

Sr. No	Name of chapter & Details	Session Allotted
	SECTION-I	
1	**Bohr's theory and spectrum of Hydrogen atom** Investigation of spectra, Production of spectra, types of spectra, absorption spectra in aeveryday life, wave number, spectrum of hydrogen atom, Failure of electromagnetic theory of radiation, Bohr's theory and spectrum of hydrogen atom, Explanation of spectral series in hydrogen atom, energy level diagram, evidence in favour of Bohr's theory, problems.	**12**
2	**Atomic Physics** Pauli's exclusion principle, maximum number of electrons in a given group or subgroup, different series in alkali spectra, term values in alkali spectra and quantum defect, silent futures in alkali spectra, transition rules, intensity rules, L-S coupling, JJ coupling, fine structure and hyperfine structure (general idea).	**10**
3	**Zeeman Effect** normal and anomalous Zeeman effect, Paschen-back effect and Stark effect, Problems.	**6**
	SECTION-II	
4	**Rotational Motion of Molecules - I** Rotation of molecules, classification of molecules, interaction of radiation with rotating molecule, rotational spectra of rigid diatomic molecules, isotope effect in rotational spectra, intensity of rotation lines, non-rigid rotator, linear polyatomic molecules.	**10**
5	**Rotational Motion of Molecules - II** Symmetric top molecules, asymmetric top molecules, Stark effect, microwave spectrometer, information derived from rotational spectra, vibrational energy of a diatomic molecule, infrared spectra (preliminaries), morse curve and the energy levels of a diatomic molecules.	**10**
6	**Vibrational Motion of Molecules** Vibrating diatomic molecule, diatomic vibrating rotator, vibration of polyatomic molecules, normal modes of vibration in crystal, interpretation of vibrational spectra, I-R spectrophotometer-instrumentation.	**08**

Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to buildan appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

On the successful completion of the course, students will be able to:

Recognize types of spectra

Explain types of alkali spectra

Distinguish rotational motion & vibrational motion of molecules.

Text book:

1. Elements of Spectroscopy by Gupta Kumar Sharma
2. Molecular Structure & Spectroscopy by G. Aruldhas

Reference Books:

1. Introduction to Atomic Spectra by H. E. White
2. Introduction to Molecular Spectroscopy by G. M. Barrow

RKUNIVERSITY

SYLLABUS

Course Title	**ELECTRODYNAMICS AND PLASMA PHYSICS**
Course Code	MPH203
Course Credit	Lecture : 04
	Tutorial : 00
	Practical : 00
	Total : 04

Detailed Syllabus:

Sr. No	Name of chapter & Details	Session Allotted
	SECTION-I	
1	**Vector analysis** Introduction, Representation of vectors, Addition of vectors, Subtraction of vectors, Scalar multiple of a vector, Unite vectors, Product of vectors, Scaler product, Vector product.	**06**
2	**Maxwell's Equations** Introduction to electrodynamics, Electrodynamics before Maxwell, Ampere's law, Maxwell equations in matter and boundary conditions.	**11**
3	**Electromagnetic Waves, Potentials and Fields** The wave equation for E and B, propagation in linear media, reflection and transmission at normal and oblique incidence, electromagnetic waves in conductors, scalar and vector potentials, Gauge transformations, Retarded potentials, Lienard - Wiechert potentials, the field of a moving point charge.	**11**
	SECTION-II	
4	**Fundamental of Plasma:** Occurrence of Plasma, Plasma as a state of matter, Definition of Plasma, Shaha Equation of Plasma, Debye shielding, Debye length, plasma frequency, Criteria of plasma, collisions, dc conductivity.	**10**
5	**Plasma Production and measurements:** Dc discharge, rf discharge, photo – ionization. Tunnel ionization, avalanche breakdown, laser produced plasmas, Langmuir probe.	**09**
6	**Behaviors of plasm** Plasma behavior in Uniform E and B field, effect of gravitational field, Dielectric constant of Plasma, Fluid equation of Plasma, convective derivative, fluid drifts perpendicular to B, plasma instabilities **Applications of Plasma** Gas discharge, controlled Thermonuclear fusion, Space Physics, Modern Astrophysics, Solid State Plasma, and Gas Laser.	**09**

Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to buildan appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

On the successful completion of the course, students will be able to:

Understand the concepts of Maxwell's equations, electromagnetic waves, fundamental of plasma.

Calculate different example for plasma application and use of Maxwell's equation for electrodynamic problems.

Apply plasma parameters in different experiment

Text book:

1. MIntroduction to Plasma Physics & controlled fusion (IInd edition): Vol. 1: Plasma Physics By F.F. Chen.
2. Introduction to electrodynamics, D.J. Griffith (PHI, New Delhi)

Reference Books:

1. Plasma Physics by Bittencourt
2. Plasma Physics by Chakraborty

RK UNIVERSITY	**SYLLABUS**
Course Title	**SOLID STATE PHYSICS**
Course Code	MPH204
Course Credit	Lecture : 04
	Tutorial : 00
	Practical : 00
	Total : 04

Detailed Syllabus:

Sr. No	Name of chapter & Details	Session Allotted
	SECTION-I	
1	**Crystalline Solids and Crystal Imperfections** Crystalline state, Basic definitions, Bravais and non Bravais lattices, Elements of symmetry, Crystal planes and Miller indices, Examples of Simple Crystal structures, Principals of X-Ray, Neutron and Electron Diffraction in Crystalline solids, Bragg's Law, Concept of Reciprocal lattice, Experimental techniques of X-Ray Diffraction. Types of defects; point defects, line defects, surface defects; Grain boundaries, tilt boundary, twist boundary, twin boundary, stacking faults, Frank-Read Source, dislocations, Diffusion in solids.	**13**
2	**Free Electron theory of metals** Conduction in Metals, Electrical conductivity and Thermal conductivity, Wiedemann-Franz law and its application, free electron theory and drawbacks of classical free electron theory, Thermoelectricity: Seebeck Effect, Thermoelectric power and Thermocouple.	**07**
3	**Band Theory of Solids** Band Model, classification of solids; Semiconductors, Insulators and Metals, Effect of Thermal energy, Electrical field and Electromagnetic radiation one excitation mechanism, Concept of Effective mass, Direct & Indirect band gap, concept of photon and phonon, Electron in periodic potential, Bloch Theorem, Kronig-Penney model, Fermi surfaces.	**08**
	SECTION-II	
4	**Superconductivity** Definition, Types of superconductors, Properties, Meissner effect, Isotope effect, BCS theory – Qualitative approach, outcomes of BCS theory, Josephson effects, SQUID, Applications of superconductivity.	**08**
5	**Diamagnetism and Paramagnetism** Classical theory, Paramagnetism-origin of paramagnetic moment, Langevin's theory, Quantum theory, Paramagnetism in rare earth and iron group ions, paramagnetism of conduction electrons.	**10**

6	**Ferromagnetism, Antiferromagnetism and Ferrimagnetism** Weiss theory, Temperature dependence of Saturation magnetization (MS), Heisenberg's exchange model, Slater's criterion, concept of magnons, Ferromagnetic domains, origin of domains, Antiferromagnetism and ferrimagnetism, ferrites.	**10**

Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Seminar/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to buildan appreciation for the concepts being taught in lectures.

Students Learning Outcomes:

On the successful completion of the course, students will be able to:

- **Identify** the phase of materials**.**
- **Classify** the solid materials.
- **Apply** the concept of X-ray diffraction to interpret crystalline structure.
- **Compare** different solids using band theory.
- **Distinguish** magnetic materials.

Text book:

1. A Text Book of Solid State Physics by S.L. Kanani & C. Hemrajani, S. Chand & Sons Publication
2. Elementary Solid State Physics by M. Ali Omar, Addison Wesley Publication

Reference Books:

1. Introduction to Solid State Physics by C. Kittel, Wiley Eastern Publication
2. Elements of solid state physics by J. P. Srivastava (Prentice Hall India)
3. Solid State Physics by M.A. Wahab (Nerosa Publishers) Solid State Physics - Dan Wei (Cengage Learning)
4. Material Science and Engineering an Introduction 6^{th} Edition, by William D. Callister, Jr., John Wiley & Sons, Inc.

RK UNIVERSITY	**SYLLABUS**
Course Title	**PHYSICS EXPERIMENTS – II**
Course Code	MPH205
Course Credit	Lecture : 00
	Tutorial : 00
	Practical : 09
	Total : 09

Detailed Syllabus:

Sr. No	Name of Experiments	Session Allotted
1	Prove that NAND gate as a Universal gate using IC 7400.	
2	Prove that NOR gate as a Universal gate using IC 7402.	
3	Verify Demorgan's theorems using IC 7400, 7402 and 7408.	
4	Simplify the given five logical expressions and construct a logic circuit for same & verity their truth tables.	
5	To design & study I-V characteristics of FET and use FET as voltmeter.	
6	To study DIAC characteristics.	
7	To study TRIAC characteristics.	
8	To study thermistor characteristics.	
9	To design and construct +5 V D.C. power supply using IC 7805.	
10	To design & study astable multivibrator using IC 555 timer.	
11	To design & study monostable multivibrator using IC 555 timer.	
12	To find out Hall coefficient of a semiconductor material using Hall effect apparatus.	
13	To find out charge carrier density of a semiconductor material using Hall effect apparatus.	
14	To find Seeback coefficient of Cu-Fe thermocouple.	
15	To find out semiconductor band gap of a semiconductor using four probe method.	
16	To calculate interplanner spacing using X-ray image.	
17	To study magnetic hysteresis loop & magnetization curve of a magnetic materials using ready-made kit.	
18	To solve five problems related to probability.	
19	To calculate work, pressure, entropy, Helmholtz free energy and specific heat in terms of partition function for a given statistical system.	
20	To estimate the position of the band centre and B value of the two different molecules from their given spectra.	

Students Learning Outcomes:

On the successful completion of the course, students will be able to:

- **Identify** active and passive components.

- **Apply** experimental skill during practical session
- **Calculate** the unknown physical quantity using obtained data.
- **Explain** the obtained result using scientific background.