C. U. SHAH UNIVERSITY

WADHWAN CITY

FACULTY OF SCIENCES

B.Sc.

SEM – III

Syllabi (CBCS) of Physics WEF June 2016

C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

DEPARTMENT OF PHYSICS

COURSE: B.Sc. **SEMESTER: III**

SUBJECT NAME: Thermal Physics and Statistical Mechanics

SUBJECT CODE: 4SC03TPS1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
3	0	0	3	3	30	1.5	70	3	--	--	--	100

Objectives:-The general purpose of this course is

- To expose the student knowledge of laws of thermodynamics and their applications.
- To expose the student knowledge of thermodynamic potentials.
- To expose the student knowledge of kinetic theory of gases.
- To expose the student knowledge of statistical mechanics.

Prerequisites:-Fundamental knowledge of thermodynamics and statistical mechanics.

Course outline:-

Sr. No.	Course Contents	Hours
1	**Laws of Thermodynamics** Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_p and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle and theorem, Entropy changes in reversible and irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.	20
2	**Thermodynamic Potentials** Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications, Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (CP-CV), CP/CV, TdS equations.	08
3	**Kinetic Theory of Gases** Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.	10

4	**Statistical Mechanics** Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, comparison of three statistics.	07

Learning Outcomes:-After successful completion of this course, students have:

- Knowledge of laws of thermodynamics and their applications.
- Knowledge of thermodynamic potentials.
- Knowledge of kinetic theory of gases.
- Knowledge of properties of statistical mechanics.

Books Recommended:-

1. 'Thermodynamics', **Enrico Fermi**, Courier *Dover Publications*.
2. 'A Treatise on Heat Including Kinetic Theory of Gases, Thermodynamics and Recent Advances in Statistical Thermodynamics', **Meghnad Saha and B. N. Srivastava**, *Indian Press*, (1969).
3. 'Heat and Thermodynamics: An Intermediate Textbook' **Mark Waldo Zemansky, Richard Dittman**, *McGraw Hill.*
4. 'Thermal Physics', **S. Garg, R. Bansal and C. Ghosh**, *Tata McGraw Hill.*
5. 'Thermodynamics, Kinetic Theory, and Statistical Thermodynamics', **Francis W. Sears and Gerhard L. Salinger,** *Narosa Publication.*
6. 'Heat and Thermodynamics', **M. W. Zemasky and R. Dittman**, *McGraw Hill*.
7. 'University Physics', **Ronald Lane Reese**, *Thomson Brooks/Cole, (2003)*.
8. 'Thermal Physics', **A. Kumar and S. P. Taneja**, *R. Chand Publications*.

E-Resources:-

1. http://pms.iitk.ernet.in/wiki/index.php/Physics
2. www.wikipedia encyclopaedia
3. www.physic.about.com
4. www.physic.org
5. www.Physicsclassroom.com
6. www.howstuffwork.com
7. www.colorado.edu/physics/2000
8. www.ndrs.org. physic.com
9. www.physlinc.com
10. www.fearophysic.com
11. www.hyperphysics.com

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1. Hyper Physics.
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FACULTY OF SCIENCES

DEPARTMENT OF PHYSICS

COURSE: B.Sc. **SEMESTER: III**

SUBJECT NAME: Electricity and Magnetism **SUBJECT CODE: 4SC03ELM1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
3	0	0	3	3	30	1.5	70	3	--	--	--	100

Objectives:-The general purpose of this course is

- To expose the student knowledge of Electric field intensity, Electric flux, Electric flux density, Gauss law, proof of Gauss law, capacity of a parallel plate condenser, Biot-Savart's law, Magnetic Induction, Magnetic susceptibility, permeability, magnetic materials, Maxwell`s equations and Electromagnetic wave propagation.

Prerequisites:- Fundamental knowledge of Electricity and Magnetism.

Course outline:-

Sr. No.	Course Contents	Hours
1	**Electrostatics** Electrostatic Field, electric flux, Gauss's theorem of electrostatics, Applications of Gauss theorem, Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere, Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field, Dielectric medium, Polarisation, Displacement vector, Gauss's theorem in dielectrics, Parallel plate capacitor completely filled with dielectric.	18
2	**Magnetism** Magnetostatics: Biot-Savart's law and its applications-straight conductor, circular coil, solenoid carrying current, divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law, Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility,	10
3	**Properties of Magnetic Materials** Brief introduction of dia-, para- and ferro-magnetic materials. Hall Effect, Hall Voltage and Hall coefficient, Hall Mobility, Hysteresis loop, Energy loss due to Hysteresis.	07

4	**Maxwell`s equations and Electromagnetic wave propagation** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.	10

Learning Outcomes:-After successful completion of this course, the students have

- Knowledge of Electric field intensity, Electric Flux, Electric Flux density, Gauss Law and its proof, Capacity of a Parallel Plate Condenser, Magnetic Induction, Magnetic susceptibility, permeability and different magnetic materials, electromagnetic induction, Maxwell's equations and electromagnetic wave propagation.

Books Recommended:-

1. 'Electricity and Magnetism', **Berkeley**, *Physics Course*.
2. 'Fundamentals of Electricity and Magnetism', **Arthur F. Kip**, *McGraw Hill.*
3. 'Electricity and Magnetism', **J. H. Fewkes and John Yarwood**, *Oxford Univ. Press*.
4. 'Introduction to Electrodynamics', **David J. Griffiths**, *Benjamin Cummings*.
5. 'Electricity and Magnetism', **Edward M. Purcell**, *McGraw-Hill Education*.
6. 'Electricity and Magnetism', **D. C. Tayal**, *Himalaya Publishing House.*
7. 'Electromagnetics', **Joseph A. Edminister**, *Tata McGraw Hill*.
8. 'University Physics', **Ronald Lane Reese**, *Thomson Brooks/Cole*, (2003).
9. 'Engineering Physics', **R. K. Gaur and S. L. Gupta**, *Dhanpat Rai and Sons*.
10. 'Electromagnetics', **B. B. Laud**, *2nd Edition, Wiley Eastern Ltd.*

E-Resources:-

1. http://pms.iitk.ernet.in/wiki/index.php/Physics
2. www.wikipedia encyclopaedia
3. www.physic.about.com
4. www.physic.org
5. www.Physicsclassroom.com
6. www.howstuffwork.com
7. www.colorado.edu/physics/2000
8. www.ndrs.org. physic.com
9. www.physlinc.com
10. www.fearophysic.com
11. www.hyperphysics.com

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FACULTY OF SCIENCES

DEPARTMENT OF PHYSICS

COURSE: B.Sc. **SEMESTER: III**

SUBJECT NAME: Elements of Modern Physics **SUBJECT CODE: 4SC03EMP1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
3	0	0	3	3	30	1.5	70	3	--	--	--	100

Objectives:- The general purpose of this course is

- To expose the student knowledge of plank's theory of radiation, gamma ray microscope, size and structure of nucleus, wave physical interpretation of wave function and Eigen values and Eigen function of wave function etc.

Prerequisites:- Fundamental knowledge of Physics.

Course Outline:-

Sr. No.	Course Contents	Hours
1	Planck's quantum, Planck's constant and light as a collection of photons, Photo-electric effect and Compton scattering, De Broglie wavelength and matter waves, Davisson-Germer experiment, problems with Rutherford model, instability of atoms and observation of discrete atomic spectra, Bohr's quantization rule and atomic stability, calculation of energy levels for hydrogen like atoms and their spectra.	12
2	Position measurement-gamma ray microscope thought experiment, wave-particle duality, Heisenberg uncertainty principle, impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle, energy-time uncertainty principle, size and structure of atomic nucleus and its relation with atomic weight, Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle, nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy.	10
3	Two slit interference experiment with photons, atoms and particles, linear superposition principle as a consequence, Matter waves and wave amplitude, Schrodinger equation for non-relativistic particles, momentum and energy operators, stationary states, physical interpretation of wave function, probabilities and normalization, Probability and probability current densities in one dimension.	11
4	One dimensional infinitely rigid box-energy eigenvalues and Eigen functions, normalization, quantum dot as an example, quantum mechanical scattering and tunnelling in one dimension-across a step potential and across a rectangular potential barrier.	12

Learning Outcomes:-After successful completion of this course, students have:

- Knowledge of plank's quantum theory of radiation.

- Knowledge of gamma ray microscope and Heisenberg uncertainty principle.
- Knowledge of size and structure of nucleus.
- Knowledge of wave physical interpretation of wave function and Eigen values and Eigen function of wave function.

Books Recommended:-

1. 'Modern Physics', **R. Mrugeshan and K. ivaprasath**, *S. Chand and Comp.*
2. 'Modern Physics', **B. L. Theraja**, *S. Chand and Comp.*
3. 'University Physics', **Sears, Zeemansky and Young**, *Narosa Pub.*
4. 'A Text Book of Quantum Mechanics', ***P. M. Mathews and K. Venketeshan***, *Tata McGraw Hill Pub.*
5. 'Quantum Mechanics', **G. Aruldhas**, *Prentice-Hall of India.*
6. 'Introduction to Quantum Mechanics', **David J Griffiths**, 2nd Ed., *Pearson.*
7. 'Quantum Mechanics', **Leonard I. Schiff**, *McGraw Hill Book Co.*
8. 'Concepts of Modern Physics', **Arthur Beiser**, McGraw Hill.
9. 'Modern Physics', **John R. Taylor, Chris D. Zafiratos and Michael A. Dubson**, *PHI Learning*.
10. 'Six Ideas that Shaped Physics: Particle Behave like Waves', **Thomas A. Moore**, *McGraw Hill*.
11. 'Quantum Physics, Berkeley Physics Course', Vol.4, **E. H. Wichman**, *Tata McGraw Hill*.
12. 'Modern Physics', R.A. Serway, **C. J. Moses, and C. A. Moyer**, *Cengage Learning*.
13. 'Modern Physics', **G. Kaur and G.R. Pickrell**, *McGraw Hill*.

E-Resources:-

1. http://pms.iitk.ernet.in/wiki/index.php/Physics
2. www.wikipedia encyclopaedia
3. www.physic.about.com
4. www.physic.org
5. www.Physicsclassroom.com
6. www.howstuffwork.com
7. www.colorado.edu/physics/2000
8. www.ndrs.org. physic.com
9. www.physlinc.com
10. www.fearophysic.com
11. www.hyperphysics.com

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FACULTY OF SCIENCES

DEPARTMENT OF PHYSICS

COURSE: B.Sc. **SEMESTER: III**

SUBJECT NAME: Renewable Energy and Energy Harvesting

SUBJECT CODE: 4SC03REE1

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total Marks
					Marks	Hrs	Marks	Hrs	Pr	TW		
3	0	0	3	3	30	1.5	70	3	--	--	--	100

Objectives:- The general purpose of this course is

- To expose the students' knowledge towards need of alternative and non-conventional renewable energy sources, their optimal usage with existing non renewable energy sources and their management to reduce the pollution and make this earth more liveable for all living organisms.

Prerequisites:- Fundamental knowledge of Bachelor degree in physics.

Course Outline:-

Sr. No.	Course Contents	Hours
1	**Fossil fuels and Alternate Sources of energy** Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.	10
2	**Solar energy** Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **Geothermal Energy** Geothermal Resources, Geothermal Technologies.	12

3	**Ocean Energy** Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass. **Hydro Energy** Hydropower resources, hydropower technologies, environmental impact of hydro power sources. **Fuel Cells** Introduction, Design Principle and Operation of Fuel Cell, Types of Fuel Cells, Conversion Efficiency of Fuel Cell, Application of Fuel Cells.	11
4	**Wind Energy harvesting** Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. **Piezoelectric Energy harvesting** Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modelling piezoelectric generators, Piezoelectric energy harvesting applications, Human power **Electromagnetic Energy Harvesting** Linear generators, physics mathematical models, recent applications. Environmental issues and Renewable sources of energy, sustainability.	12

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

- To understand towards need of alternative and non-conventional renewable energy sources, their optimal usage with existing non renewable energy sources and their management to reduce the pollution and make this earth more liveable for all living organisms.

Books Recommended:-

1. 'Non-Conventional Energy Sources', **G. D. Rai**, *Khanna Publishers*.
2. 'Solar Energy: Fundamentals and Applications'**, H. P. Garg and Jai Prakash**, *Tata McGraw Hill Pub.*
3. 'Solar Energy: Principals of Thermal Collection and Storage', **S. P. Sukhatme**, *Tata McGraw Hill Pub.*
4. 'Alternative Energy Sources', **B. L. Singhal**, *Tech Max Publication.*
5. 'Solar Energy', **M. P. Agarwal**, *S. Chand and Co. Ltd*.
6. 'Magneto Hydro Dynamics', **Kuliovsky and Lyubimov**, *Addison-Wisely Pub.*
7. 'Solar Engineering of Thermal Process', **Duffic and Beckman**, *John Willy & Sons.*
8. 'Non-Conventional Energy Systems', **K Mittal**, *Wheeler Pub.*
9. 'Renewable energy resources', **Tiwari and Ghosal**, *Narosa Pub.*
10. 'Renewable Energy Technologies'*,* ***Ramesh and Kumar***, *Narosa Pub.*
11. 'Renewable Energy, Power for a sustainable future', Godfrey Boyle, *Oxford University Press*, in association with The Open University (2004).
12. 'Renewable Energy Sources and Emerging Technologies', **D. P. Kothari**, *Prentice Hall of India Pvt. Ltd.*
13. 'Non-Conventional Energy', **Ashok V. Desai**, *New Age International Publishers Ltd.*
14. 'Solar Energy: Resource Assessment Handbook', **Dr. P Jayakumar** (2009).

15. 'Photovoltaics', **J. Balfour, M. Shaw and S. Jarosek**, *Lawrence J Goodrich* (USA).
16. http://en.wikipedia.org/wiki/Renewable_energy.

E-Resources:-

1. http://pms.iitk.ernet.in/wiki/index.php/Physics
2. www.wikipedia encyclopaedia
3. www.physic.about.com
4. www.physic.org
5. www.Physicsclassroom.com
6. www.howstuffwork.com
7. www.colorado.edu/physics/2000
8. www.ndrs.org. physic.com
9. www.physlinc.com
10. www.fearophysic.com
11. www.hyperphysics.com

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FACULTY OF SCIENCES

DEPARTMENT OF PHYSICS

COURSE: B.Sc. **SEMESTER: III**

SUBJECT NAME: Physics Practical-III **SUBJECT CODE: 4SC03PPR1**

Teaching & Evaluation Scheme:-

Teaching hours/week				Credit	Evaluation Scheme/semester							
					Theory				Practical			
					Sessional Exam		University Exam		Internal		University	Total Marks
Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr	TW		
0	0	6	6	3	--	--	--	--	20	10	70	100

Objectives:-The general purpose of this course is

- To expose the student knowledge of practical related to theory.

Prerequisites:- Fundamental knowledge of physics practical.

Course outline:-

Sr. No.	Course Contents
1	To determine mechanical equivalent of heat by Callender and Barne's constant flow method.
2	Measurement of Planck's constant using black body radiation.
3	To determine Stefan's constant.
4	To determine the coefficient of Thermal conductivity of a bad conductor by Lee and Charlton's disc method.
5	To determine coefficient of thermal conductivity of Cu by Searl's method.
6	To determine coefficient of thermal conductivity of Cu by Angstrom's method.
7	Measurement of field strength B and its variation in a solenoid. (determine dB/dx)
8	To determine high resistance by Leakage method using ballistic galvanometer.
9	To study the characteristics of series RC circuit.
10	To study the series LCR circuit and determine its (a) resonant frequency and (b) quality factor Q.
11	To compare capacitances using De'sauty's Bridge.
12	To study the parallel LCR circuit and determine its (a) anti-resonant frequency (b) quality factor Q.
13	To determine the value of Boltzmann constant using V-I characteristics of P-N junction diode.
14	Photoelectric effect: Photo current v/s intensity and wavelength of light, maximum energy of photoelectrons v/s frequency of light.
15	To determine Planck's constant using LED's of at least four different colours.

* 15% of new experiments can be introduces AND/OR replaced as per the need, with the permission of the Head.

Learning Outcomes:-After successful completion of this course, students have:

- Knowledge of practical's and its application in various fields.

Books Recommended:-

1. 'B. Sc. Practical Physics', **C. L. Arora**, *S. Chand and Company Ltd*.
2. 'Advanced Practical Physics', **M. S. Chauhan and S. P. Sing**, *Pragati Prakashan*.

3. 'Experimental Physics', **University Granth Nirman Board**, (Gujarati Medium).
4. 'Physics through experiments Vol. I & II', **B. Saraf et al.**, *Vikas Publishing House*.
5. 'Advanced Practical Physics', **S. L. Gupta and V. Kumar**, *Pragati Prakashan*.
6. 'An advanced course in practical Physics', **D. Chattopadhyay and P. C. Rakshit**, *New Central Book Agency Pvt. Ltd.*
7. 'Electronic Laboratory Primer', **Poorna Chandra and Sasikala**, *S. Chand and Company Ltd*.
8. 'Advanced Practical Physics for Students', **B. L. Wosnop and H. T. Flint**, *Asia Publishing House*.
9. 'Advanced Level Physics Practicals', **Michael Nelson and Jon M. Ogborn**, 4th Ed., *Heinemann Educational Publishers*.
10. 'Engineering Practical Physics', **S. Panigrahi and B. Mallick**, *Cengage Learning India Pvt. Ltd*.
11. 'A Text Book of Practical Physics', **Indu Prakash and Ramakrishna**, 11th Ed., *Kitab Mahal*.
12. 'A Laboratory Manual of Physics for Undergraduate Classes', **D. P. Khandelwal**, *Vani Publication*.
13. 'Basic Electronics: A Text Lab Manual, **P. B. Zbar, A. P. Malvino and M. A. Miller**, *McGraw Hill*.

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4. www.physic.org
5. www.Physicsclassroom.com
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