C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Electrodynamics and Plasma Physics

SUBJECT CODE: MSCPHC201

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)			Evaluation Scheme								
Th	Pr	Total	Theory					Practical (Marks)			Total
			Sessional Exam		University Exam		Total	External	Internal	Total	
			Marks	Hrs	Marks	Hrs					
4	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-

The general purpose of this course is

- To expose the student knowledge of Maxwell's equation, wave equation of E and B,and Lienard Wiechert potentials.
- To expose the student knowledge of plasma the forth state of matter.

Prerequisites: -Fundamental knowledge of Bachelor degree in physics.

Course outline:-

Sr. No.	Course Contents
1	**Maxwell's equations** Electrodynamics before Maxwell, Ampere's law, Maxwell's equation in matter andBoundary condition, Electromagnetic Waves,The wave equation for E and B propagation in linear media, Reflection andtransmission at normal and oblique incidence, e.m. Waves in conductors.
2	**Potentials and fields** Scalar and vector potentials, gauge transformations, Coulomb Gauge Lorentz Gauge,Retarded potentials, Lienard Wiechert potentials, the field of a moving point charge,Power radiated point charge.

3	**Introduction to Plasma** Definition of Plasma, Plasma parameters, Criteria for Plasma, Applications ofPlasma.
4	**Hydro dynamical description of Plasma** Fluid equation of Plasma, Convective derivative, Fluid drifts perpendicular to B,Plasma instabilities.
5	**Waves in Plasma** Phase velocity, group velocity, plasma oscillation, Resonance for EM wavespropagating parallel and perpendicular to the magnetic field, Experimentalconsequences Whistler & Faraday Rotation, Hydro magnetic waves – Magneto sonicand Alfven waves.

Learning Outcomes: -After successful completion of this course, students will be able

- To knowledge of Maxwell's equation in matter and Boundary condition.
- To knowledge of Electromagnetic Waves.
- To knowledge of Plasma.

Books Recommended:

1. 'Plasma Physics and Controlled Fusion',**F.F.Chen**, *Plenum Press, New York.*
2. 'Classical Electrodynamics', **J.D. Jackson,** *John Wiley & Sons, New York.*
3. 'Introduction to Electrodynamics', **D.J. Griffith**, *Prentice Hall.*
4. 'Plasma Physics', **Bitten Court,** *Springer.*
5. 'Classical Electrodynamics',**S. P. Puri,***Tata McGraw-Hill Publ. Company Ltd. New Delhi.*
6. 'Introduction to Plasma Physics and Controlled fusion', **F. F. Chen**, *Plenum Press, New York London.*

E-Resources:

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com
4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
6. www.ndrs.org. physic.com
7. www.physlinc.com
8. www.fearophysic.com
9. www.hyper physics.com

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Atomic and Molecular Physics **SUBJECT CODE: MSCPHC202**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)			Evaluation Scheme								
			Theory					Practical (Marks)			
Th	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
			Marks	Hrs	Marks	Hrs					
4	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-The general purpose of this course is

- To expose the student knowledge of Schrodinger equation for hydrogen atom and its Application, Pauli's exclusion principle.
- Be able to knowledge of, Zeeman Effect, Paschen-back effect and Stark effect.
- Be able to knowledge of Rotation of molecules, classification of molecules, Symmetric top molecules, asymmetric top molecules.
- Be able to knowledge of Vibrating diatomic molecule, I-R spectrophotometer-instrumentation.

Prerequisites: -Fundamental knowledge of Bachelor degree in physics.

Course outline:-

Sr. No.	Course Contents
1	Application of Schrodinger equation for hydrogen atom, interpretation of the results of Schrodinger equation, atomic energy levels, dependence of wave function on the angle θ and Φ, radial dependence of wave function.

2	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, L-S coupling, JJ coupling, interaction energy in L-S coupling & JJ coupling, fine structure and hyperfine structure (qualitative), General ideas of Line-broadening mechanisms, normal and anomalous Zeeman effect, Paschen-back effect and Stark effect.
3	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.
4	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.
5	Vibrating diatomic molecule, diatomic vibrating rotator, vibration of polyatomic molecules, normal modes of vibration in crystal, interpretation of vibrationalspectra, I-R spectrophotometer-instrumentation.

Learning Outcomes:-After successful completion of this course, students be able for

- The knowledge Schrodinger equation for hydrogen atom and its Application.
- Pauli's exclusion principle.
- Rotation of molecules.
- Vibrating diatomic molecule.
- I-R spectrophotometer-instrumentation.

Books Recommended:

1. 'Elements of Spectroscopy', **Gupta, Kumar& Sharma,***Academic Press, New York.*
2. 'Molecular Structure & Spectroscopy', **G. Aruldhas,** *PHI learning private limited.*
3. 'Introduction to Atomic Spectra', **H. E. White**, *McGraw Hill.*
4. 'Introduction to Molecular Spectroscopy', **G. M. Barrow**,*McGraw-Hill.*

E-Resources:

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com
4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
6. www.ndrs.org. physic.com
7. www.physlinc.com
8. www.fearophysic.com
9. www.hyper physics.com

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FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Solid State Physics **SUBJECT CODE: MSCPHC203**

Teaching & Evaluation Scheme:-

Teaching Scheme			Evaluation Scheme								
Th	Pr	Total	Theory					Practical (Marks)			Total
			Sessional Exam		University Exam		Total	External	Internal	Total	
			Marks	Hrs	Marks	Hrs					
4	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-After completion of course students will,

- Be able for knowledge ofCrystalline Solids and Defects in Solids.
- Be able for knowledge of Band Theory of Solids.
- Be able for knowledgeSuperconductivity, Diamagnetism and Para magnetism Ferromagnetism,Antiferromagnetism,Ferrimagnetisms.

Prerequisites:-Basic Knowledge Bachelor of Physics.

Course outline:-

Sr. No.	Course Contents
1	**Crystal Physics:** Crystalline state, Basic definitions, Space lattice, Bravais and non Bravais lattices, Unit cell, Lattice parameters, Elements of symmetry, Miller indices, Inter planer distance, Crystal planes,Atomic radius co-ordination number & Packing Factor of SC-BCC-FCC-HCP crystals, Examples of Simple Crystal structures like NaCl-ZnS-CsCl, Principals of X-Ray, Neutron and Electron Diffraction in Crystalline solids, Bragg's Law, Concept of Reciprocal lattice Experimental techniques of X-Ray Diffraction, Numerical sums.
2	**Defects in Solids :** Different types of defects in solids- point defects, line defects, plane defects, Grain boundaries, stacking faults, Diffusion in solids.

3	**Band Theory of Solids** Electron in periodic potential, Bloch Theorem, Kronig-Penney model, Effective mass, Tight binding approximation, Brillouin Zones, Cellular and pseudo potential methods, Fermi surfaces, De Hass Van Alfon Effect, Cyclotron resonance, classification of solids, limit of Band theory-metal insulator transition.
4	**Superconductivity** Introduction,Definition, Types of superconductors, Comparison of type I & II superconductors, Properties of superconductors, Effect of magnetic field on superconductors, Meissner effect, Isotope effect, BCS theory,Qualitative approach, outcomes of BCS theory, A.C. & D.C. Josephson effects, SQUID, Maglev and other Applications of superconductivity. High temperature superconductors
5	**Magnetism & Magnetic Properties :** Permeability, Field Intensity, Magnetic Field Induction,Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment,Paramagnetism-origin of paramagnetic moment, Langevin's theory, Quantum theory, Paramagnetism in rare earth and iron group ions, para-magnetism of conduction electrons. Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment. Weiss theory, Temperature dependence of Saturation magnetization (MS), Heisenberg's exchange model, Slater's criterion, concept of magnons, Ferromagnetic domains, origin of domains, Anti-ferromagnetism and ferri-magnetism, Properties of Anti-ferromagnetic and ferri - magnetic materials, ferrites and their applications.

Learning Outcomes:-After completion of this paper

- Students will be able for theknowledge of Crystalline Solids and Defects in Solids.
- Be able for Knowledge of Band Theory of Solids.
- Be able for Knowledge of Superconductivity and Magnetism.

Books Recommended:

1. 'Introduction to Solid State Physics', **CharlesKittel**, *Wiley Eastern.*
2. 2.'Elementary Solid State Physics', **M. Ali Omar**,*Addison Wesley.*
3. 3.'Elements of solid state physics', **J. P. Srivastava**,*Prentice Hall India.*
4. 'Solid State Physics', **M.A. Wahab**,*Nerosa Publishers.*
5. 'Solid State Physics', **Dan Wei**, *Cengage Learning.*
6. 'Solid State Physics',**Aschroff and Mermin.**
7. 'Solid State Physics',**AJ Dekker,** *Tata McGraw-Hill.*
8. 'Solid State Physics',**Levey,** *W. A. Benjamin, New York.*

E-Resources:

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com

4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
6. www.ndrs.org. physic.com
7. www.physlinc.com
8. www.fearophysic.com
9. www.hyper physics.com

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FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Quantum Mechanics - II and Statistical Mechanics

SUBJECT CODE: MSCPHC204

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)			Evaluation Scheme								
			Theory					Practical (Marks)			
Th	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
			Marks	Hrs	Marks	Hrs					
4	0	4	30	1.5	70	3	100	--	--	--	100

Objectives:-

- To expose the student knowledge ofThepostulate of classical statistical mechanics and Postulate of Quantum Statistical mechanics, different types of Ensembles.
- To expose the student knowledge of Super Fluids, The Ising Model.
- To expose the student knowledge of Scattering Theory, Green's functions, Born approximation.
- To expose the student knowledge of Partial Wave Analysis, Expression for the phase shift.

Prerequisites:- Knowledge of bachelor degree in physics.

Course outline:-

Sr. No.	Course Contents
1	**The Classical-Statistical Mechanics& Ensemble theory :** Classical statistical mechanics postulate, Derivation of thermodynamics, Classical ideal gas, Gibbs Paradox, Canonical Ensemble, Energy fluctuations in canonical ensemble, Grand canonical ensemble, Density fluctuations in grand canonical ensemble.
2	**Quantum Statistical Mechanics :** Quantum Statistical mechanics Postulate, Density matrix, Macro-Canonical ensemble, canonical ensemble, The ideal gases, Micro -canonical ensemble.

3	**Super Fluids& Ising Model :** Liquid Helium, Why helium does not solidify?, Tisza's two- fluid model, The ising model, Lattice gas, Binary alloys.
4	**Scattering Theory :** Kinematics of the scattering process, Differentials and total cross-sections, Wave mechanical picture of scattering, The scattering amplitude, Green's functions, Formal expression for the scattering amplitude, Born approximation, The screened Coulomb potential, Validity of Born approximation, Born series, The eikonel approximation.
5	**Partial Wave AnalysisTheory:** Definition of partial waves, Asymptotic behavior of partial waves: phase shifts , (i) partial waves (ii) asymptotic form of radial function (iii) phase shifts, The scattering amplitude in terms of phase shifts, The differential and total cross-sections, Optical theorem, Phase shifts: Relation to the potential, Expression for the phase shift.

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Learning Outcome:-Students will be able for

- To expose the student knowledge ofClassical Statistical Mechanicsand Quantum Statistical Mechanics.
- To expose the student knowledge of Super Fluidity and Scattering Theory.
- To expose the student knowledge of Partial Wave Analysis.

Books Recommended:

1. 'Statistical Mechanics',**K. Huang** ,*Wiley*,*New York.*
2. 'Quantum Mechanics', **L.I. Schiff**, *McGraw –Hill International Editions.*
3. 'A Text book of Quantum Mechanics', **P.M. Mathews and K. Venkatesan**,*Tata McGraw Hill, New Delhi.*
4. 'Modern Quantum Mechanics', **J.J. Sakurai**,*Addison Wesley.*
5. 'Statistical Mechanics', **R.K. Pathria**, *Butterworth-Heinemann, Oxford.*
6. 'Statistical Mechanics', **B.K. Agarwal and M. Eisner**,*Wiley Eastern, New Delhi.*
7. ' Elementary Statistical Physics', **C. Kittel**,*Wiley, New York.*
8. ' Statistical Mechanics',**S.K. Sinha,***Tata McGraw Hill, New Delhi.*
9. ' Statistical Mechanics', **ESR Gopal,** *Macmillan India.*

E-Resources:

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com
4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
6. www.ndrs.org. physic.com
7. www.physlinc.com

8. www.fearophysic.com
9. www.hyper physics.com

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FACULTY OF SCIENCE

DEPARTMENT OF PHYSICS

COURSE: M.Sc. **SEMESTER: II**

SUBJECT NAME: Physics Practical-II **SUBJECT CODE: MSCPHP201**

Teaching & Evaluation Scheme:-

Teaching Scheme(hrs)			Evaluation Scheme								
			Theory					Practical (Marks)			
Th	Pr	Total	Sessional Exam		University Exam		Total	External	Internal	Total	Total
			Marks	Hrs	Marks	Hrs					
0	12	12	--	--	--	--	--	150	50	200	200

Objectives: -

The objective of this course is to learn

- To measure Bang gap energy of Selenium photoconduction cell,thermistor.
- Study of i/p and o/p characteristics of CB Configuration.
- Study of I-V characteristics of a solar cell,Diac,triac,LEDs.
- Verification of Truth table.
- Verification of maximum power transfer theorem.
- Class-B pushpull power amplifier,oscillator circuits etc.
- Absorption coefficient of beta particles.

More generally, the students will improve their ability to think critically, to analyze a real problem and solve it and Designing circuits using a practical knowledge of Physics.

Prerequisites:-

Before performing these practical students have basic practical knowledge of B.sc physics and component and instrument which used in laboratories.

Course outline:-

Sr. No.	Course Contents
	(Any 12 to be performed)
1	Study of ionogram and diurnal variation of Ionasphere parameters.
2	Measurement and analysis of earth's magnetic field using Proton Precession.
3	Magnetometer.
4	Bang gap energy of Selenium photoconduction cell.
5	Production of plasma and measurement of its characteristics.
6	Absorption spectra of iodine molecule.
7	Hartman's formula.
8	Study of FET as a source follower.
9	Study of i/p and o/p characteristics of transistor for a CB Configuration.
10	Study of I-V characteristics of a solar cell and find short circuit current, open Circuit voltage, fill factor and efficiency.
11	Verification of Truth table for AND &OR gate using diodes.
12	Study of I-V characteristics of Diac.
13	Study of I-V characteristics of Red, Green, Yellow and Blue LEDs and Determination of knee voltage.
14	Study of I-V characteristics of TRIAC.
15	Study of transistor as a CE amplifier and draw frequency response curve.
16	Determination of Band gap Energy of giventhermistor.
17	Verification of maximum power transfer theorem using II and T network.
18	Absorption coefficient of beta particles using A1-foils.
19	Class-B push pull power amplifier.
20	Effect of feedback on amplifier parameters.
21	Oscillator circuit using transistors.

Learning Outcomes:-

After the successful completion of the course, students will be able to

- Understand V-I characteristics of different semiconductor devices.
- Verify different truth table.
- Design different circuits.
- MeasureBang gap energy.
- Draw graphs related to these practical.
- Analyze differential equations.

Books Recommended:-

1. 'Practical Physics'**,L.Arora**, *S. Chand Comp.*
2. 'Advanced Practical Physics',**Chauhan&Sing,***PragatiPracatio.*
3. 'Experimental Physics', **University Granth.**
4. *'Nirman Board*Practical Physics',**Chattopadhya**,***Rakshit&Saha****, Current Distributors.*
5. 'Digital principles and Applications' **A.P. Malvino and D.P. Laach,** *Tata Ma-Graw Hill.*

E-Resources:-

1. www.physic.about.com
2. www.physic.org
3. www.Physicsclassroom.com
4. www.howstuffwork.com
5. www.colorado.edu/physics/2000
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7. www.physlinc.com
8. www.fearophysic.com
9. www.hyper physics.com