

**Swami Ramanand Teerth Marathwada University,
Nanded**

**B.Sc. (Renewable Energy) First Year
(Academic Year 2014-2015)**

B.Sc. (Renewable Energy) (From Academic Year 2014-2015)

Objectives of the Course:-

The objectives of the B.Sc. (Renewable Energy) Course shall be as follows:-

To develop the human recourse in Renewable Energy sector which is the need of the hour.

To create the people who will teach the science of Renewable Energy, this will be also helpful for the promotion of Research in this field.

To create several self-employment opportunities in renewable energy and energy efficiency sectors for modestly-trained and self-trained human resources exist in all geographic locations of the country.

It will help to develop the skills required in renewable energy and energy management fields.

To develop proficiencies and skills for becoming successful scientist, technicians in RE sector.

To develop the expertise for the innovation of different skills and its implementation in RE Sector.

To explore the different techniques in RE sector.

Eligibility:-

Higher Secondary Certificate (10+2) or its equivalent Examination with English with any three science subjects such as Physics, Chemistry, Biology, Mathematics, etc.

Higher Secondary school Certificate (10+2) Examination with English and any of the following vocational subjects in technical group of +2 level.

Subjects are:

- Electrical Maintenance
- Mechanical Maintenance
- General Civil Engineering
- Electronics
- Computer Science
- Information Technology
- Electronics Technology

Admission Process:-

Admission process is based on the Merit as applicable to general B.Sc. course of S. R. T. M. University, Nanded

Reservation and relaxation will be as per the rules of S. R. T. M. University, Nanded and Government of Maharashtra.

Medium of Instruction:-The medium of instruction for the course shall be English.

Duration:-

The duration of B.Sc. (Renewable Energy) course shall be of Three years.

Standard of Passing:-

Standard of passing will be as per general B.Sc. degree course of S. R. T. M. University, Nanded

Rules of A.T.K.T.:-

Rules of A.T.K.T. rules will be as per general course of S. R. T. M. University, Nanded

Fees:-

Fees of the course will be decided by competent authority of university.

Qualification of Teacher:- The teachers to be appointed for B.Sc. Renewable Energy Course should be having following qualification:

M.Sc. (Physics / Chemistry / Mathematics)
M.Sc. / M-Tech (Energy Studies)
ME / M-Tech (Mechanical / Electrical with Renewable Energy Socialization)
ME / M-Tech (Energy Management & Energy Conservation)

Examination Pattern:-

1. First Year: Total Marks 1200 Marks (Semester Pattern)

800 Marks for Theory Papers

400 Marks for Practicals

Examinations will be conducted as per the University Guidelines.

Syllabus Framework :- (Structure)

1) First Year B.Sc. (Renewable Energy)

Theory Course:-

A. Physics

- i. Mechanics
- ii. Heat & Thermodynamics
- iii. Emerging Physics
- iv. Electricity & Magnetism

B. Chemistry

- i. Physical & Inorganic Chemistry
- ii. Organic & Inorganic Chemistry

C. Mathematics

- i. Algebra and Geometry
- ii. Calculus

D. Renewable Energy

i. Fundamentals of Energy Systems

ii. Energy Conversion System

The practical are to be conducted based on the theory papers.

Swami Ramanand Teerth Marathwada University, Nanded
B.Sc. (Renewable Energy) (Academic Year 2014-2015)

SEM. I (B.Sc. F. Y. course structure)

Paper code	Name of the paper	External A	Internal B	Max Marks A+B	Lecturers
Renew PHY- I	Mechanics	40	10	50	45
Renew PHY-II	HEAT AND THERMODYNAMICS	40	10	50	45
Renew CHE- I	PHYSICAL & INORGANIC CHEMISTRY	40	10	50	45
Renew CHE-II	ORGANIC & INORGANIC CHEMISTRY	40	10	50	45
Renew MATH-I	ALGEBRA AND GEOMETRY -I	40	10	50	45
Renew MATH-II	CALCULUS - I	40	10	50	45
Renew Energy -I	FUNDAMENTALS OF ENERGY SYSTEM – I	40	10	50	45
Renew energy-II	ENERGY CONVERSION SYSTEM – I	40	10	50	45
Phy Lab -I	Lab work on RENEW PHY- I&II	50	--	50	45
Che Lab I	Lab work on RENEW CHE- I&II	50	--	50	45
Renew Lab-I	Lab work on Renew Energy - I	50	--	50	45
Renew Lab-II	Lab work on Renew Energy - II	50	--	50	45

NOTE: Practical should be conducted based on respective theory papers as mentioned in the course structure. At least Ten practicals should complete for each lab. Course. Practical Course Examination shall be conducted at the end of the Year. Rules for paper setting & assessment are according to B.Sc. examinations

Marks: 50

No. of Lectures: 45

Mechanics

1. Kinematics

10

Displacement, Time and Average Velocity (x-t graph illustrations to be included), Instantaneous Velocity (Finding of velocity on an x-t graph), Average and Instantaneous Acceleration (Illustration with $v - t$ and $a - t$ graph), Motion with Constant Acceleration (Illustration with $a - t$ and $v - t$ graph), Freely Falling Bodies (Up and Down motion in fall with y-t and v_y -t graph), Position and Velocity Vectors, Acceleration Vector, Problems

2. Newton's laws of motion

05

Newton's First and Second Law and their explanation, Working with Newton's First and Second Law, Newton's Third Law of motion and its explanation with, problems, Pseudo Forces (e.g. Centrifugal Force), Problems

3. Work and Energy

08

Kinetic Energy, Work and Work-Energy Theorem, Calculation of Work done with, i) Constant Force, ii) Spring Force, Work-Energy Theorem, Potential energy Conservative and Non-conservative Forces, Change in the potential energy in a rigid body motion, Mass-energy equivalence, problems

4. Surface Tension

08

Rise of liquid in capillary tube of insufficient length, Rise of liquid in a conical capillary tube., Energy required to raise a liquid in capillary tube., Factors affecting surface tension, Jeager's Method for Determination of surface tension, Applications of Surface Tension

5. Viscosity and Fluid Mechanics

14

Fluids, Pressure in a fluid Definition of buoyancy, Steady and Turbulent Flow, Equation of continuity, Bernoulli's Principle, Application of Bernoulli's equation, i. Speed of Efflux ii. Venturi meter, iii. Aspirator Pump, iv. Atomiser or spray,

Reference Books:

1. University Physics, Sears and Zeemansky XIth edition, Pearson education.
2. Concepts of Physics H.C. Varma Bharati Bhavan Publishers
3. Problems in Physics P.K. Srivastava Wiley Eastern Ltd.
4. Applied Fluid Mechanics, Mott Robert Pearson Benjamin Cummir, VI Edition, Pearson Education/Prentice Hall International, New Delhi.
5. Properties of Matter, D. S. Mathur, Shamlal Chritable Trust New Delhi

HEAT AND THERMODYNAMICS

- 1. Basic Concepts of Thermodynamics 08**
Thermodynamic state of a system, Thermal Equilibrium, Zeroth law of Thermodynamics, Internal Energy of System-Concept of heat, Equation of State : The Ideal Gas Equation, Indicator Diagram, First law of Thermodynamics, Thermodynamic Process-Isothermal, Adiabatic, Isobaric, Isochoric, Adiabatic relations of system for perfect gas, Work done during Isothermal and Adiabatic changes,
- 2. Second Law of Thermodynamics: Entropy 10**
Conversion of Heat into Work and its converse, Reversible and Irreversible Processes, Examples of Irreversible Processes, Carnot's Cycle and Carnot's Heat Engine and its efficiency, Second law of Thermodynamics: Statements, Carnot Theorem, Entropy, Principle of Increase in Entropy, Generalised form of the First and Second laws: Entropy changes for an Ideal Gas, ii Entropy of van der Waals' gas.
- 3. Heat engines & Refrigerators 10**
Heat Engines, Otto cycle and its efficiency, Diesel cycle and its efficiency Comparison between Otto and Diesel cycle, Refrigerators: General Principle and Coefficient of performance of refrigerator & Heat Pump, The Carnot Refrigerator & Heat Pump, Simple structure of vapour compression refrigerator.
- 4. Equation of state and Thermodynamic relations 10**
Various equations of state, Andrew's experiment, Amagat's experiment van der Waals' equation of state, Critical constants, Reduced equation of state .
- 5. Thermometry 07**
Principle and Types of Thermometry, Gas filled and Liquid Filled Thermometers Problems

Reference Books:

1. Physics, 4th Edition, Volume I, Resnick/Halliday/Krane JOHN WILEY & SONS (SEA) PTE LTD.
2. Heat and Thermodynamics Mark. W. Zemansky, Richard H. Dittman Seventh Edition, McGraw-Hill International Editions.
3. Thermal Physics (Heat & Thermodynamics) A.B. Gupta, H.P. Roy Books and Allied (P) Ltd, Calcutta.
4. Heat and Thermodynamics Brijlal, N. Subrahmanyam S. Chand & Company Ltd, New Delhi.
5. Thermodynamics and Statistical Physics J.K. Sharma, K.K. Sarkar, Himalaya Publishing House.
6. Concept of Physics H.C. Verma Bharati Bhavan Publishers

PHYSICAL & INORGANIC CHEMISTRY

1. Chemical Mathematics 10
Logarithm: Rules of logarithm, Characteristic and mantissa, Change of sign Graphical representation of equations: Rules for drawing graphs, co-ordinates etc., Equation of straight lines, slope and intercept, plotting the graph from the data of chemical properties and problems.

Derivative: Rules of differentiation and partial differentiation, Algebraic, logarithmic and exponential functions and problems.

Integration: Rules of integration, Algebraic and exponential functions and problems.

2. Gaseous and Liquids State 08
Ideal and non-ideal gases, deviation of gases from ideal behavior, compressibility factor (Z), van der Waal's equation of state and its application to explain deviation of gases. Law of corresponding states. Measurable physical properties of liquid such as vapour pressure, Surface tension and viscosity and their experimental determination (One method of each).

3. Chemical Thermodynamics 10
Second law of thermodynamics, Carnot cycle, mechanical efficiency, Entropy changes for system and surroundings for reversible and irreversible processes, Entropy changes for an ideal gas in isothermal, isobaric and isochoric changes, Entropy Changes in chemical reactions. Entropy changes accompanying fusion.

4. Chemistry of hydrogen And Hydrogen bonding 08
Position of hydrogen in periodic table, Isotopes of Hydrogen, properties of Isotopes, heavy water, its preparation and applications. Types of hydrogen bonding. Effect of hydrogen bonding on physical properties of substances like. a) Physical State b) MP & BP c) Solubility d) Viscosity

5. Stoichiometry 09
Mole concept, Determination of mole wt. By gram molecular volume relationship, problems based on mole concept. Methods of expressing concentrations, strength, Normality, Molarity & Molality, ppm. Standardization of solutions, primary and secondary standard substances. Preparation of standard solution of acids and bases,

Reference Books :-(1 2 & 3)

1. Mathematical preparation for physical Chemistry By F. Daniel, Mc. Graw Hill publication.
2. University General Chemistry. By C.N. R. Rao Mc. Millan Publication.
3. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
4. Physical Chemistry. By G.M. Barrow.

Text Books (for Chapter 4)

1. Concise Inorganic Chemistry By J.D. Lee, Chapman & Hall 5th Ed. (1996) (Page No. 240 – 247)
2. Advanced Inorganic Chemistry by Satya Prakash Tuli, Basu & Madan 6th edn. (page 301 – 303, 311-318, 319-322)

3. A new guide to Modern Valency Theory by G.I. Brown (Pages 142 – 149, 154 – 160)

References: (5)

1. College Chemistry by Linus Paulling (Page 165 to 171)

2. Calculation of Analytical Chemistry by Hamilton, Simpson & Ellis 7th Edn.
(Pages 154 – 199)

3. Quantitative Inorganic Analysis by A.I Vogel. (Page 257-262)

4. Analytical Chemistry by G.D. Christian relevant pages.

F. Y. B. Sc. Semester – I Renew Chemistry-II Paper No. II
Marks: 50 No. of Lectures: 45

ORGANIC & INORGANIC CHEMISTRY

1. Chemistry of Alkanes 08

Classification, Higher Alkanes Homologous Series, Nomenclature, Physical Properties, Laboratory Methods of Preparation, Industrial Methods of Preparation, Reactions of Alkanes, Combustion, Pyrolysis, Cracking, Analysis of Alkanes.

2. Structure & Bonding in organic Molecules 08

Covalent bond, Hybridization in organic molecules (sp^3 , sp^2 , sp), bond length, bond angles, bond energies, localized & delocalized chemical bond, vander Waal's interactions, Inter & Intra molecular forces & their effects on physical properties. Structural effects like inductive, Resonance, Hyper conjugation, steric effect and Hydrogen bonding.

3. Isomerism in organic compounds 10

Concept of isomerism, type, (Structural chain, position, functional group), Representation of organic molecules – zig- zag structures, projection formulae – [Saw horse (Andiron), Newman, Fisher & Dotted – wedge], Conformational isomerism in alkanes, free rotation about carbon- carbon single bond, conformation of ethane, propane, butane, relative stability of different conformations. Optical isomers – Isomer number & tetrahedral carbon atom chirality, optical isomerism with one asymmetric carbon atom. Polarimeter, Specific rotation, Enantiomerism, R & S Nomenclature. Geometrical isomerism – Definition, conditions for geometrical isomerism, cis-trans & E-Z nomenclature, physical & chemical properties of geometrical isomerism

4. Modern Periodic table and electronic configurations of elements 12

Electronic Configuration of Elements, Aufbau principle, Hund's rule of Maximum multiplicity, $(n+1)$ rules, shapes of s, p, and d orbitals, Pauli's exclusion Principle, Heisenberg's uncertainty principle and problems based on uncertainty in velocity and position. Periodic table. Types of elements: inert gases, representative elements, transition and inner transition elements, Blocks in periodic table S, p, d & f blocks. Nomenclature of super heavy elements. periodic law periodicity in properties throughout the periodic table (Only general trends in each block.) a) Size and atoms of ions. b) Ionisation energy c) Electron affinity d) Electro negativity, Shielding effect and shielding constant.

5. Oxidation & Reduction 07

Introduction, definition of related terms like oxidation, reduction, oxidizing agent and reducing agent, Balancing of redox reactions using ion electron method and oxidation number method. Rules to find oxidation number.

References: (Inorganic Chemistry)

1. Concise Inorganic Chemistry by J.D. Lee, Chaman and Hall, 5th edn. (1996) (Pages 17 to 24).
2. Theoretical Inorganic Chemistry by Day & Selbin.
3. Chemistry by Raymond Chang (pages 292 – 314)
4. Concepts, Models of inorganic chemistry by B. Douglas & D. Mc. Daniels, J. Alexander, Mohan wiley & sons 3rd Edn (2007) Relevant Pages.

F. Y. B. Sc. Semester – I
Marks: 50

Renew Mathematics-I Paper No. I
No. of Lectures: 45

ALGEBRA AND GEOMETRY –I

- 1. Sets** **05**
Power set of a set, Product of two sets. Equivalence relations, partitions of sets, Equivalence classes
- 2. Functions** **05**
Definition of a function. Domain, co- domain and the range of a function. Review of injective, surjective and bijective functions, Composition of functions. Invertible functions and the inverse of a function. Binary operations.
- 3. Integers** **15**
Well Ordering Property (W.O.P) for \mathbb{N} ., Divisibility in \mathbb{Z} : Definition and elementary properties, Division Algorithm, G.C.D. and L.C.M of two integers. Basic properties of G.C.D. including G.C.D. for any two integers a and b if it exists, is unique, and can be expressed as $ua+vb$. Euclidean Algorithm. Primes. Euclid's Lemma, Unique factorization Theorem. Congruences: Definition and elementary properties. The set \mathbb{Z}_n . Fermat's Theorem. Euler phi-function. Addition modulo n , multiplication modulo n and its properties.
- 4. Complex Numbers** **12**
Addition and multiplication of complex numbers, Modulus and amplitude of a complex number. Real and imaginary parts and the conjugate of a complex number. Geometric representation of the sum, difference, product and quotient of two complex numbers as well as of the modulus, amplitude and the conjugate of a complex number. De-Moivre's Theorem. Roots of unity. Solutions of the equation $w^n = z$.
- 5. Polynomials** **08**
The set $\mathbb{Q}[x]$ of polynomials in one variable with rational coefficients. Division algorithm (without proof). G.C.D of two polynomial (without proof) 5.2 Remainder Theorem, Factor Theorem (with proof). Relation between the roots and the coefficients of a polynomial. Examples.

TEXT BOOKS:

1. Complex Variables and Applications: Ruel. V.Churchill; McGraw Hill Co.
2. Elementary Number Theory: David Burton; Tata McGraw Hill (Walter Rudin Series), Indian Edition.
3. Matrices : Shanti Narayan; S.Chand & Co. N. Delhi
4. Analytical Geometry of Two and Three Dimensions: Qazi Zameeruddin; Narosa Publ.

F. Y. B. Sc. Semester – I Renew Mathematics-II Paper No. II
Marks: 50 No. of Lectures: 45

CALCULUS - I

- 1. The Real Numbers** **10**
Algebraic and order properties of \mathbb{R} , Absolute Value and the Real Line, The Completeness Property of \mathbb{R} , Applications of the Supremum Property.
- 2. Sequences of Real Numbers** **25**
Sequences and their Limits, Limit Theorems, Monotone Sequences, Subsequences and Bolzano - Weierstrass Theorem, The Cauchy criterion, Properly divergent sequences, Introduction to infinite series
- 3. Limits** **10**
Limits of Functions, Limit Theorem, Some Extensions of Limit Concepts.

Text Books:

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons, 2002

Sections :

First Term: 2.1, 2.2, 2.3, 2.4, 3.1 to 3.7, 4.1, 4.2, 4.3

Second Term : 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4

2. Differential Calculus, Shantinayyan, 7th Edition, S. Chand and Co. Publication Chapter 5

Reference Books :

1. A Course in Calculus and Analysis by Sudhir Ghorpade and Balmohan Limaye, Springer 2006.

2. Principles of Mathematical Analysis, W. Rudin, Third Edition, McGraw Hill, 1976

F. Y. B. Sc. Semester – I Renewable Energy-I Paper No. I
Marks: 50 No. of Lectures: 45

FUNDAMENTALS OF ENERGY SYSTEM – I

1.CONVENTIONAL ENERGY SOURCES. 10

Energy Sources & World Energy Status :

Energy Sectors: Domestic, Transportation, Agriculture, Industry Sector, Energy Scenario, World Energy Present Situation, Availability of Conventional & Non-Conventional Energy Resources

Conventional Energy Sources : Fossil Fuel, Hydro Resources, Nuclear Resources, Coal, Oil, Gas, Thermal Power Stations, Comparison of various conventional energy systems, their prospects and limitations, Advantages and Disadvantages of Conventional Energy Sources

2. Non-Conventional Energy Sources: 10

Solar Energy, Wind Energy, Energy from Biomass & Biogas, Ocean Thermal Energy Conversion, Tidal Energy, Geothermal Energy, Hydrogen Energy, Fuel Cell, Magneto Hydro-Dynamics Generator, Advantages & Limitations of Non-Conventional Energy Sources

3. Fluid Properties and Classification of Fluid 08

Viscosity, Newton's law of viscosity, Newtonian and Non-Newtonian Fluids, Ideal and Real fluids, Steady & Unsteady Flow, Uniform & Non-Uniform Flow, Laminar & Turbulent Flow, Compressible & Incompressible Flow, Surface tension, Definitions, units and dimensions

4. Fluid Pressure & Its Measurement 08

Definition of pressure, units and dimensions, Pressure at a point, Pascal's law, Hydrostatic pressure law, Absolute and Gauge pressure Measurement of pressure, Simple Manometer & Differential Manometer theory and problems, Mechanical Pressure Gauges

5. Dynamics of Fluid Flow 09

Concept of Inertia force and other forces causing motion, Derivation of Euler's equation and, Modification of Bernoulli's equation, problem on Bernoulli's equation without and with losses, Flow through Orifices; classification, Hydraulic Co-efficient of an Orifice and relation between them,

REFERENCES (CONVENTIONAL & NON- CONVENTIONAL ENERGY)

1. Non-Conventional Energy Sources, **G. D. Rai, Khanna Publication.**
2. Non-Conventional Energy Resources, **B. H. Khan, The McGraw Hill Publishers.**

FLUID MECHANICS

REFERENCE BOOKS:

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S. K. Kataria & Sons
2. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan
3. Theory and Applications of Fluid Mechanics by K. Subramanya, TMH outline series, Tata McGraw Hill Publishing Company

F. Y. B. Sc. Semester – I Renewable Energy-II Paper No. II
Marks: 50 No. of Lectures: 45

ENERGY CONVERSION SYSTEM – I

1. ELEMENTS OF ELECTRO-MECHANICAL ENERGY CONVERSION

Introduction, Salient aspects of conversions, Energy- Balance, Magnetic-field System; Energy and Co-energy, A Simple Electromechanical System, Energy in Terms of Electrical Parameters, Rotary Motion, Dynamic Equations and system-model of a simple system

2. D.C. GENERATORS

Simple Loop Generator, Practical Generator, Yoke, Pole Cores and pole shoes, Pole Coils, Armature Core, Armature Windings, Commutator, Brushes and Bearings, Armature windings, Pole-pitch, Conductor, Types of Generators, Separately-excited, Self-excited generators : Shunt Wound, Series Wound, Compound Wound, Measurement of Generator Efficiency, Irons Loss in Armature, Hysteresis Loss (W_h), Eddy Current Loss (W_e) , total Loss in a D.C. Generator, Copper Losses, Magnetic Losses, Mechanical Losses, Stray Losses, Constant or Standing Losses.

3. GENERATOR CHARACTERISTICS

Characteristics of D. C. Generators, Separately-excited Generator, (i) No-load Saturation Characteristics, (ii) Load Saturation Curve, Internal and External Characteristics

4. D. C. MOTOR

Motor Principle, Comparison of Generator and Motor Action, Significance of the Back e.m.f., Voltage Equation of a Motor, Condition for Maximum power Torque, Armature Torque of Motor, Shaft Torque, Speed of D. C. Motor Speed Regulation, Torque and Speed of D. C. Motor,

5. Motor Characteristics:

Motor Characteristics, Characteristics of Series Motors, Characteristics of Shunt Motors, Compound Motors, Cumulative-compound Motors, Differential-Compound, Performance Curves, Shunt Motor, Series Motor, Comparison of Shunt & Series Motors, Power Stages

Reference Book:

1. Text Book of “**Electrical Technology**” Vol. II, B.L. Theraja & A.K. Theraja, S. Chand Publications.
2. “**Electrical Machines**” by P. S. Bhimbra

Swami Ramanand Teerth Marathwada University, Nanded
B.Sc. (Renewable Energy) FY (Academic Year 2014-2015)
SEM –II (B.Sc. F. Y. course structure)

Paper code	Name of the paper	External A	Internal B	Max Marks A+B	Lecturers
Renew PHY- III	Emerging Physics	40	10	50	45
Renew PHY-IV	Electricity and Magnetism	40	10	50	45
Renew CHE- III	PHYSICAL & INORGANIC CHEMISTRY	40	10	50	45
Renew CHE-IV	ORGANIC & INORGANIC CHEMISTRY	40	10	50	45
Renew MATH- III	ALGEBRA AND GEOMETRY – II	40	10	50	45
MATH- IV	CALCULUS - II	40	10	50	45
Renew energy- III	FUNDAMENTALS OF ENERGY SYSTEM - II	40	10	50	45
Renew energy- IV	ENERGY CONVERSION SYSTEM – II	40	10	50	45
Phy Lab - II	Lab work on Renew PHY- III&IV	50	--	50	45
Che Lab II	Lab work on Renew CHE- III&IV	50	--	50	45
Renew Lab-III	Lab work on Renew energy - III	50	--	50	45
Renew Lab-IV	Lab work on Renew energy - IV	50	--	50	45

NOTE: Practical should be conducted based on respective theory papers as mentioned in the course structure. At least Ten practicals should complete for each lab. Course. Practical Course Examination shall be conducted at the end of the Year. Rules for paper setting & assessment are according to B.Sc. examinations

EMERGING PHYSICS

1. History and Philosophy of Physics

07

Introduction to the specific meaning of the world modern as in ‘Modern Physics’

Physics of 18th Century – Newton, Boyle and Young, Thompson, Coulomb, Amperes, Gauss, Biot – Savarts, Cavendish, Galvani, Franklin, Lagrange and Bernoulli, Physics of 19th century – Volta, Dalton, Michael Faraday, Ohm, Oersted, Hamilton, Maxwell, J. J. Thomson, Clausius, Hall, Boltzmann, Joule, Michelson Morley expt, Miller, Tesla, Roentgen, Pierre and Marie Curie, Becquerel , Physics of 20th century – Rutherford, Larmour, Lorentz, Einstein, Planck, Bohr, William, Bragg, Chadwick, Heisenberg, Fermi, Edwin Hubble, Karl Jansky, George Gamow, Pauli, Dirac, Max Born, Felix, Bloch, Ernest Lawrence, Shockley, Brattain, and Bardin, Fred Hoyle, Richard Feynman, Robert Mills, Murray Gell-Mann, Glashow, Abdus Salam, Steven Weinberg, K Onnes, A. Fert and Grunberg, Stephan Hawking, Indian Scientists : Bose, Raman, Saha and Chandrasekhar, C. N. R. Rao.

2. Lasers and Laser applications

12

A brief history of lasers, Einstein prediction : The Three Processes, Einstein’s relations (qualitative discussion only), Pumping schemes Characteristics of Types of lasers : 1. Ruby laser, 2. He-Ne, Applications of lasers

3. Sensors and Transducers

12

Overview – need, definition and qualities of transducers, Temperature – thermocouples, thermistors, platinum resistance thermometer, IC temperature sensors, quartz thermometer, pyrometers, cryogenic temperature measurements, Light Sensors- Photodiodes, Phototransistors, and Photomultipliers

4. Bioelectricity

07

Electricity observed in living systems, Origin of bioelectricity, Sodium and potassium transport, Resting potential and action potential, Nernst’s equation
Conduction velocity, Origin of compound action potential, Neuron structure and function, An axon as cable, Membrane resistance and capacitance

5. Nanomaterials

08

Introduction, Reduction of dimensions 3D, 2D, 1D, 0D materials, Surface and Interface effect, Modelling of quantum size effect, Synthesis of nano particles – Bottom Up and Top Down approach, Wet Chemical Method, Idea of Biomimicking, naturally occurring nanocrystals

SECTION – I (EMERGING PHYSICS)

Reference : History and Philosophy of Physics

1. [http://en.wikipedia.org/wiki/History of Physics](http://en.wikipedia.org/wiki/History_of_Physics)
2. [http://en.wikipedia.org/wiki/Nobel Prizes in Physics](http://en.wikipedia.org/wiki/Nobel_Prizes_in_Physics)

LASERS AND LASER APPLICATIONS

References:

1. An introduction to Lasers – Theory and Applications M. N. Avadhanalu, S. Chand and Co, Ltd.
2. Solid State Physics P. K. Palanisamy, Scitech Publications (India) Pvt. Ltd

SENSORS AND TRANSDUCERS

References:

1. Instrument measurement and Analysis by B. C. Narka and K. K. Chaudhary, Tata McGraw Hill Publishing Company 16th reprint Chapter 1.

BIOELECTRICITY

Reference :

1. From Neuron to Brain, Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland, Massachusetts

NANOMATERIALS

References :

1. Nanomaterial- Synthesis, Properties and Applications - Edelstein, Camarata, Institute of Physics Publishing, Bristol and Philadelphia.
2. Introduction to Nanotechnology Charles P. Poole Jr, Frank J. Owens John Wiley and Sons publications.
3. Physics Education Vol. 14, No. 4, Jan – March 1998.
4. Nanotechnology : Principles and Practices S. K. Kulkarni, Capital Publishing Company.

ELECTRICITY AND MAGNETISM

1. Electrostatics

12

Vector form of Coulomb's law for like and unlike charges., Superposition principle, Statement and explanation with illustration, Illustrations with specific configuration of three charges (triangular form) and four charges (square form), Problems on superposition principle, Energy of the system of charges, Illustration with three charges Concept of electric field, Electric field due to point charge, Electric field due to group of charges, Lines of force, Relation between electric intensity and electric potential, Concept of electric flux, Gauss's theorem in electrostatics (statement only and explanation),

2. Dielectrics

10

Electric Dipole, Electric dipole and dipole moment, Electric potential due to dipole, Electric intensity due to dipole, Torque on electric dipole in external electric field, Polar and non – polar molecules with examples, Dielectric materials, Electric polarization of dielectric material, Electric polarization vector, Strength of dielectric material and Dielectric breakdown, Electric displacement and Gauss law in dielectric, Relation between three electric vectors (E, D and P)

3. Magnetostatics

05

Concept of magnetic field: Definition and properties of magnetic field, Revision of Biot – Savart's law: 1. Long straight conductor. 2. Current carrying circular loop on the axis, Ampere's circuital law: Field of solenoid, Field of toroidal solenoid, Magnetic Field lines and Magnetic flux,

4. Magnetic Properties Of Material

10

Magnetic Materials, Bohr magneton, Magnetisation (M), Magnetic Intensity (H) and magnetic induction (B), Magnetisation and Susceptibility and magnetic permeability, Relation between B, M and H (without derivation, qualitative discussion only), Diamagnetic, paramagnetic and ferromagnetic. Explanation with the help of susceptibility and permeability, Hysteresis

5. Transient Currents

08

Transient currents, Growth of current in an inductive (LR) circuit, Decay of current in an inductive circuit, Physical meaning of time constant, Charging of condenser through resistance, Discharging of condenser through resistance, Time constant

ELECTRICITY AND MAGNETISM

Reference books:

1. Berkeley Physics Course – Vol. – II Electricity and Magnetism. Edward M. Purcell.
2. University Physics – H.D. Young R. A. Freedman Pearson – Freedman.
3. Resnick and Halliday, Physics Vol. – II.
4. Electromagnetics by B.B.Laud.

F. Y. B. Sc. Semester – II Renew Chemistry-III Paper No. III
Marks: 50 No. of Lectures: 45

PHYSICAL & INORGANIC CHEMISTRY

1. Atomic structure

11

Historical Development, Dalton's atomic theory, Limitation of Dalton's atomic theory, Electron, its discovery and properties, e/m ratio of electron by Thomson's method. Charge on electron by Milliken's oil drop method. Proton- its discovery and properties, 'Thomson's Atomic model and its drawbacks. Rutherford's alpha particles scattering experiments, Rutherford's atomic model and its drawbacks. Prouty's hypothesis, Moseley experiment and its importance. The Neutron – its discovery and properties, atomic spectra. Ritz – combination principle. Bohr's model of hydrogen atom, postulates, derivation for its radius and energy. Application of Bohr's theory, spectra and ionization potential of hydrogen, Quantum numbers, Pauling's Exclusion principle.

2. Colloids

06

Preparation, purification, Optical properties. Tyndall effect, shape and size, stability, solvation, interaction amongs colloids, solution, emulsions and gels. Applications of colloids.

3. Catalysis

08

Catalyst and catalysis, positive and negative catalysis, Types of catalysis, Characteristics of catalytic reactions, promoters, Catalytic poisoning*, Theories of catalysis, Active centres on catalyst surface, Adsorption theory and catalytic activity. Acid – Base catalysis. Enzyme catalysis, Mechanism of enzyme catalysis, characteristics of enzyme catalysis. Applications of catalysis in industries. Autocatalysis, Activation energy and catalysis.

4. Chemical bonding and structure

10

Attainment of stable configuration. . Types of bonds a) ionic, b) covalent c) Coordinate d) Metallic. Types of overlap, formulation of σ and π bonds S – S overlap, PP overlap, p-d overlap with suitable examples. Theories of bonding, Valence bond theory, Hitler London theory and Pauling Slater theory.

5. Concept of hybridization

10

Definition, need of hybridization, steps involved in Hybridization. Explanation of covalency of atoms in the molecules on the basis of hybridization. Types of hybridization involving S, P orbitals and S, P, d, orbitals. Applications of hybridization concept, geometries of molecules like BeF_2 , CH_4 , BF_3 , SiCl_4 , PCl_5 , IF_7 , SF_6 , $[\text{Ni}(\text{CN})_4]^{2-}$ VSEPR theory, Assumptions, need of theory, application of the theory to explain geometry of irregular molecules like H_2O , NH_3 , TiCl_4 , ClF_3 , ICl_2 , BrF_3 , BrF_5 , OF_2 .

Reference Books For second term.

1. University General Chemistry. By C.N. R. Rao. Mc Millan Publication.
2. Principles of Physical Chemistry. By Maron and Pruton 4th Ed. Oxford and IBH publication.
3. Physical Chemistry. By G.M. Barrow.

References:

1. Concise Inorganic Chemistry by J.D. Lee 5th Edn. (page No. 30 to 36, 90 – 96)
2. A new guide to modern valency theory by G.I. Brown (Pages 106, 114, 165 – 168)

References:

1. Concise Inorganic Chemistry by J.D. Lee 5th edn. (Page 30-36, 72-96)
2. Basic Inorganic Chemistry by Cotton & Wilkinson.
3. Inorganic Chemistry – Principles of structure and reactivity by J.E. Huheey, E.A. Keiter, R.L. Keiter, U.k. Medhi, 1st impression (2006) Pearson Education Publishers (Pages 117 – 170) and (171-190)
4. New guide to modern valence Theory By G.I. Brown (Pages 106-114, 165-168).

F. Y. B. Sc. Semester – II Renew Chemistry-IV Paper No. IV
Marks: 50 No. of Lectures: 45

ORGANIC & INORGANIC CHEMISTRY

1. Alkenes, Dienes & Alkynes & Halogen derivatives of Alkanes 10

Alkenes: Introduction, higher alkenes, Nomenclature, physical properties, preparations, Reactions of alkenes, Analysis of Alkenes. Dienes: Structure & Properties, Conjugated dienes, Reactions of dienes, analysis of dienes. Alkynes:- Introduction, Nomenclature, Physical properties, preparation, Reactions & analysis of alkynes Introduction & Classification of Halogen derivatives, Structure of alkyl halides, Classification, Nomenclature, physical properties, preparation, reactions, analysis of alkyl halides.

2. Alcohols & Ethers 10

Alcohols: - Introduction, physical properties, Reactions of alcohols. Industrial sources of ethyl alcohol, proof, spirit, denatured spirit, absolute alcohol, analysis of alcohols.

3. Benzene, its Reactions & Phenols 10

Structure of benzene, Kekule structure, stability of benzene. Reactions of benzene, aromatic character, Huckel rule, Nomenclature of benzene derivatives, sulphonation, halogenation, Friedal – Crafts reactions of benzene. Structure, classification, Physical properties. Nomenclature, Preparation of phenols, industrial source, Laboratory methods. Reactions of Phenols Nitration, Sulphonation, Halogenation, nitrosation, carbonation (Kolbe synthesis,) Reimer –Tiemann reaction & analysis of phenols.

4. Chemistry S. Blocks Elements 10

Position of elements in periodic Table, Electronic configuration, Periodic trends in Properties viz. size of atom, ion, oxidation state, ionization potential, & reactivity. Anomalous behavior of Li, Be Diagonal relationship between Li & Mg. Industrial biological and Agricultural applications of these elements & their Compounds, Crown ethers, Separation of these elements using Crown ethers. Solution of these metals in liquor NH₃

5. Chemistry of Noble Gases 05

Position of these elements in periodic table, Electronic configuration. Chemical Properties of Noble Gases. Chemistry of xenon structure and bonding in xenon compounds. XeF₂, XeF₄, XeO₆, XeO₄, XeO₂ F₂, [XeO₆]₄, XeOF₄.

List of Reference Books (Organic Chemistry)

1. Ref. 1 Organic Chemistry by Clayden, Oxford uni.press.
2. Ref. 2 Organic Chemistry by Morrison & Boyd, 6th Edition.
3. Ref. 3 A guide book to Mechanism in Organic Chemistry by Peter Sykes, 6th Edition.

Text Book:- (6) – Inrganic Chemistry

1. Concise inorganic Chemistry by J.D. Lee, Chapman & Hall 5th Edn. (1996) (Page No. 273, 281, 302, 308, 325, 326, 329, 335 and 353)

Ref Books:- (7) - Inorganic Chemistry

1. Concise Inorganic Chemistry by J.D. Lee Chapman and hall 5th edn. (1996) pages (635 – 647)
2. Concepts and Models of Inorganic Chemistry by B. Douglas & D. Mc. Daniels Alexander Mohan Wiley & sons 3rd Edn. (2007) Relevant pages.
3. Inorganic Chemistry Principles of structure & reactivity By James Huheey, Keiter, Medhi (Pearson Education) Pages 342-348.

F. Y. B. Sc. Semester – II Renew Mathematics-III Paper No. III
Marks: 50 No. of Lectures: 45

ALGEBRA AND GEOMETRY –II

- 1. Analytical Geometry of Two Dimensions 10**
Change of axes: translation and rotation. Conic Sections: General equation of second degree in two variables. Reduction to standard form. Centre of conic. Nature of conic..
- 2. Analytical Geometry of Three Dimensions 15**
Review of Co-ordinates in 3-space. Direction cosines and direction ratios. Every linear equation in x, y, and z represents a plane. Equations of coordinate planes. Normal form of equation of a plane. Plane passing through three non-collinear points. Intercept form of equation of a plane. Distance of a point from a plane. Distance between parallel planes. Systems of planes. Bisector planes. Equations of a line in various forms. Symmetric and unsymmetric forms of the equations of a line. Line passing through two points. Angle between a line and a plane. Perpendicular distance of a point from a plane. Condition for two lines to be coplanar. Skew lines and shortest distance between skew.
- 3. Sphere 10**
Equation of a sphere in different forms, plane section of a sphere, Equation of a circle. Sphere through a given circle. Intersection of a sphere and a line. Equation of tangent plane to standard sphere and general sphere.
- 4. System of Linear Equations 10**
System of m linear equations in n unknowns; Homogeneous systems, Non homogeneous system, Matrix form of System of Equations, Echelon form; row reduced echelon form of a matrix, Definition of rank of a matrix. Examples. Gauss Elimination Method. Consistency of a system of non homogeneous equations; Condition of consistency i.e. for $AX = B$, $\rho [A, B] = \rho [A]$ (without proof).

TEXT BOOKS:

1. Complex Variables and Applications: Ruel. V.Churchill; McGraw Hill Co.
2. Elementary Number Theory: David Burton; Tata McGraw Hill (Walter Rudin Series), Indian Edition.
3. Matrices : Shanti Narayan; S.Chand & Co. N. Delhi
4. Analytical Geometry of Two and Three Dimensions: Qazi Zameeruddin; Narosa Publ.

F. Y. B. Sc. Semester – II Renew Mathematics-IV Paper No. IV
Marks: 50 **No. of Lectures: 45**

CALCULUS – II

1. Continuous Functions	15
Continuous Functions, Combinations of Continuous Functions, Continuous functions on intervals	
Differentiation	15
The Derivative, The Mean Value Theorem, L' Hospital's Rules, Successive Differentiation, Taylor's Theorem	
Unit III:- Riemann Integral	15
Riemann Integral, Rieman Integrable functions , fundamental theorem.	

Text Books:

1. Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, Third Edition, John Wiley and Sons, 2002

Sections:

First Term: 2.1, 2.2, 2.3, 2.4, 3.1 to 3.7 , 4.1, 4.2, 4.3

Second Term: 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.4

2. Differential Calculus, Shantinarayan, 7th Edition, S. Chand and Co. Publication Chapter 5.

Reference Books:

1. A Course in Calculus and Analysis by Sudhir Ghorpade and Balmohan Limaye, Springer 2006.

2. Principles of Mathematical Analysis, W. Rudin, Third Edition, McGraw Hill, 1976.

F. Y. B. Sc. Semester – II RENEWABLE ENERGY-III Paper No. III
Marks: 50 **No. of Lectures: 45**

FUNDAMENTALS OF ENERGY SYSTEM - II

1. THERMODYNAMICS Introduction & Laws of Thermodynamics (First & Second) 10

Basic Concepts : System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Thermodynamic Equilibrium, Property, Process Cycle – Reversibility – Quasi – static Process, Types, Work and Heat, Point and Path function, Concept of quality of Temperature, Principles of Thermometry, Const. Volume gas Thermometer, Ideal Gas Scale, Joule’s Experiments, Steady Flow Energy Equation, Limitations of First Law of Thermodynamics, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Perfect Gas Laws, Specific and Universal Gas Constants, Heat and, Work Transfer, changes in Internal Energy, Throttling and Free Expansion, Processes, Flow processes, Deviations from perfect Gas Model, , Mixtures of perfect Gases, Avogadro’s Laws of additive volume, Dalton’s and Amagat’s laws

2. HEAT TRANSFER (and) 12

Conduction: Various modes of Heat Transfer, Mechanisms of Different Modes of Heat Transfer, Fourier’s Law of Heat Conduction, Conductivity, Electrical, Analogy, Concept of Thermal Resistance, Introduction to Newton’s Law of Cooling, **Convection:** Basic concept: convective type heat transfer coefficient, Boundary layer concept, Type of convection, Forced convection, Types of convective Flow, Nusselt Theory.

3. Radiation, Heat Exchanger & Insulation 08

Basic Concepts, Laws of Radiation, Stefan Boltzmann Law, Kirchoff Law Black Body Radiation Classification of Heat Exchangers, Overall Heat Transfer Coefficient, Fouling Factor, Design & Selection of Heat Exchanger, Classification of Insulation, Types of Insulation Material, Economic Thickness of Insulation

4. REFRIGERATION & AIR CONDITIONING 10

Introduction : First and Second law applied to refrigerating, machines, Unit of , refrigeration, COP, EER, **Air Refrigeration:** Air refrigeration cycle, Reverse Carnot cycle, Bell-Coleman cycle, Thermodynamic processes, Types of Air refrigeration system, Simple, Boot Strap, Regeneration,. **Vapour Compression Cycle:** Thermodynamic processes in VCC, Compound vapour Compression System: Need of compound compression, Two and Three Stage Compressions: Various arrangements for improvement in C.O.P., Multiple Evaporator System

5. Refrigerants 05

Desirable properties of refrigerant : R-12, R-22, R-717, R-134, Butane recent substitute for refrigerants

THERMODYNAMICS

TEXT BOOKS:

1. Engineering Thermodynamics / PK Nag /TMH, III Edition
2. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen /

John Wiley & sons (ASIA) Pvt. Ltd.

REFERENCES:

1. Engineering Thermodynamics – Jones & Dugan
2. Thermodynamics – An Engineering Approach – Yunus Cengel & Boles /TMH
3. Thermodynamics – J.P.Holman / McGrawHill
4. An introduction to Thermodynamics / YVC Rao / New Age

For more details, visit [Http://www.jntu.ac.in/](http://www.jntu.ac.in/)

REFRIGERATION & AIR CONDITIONING

REFERENCES:

1. Refrigeration and Air Conditioning, Arora C. P., Tata McGraw Hill Publications.
2. Principles of Refrigeration, Dossat R. J., Prentice Hall Publications.
3. Refrigeration and Air Conditioning, Domkundwar, Dhanpat Rai Publications.
4. Refrigeration and Air Conditioning, Ballany P.L., Khanna Publications
5. Air Conditioning System design Handbook, Carrier Corporation, USA

DIGITAL REFERENCES:

1. www.science direct.com
 2. www.Howstuffworks.com
- www.efunda.com

HEAT & MASS TRANSFER

REFERENCES:

1. Sachdeva R C, “Fundamentals of Engineering Heat and Mass Transfer” New Age International, 1995
2. Yadav R “Heat and Mass Transfer” Central Publishing House, 1995.
3. Heat Transfer, S.P. Sukhatme.
4. Heat Transfer, P.K. Nag, Tata McGraw Hill 2002 Publications.
5. Heat Transfer, R C Sachdeva.
6. Thermal Insulation and Refractories -PCRA.
7. Insulation and Refractories - British Energy Efficiency Office.

F. Y. B. Sc. Semester – II RENEWABLE ENERGY-IV Paper No. IV
Marks: 50 No. of Lectures: 45

ENERGY CONVERSION SYSTEM - II

1. SPEED CONTROL OF D.C. MOTORS

08

Factors Controlling Motor Speed, Speed Control of Shunt motors, Variation of flux or Flux Control Method, Armature or Rheostatic Control Method, Voltage Control Method, Speed Control of series Motors, Flux Control Method, Variable Resistance in series with motor, Measurement of Motor Efficiency

2. TRANSFORMER

08

Working principle of a Transformer, Transformer Construction, Core-type transformers, Shell-type Transformers, Elementary Theory of an ideal, Transformer, DM.F. Equation of Transformer, Voltage Transformation Ratio (K), Transformer with losses but no magnetic Leakage, Transformer on No-load, Transformer on load, Transformer with winding resistance but no Magnetic Leakage, Magnetic leakage, Transformer with resistance and leakage reactance, Estimation of Transformer Efficiency (at Full Load & Actual Load)

3. TRANSFORMER THREE PHASE

06

Three-phase Transformer connections, Star/star or Y/Y Connection, Delta-Delta or – Connection, Wye/Delta or Y/ Connection, Delta / Wye or Y/Connection

4. INDUCTION MOTOR

12

Classification of A.C. Motors, Induction Motor : General Principle, Construction, Squirrel-cage rotor, Phase-wound rotor, Production of Rotating field, Three-Phase supply, Mathematical proof, Slip, Frequency of rotor current, Starting Torque of a squirrel-cage motor, Starting Torque of a slip-ring motor, Torque/Speed Curve, Current /speed curve of an induction motor.

5. SINGLE-PHASE MOTORS

11

Types of single-phase motors, Single-phase induction motor, Double-field revolving Theory, Making single-phase induction motor self-starting, Types of capacitor-start motors, Single-voltage, externally-reversible motors, single-voltage, non-reversible type, Two-voltage, non-reversible Type, Two-voltage, reversible type, single-voltage, single-voltage, instantly-reversible type.

Reference Book:

1. Text Book of “**Electrical Technology**” Vol. II, B.L. Theraja & A.K. Theraja, S. Chand Publications.
2. “**Electrical Machines**” by P. S. Bhimbra.