Indira Gandhi Delhi Technical University For Women

(Established by Govt. of Delhi vide Act 09 of 2012)
(Formerly Indira Gandhi Institute of Technology)
Kashmere Gate, Delhi-110006

Course Structure for B. Tech First Year
(Common courses for all B. Tech Programs)

First Semester					
S. No.	**Code**	**Subject**	**L-T-P**	**Credits**	**Category**
1.	BAS-101	Applied Mathematics-I	3-1-0	4	**BAS**
2.	BAS-103	Applied Physics-I	2-1-2	4	**BAS**
3.	BAS-105	Applied Chemistry	2-1-2	4	**BAS**
4.	BMA-110/ BEC-110	Engineering Mechanics/ Basic Electrical Engineering	3-0-2	4	**OEC**
5.	BMA-120/ BMA-130	Workshop Practice/ Engineering Graphics Lab	0-1-2	2	**OEC**
6.	HMC-110/ BCS-110	Humanities and Social Science/ Programming in C Language	3-1-0/ 3-0-2	4	**HMC/ OEC**
		Total		**22**	
Second Semester					
S. No.	**Code**	**Subject**	**L-T-P**	**Credits**	**Category**
1.	BAS-102	Applied Mathematics-II	3-1-0	4	**BAS**
2.	BAS-104	Applied Physics-II	2-1-2	4	**BAS**
3.	BAS-106	Environmental Science	2-1-2	4	**BAS**
4.	BEC-110/ BMA-110	Engineering Mechanics/ Basic Electrical Engineering	3-0-2	4	**OEC**
5.	BMA-130/ BMA-120	Workshop Practice/ Engineering Graphics Lab	0-1-2	2	**OEC**
6.	BCS-110/ HMC-110	Programming in C Language / Humanities and Social Science	3-0-2/ 3-1-0	4	**HMC/ OEC**
		Total		**22**	

APPLIED MATHEMATICS – I	
Course Code: BAS-101 Contact Hours: L-3 T-1 P-0 Course Category: BAS	Credits: 4 Semester: 1

Introduction: Mathematics is used in almost every field of engineering be it computer science and information technology wherein it may be used in modeling, machine learning, image processing etc., or by electrical engineers for signal processing, control engineering or by mechanical engineers for design, modeling, manufacturing etc. But the problem faced by engineers is to how to apply the basic mathematical concepts in engineering problem which they would be dealing in coming years. The course covers the various topics of engineering mathematics such as matrices, sequences and series, calculus of functions of more than one variable and vector calculus.

Course Objective:

- The students will be made familiar with the concepts of matrices, sequences and series.
- To provide students with skills and knowledge of calculus of functions of several variables and vector calculus which would enable them to devise solutions for given situations they may encounter in day to day engineering problems.

Prerequisite: Fundamentals of matrices, calculus of functions of single variable, vectors.

Course Outcomes:

Having successfully completed this course, the student will be able to

- Build a sound foundation and have comprehensive knowledge of matrices, Infinite series, Fourier series, calculus of functions of more than one variable and vector calculus.
- Evaluate rank, inverse, Eigen values and Eigen vectors of a matrix.
- Determine the convergence/divergence of an infinite series, approximation of functions and error estimation using Taylor's series expansion.
- Analyze some mathematical problems encountered in engineering applications.
- Learn various concepts and applications of maxima and minima, multiple integrals, gradient, divergence, curl, Green's theorem, Gauss divergence theorem and Stoke's theorem.

Pedagogy: Apart from class room teaching, main focus is to enhance problem solving ability supported by weekly assignments and discussing individual's doubts.

Contents

UNIT-I	10 Hours
Matrix Algebra: Elementary operations and their use in getting the rank, Inverse of a matrix and solution of linear simultaneous equations, orthogonal, symmetric, skew-symmetric, hermitian, skew-hermitian, normal & unitary matrices and their elementary properties, linear transformations, eigen values and eigenvectors of a matrix, Cayley Hamilton theorem, diagonali-zation of a matrix.	
UNIT-II	12 Hours
Sequences and series: Introduction to sequences and Infinite series, tests for convergence/divergence, Limit comparison test, ratio test, root test, Raabe's test, log test, Gauss's test, Cauchy integral test, alternating series, absolute convergence and conditional convergence. Fourier series and its convergence, Fourier half range series.	
UNIT-III	10 Hours
Differential Calculus: Functions of several variables: Limits, continuity and differentiability, Successive differentiation, Leibnitz theorem, Partial differentiation, Euler's Theorem for homogenous equations. Composite functions, Change of variables, Taylor's and Maclaurin's Series, maxima and minima, Lagrange's method of undetermined multiplier.	
UNIT-IV	10 Hours
Vector Calculus : Vector point functions, Gradient, Divergence and Curl and their physical interpretation, Line integrals, Multiple Integrals, Change of order of integration, Surface and Volume integrals, Green's, Gauss Divergence and Stoke's theorems (without proof).	

Text Books	
1.	D. G. Zill and W. S. Wright, "Advanced Engineering Mathematics", 6th Edition, The Jones and Bartlett Learning Publishers, 2016.
2.	Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House Pvt. Ltd.2012.
3.	Grewal, B. S. , "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017
Reference Books	
1.	George B. Thomas Jr., Ross L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson Education India, 2010
2.	Greenberg M., "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, 1998.
3.	Kreyszig E. , "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2010.

APPLIED PHYSICS - I	
Course Code: BAS-103 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: 1

Introduction: Applied physics is a subject rooted in the basic concepts of the physics with the utilization of scientific principles in various technological applications, devices and systems. The course covers the wide ranging topics of the physics which form the underlying principles of classical mechanics, quantum mechanics, optics and its applications. The syllabus is a perfect blend of classical laws with modern devices which will enhance the ability of students to apply fundamentals to various applications.

Course Objectives:

- To introduce the students with the wide ranging topics of the physics which form the underlying principles of classical mechanics, quantum mechanics, optics and its applications.
- To develop their ability of solving real world problems, going a step ahead of what they have studied in school.
- To impart them an in-depth knowledge of everyday systems and phenomena surrounding them and underlying principles of physics behind those phenomenon.
- To enhance the ability of students to apply fundamentals to various applications.

Pre-requisites: None

Course Outcomes:

Having successfully completed this course, the student will be able to

- Gain knowledge and comprehend various fundamentals of physics.
- Build a sound foundation of applications of physics.
- Identify and analyze relationship between different principles of physics and integrate them for various applications.
- Evaluate and apply the quantitative and qualitative aspects of physics to innovate devices in the constantly competitive Technologies.

The comprehensive list of experiments in the lab will correlate and enhance the analytical skills and develop the ability of the students to think beyond the usual.

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with periodic tutorial classes to enhance the problem-solving ability.

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Theory Contents

UNIT-I	7 Hours
Unit 1: Classical Mechanics Simple Harmonic Oscillator, Damped Harmonic Oscillator, Forced Harmonic Oscillator, Coupled Oscillations (Two body mass-spring problem), Central and Non-Central Forces.	
UNIT-II	7 Hours
Optics: Coherent Sources, Temporal and Spatial Coherence, Interference due to Division of wave-front and Division of Amplitude, Interference in Parallel Thin Films, Newton's Rings, Fresnel Diffraction at Straight Edge, Fraunhoffer Diffraction due to Single Slit, N Slits, Diffraction Grating. Polarization, Double Refraction, Nicol Prism, Production of Plane, Elliptically and Circularly Polarized Light.	
UNIT-III	7 HOUR
Quantum Mechanics: De Broglie Hypothesis, Heisenberg Uncertainty Principle, Postulates of Quantum Mechanics, Wave Function and Properties, Time Independent, and Time Dependent Schrodinger Wave Equation, Particle in 1-D Box.	
UNIT IV	7 HOUR
LASER and Optical Fiber Communication Stimulated and Spontaneous Emission, Principle of LASER, Einstein's A and B Coefficients, Components of LASER, Ruby LASER, He-Ne LASER, Ar -Ion LASER. Introduction to Holography. Optical Fibers, Step Index and Graded Index Fibers, Numerical Aperture, Acceptance angle, Pulse Dispersion in Optical Fibers, Optical Fiber Communication.	

Text Books	
1	Ajoy K. Ghatak, "Optics",6th Edition, McGraw Hill Education India Private Limited, 2017.
2	H. K. Malik And A. K. Singh, 2nd Edition, "Engineering Physics", Mc Graw Hill Ed, 2017.
3	William H. Hayt and John A Buck, 6th Edition, "Engineering Electromagnetism" 2001.
4	Arthur Beiser, Shobhit Mahajan and S. Choudhury, "Concepts of Modern Physics", 7ThEdition, Mc Graw Hill, 2015.
5	F. K. Richtmyer, E. H. Kennard, and J. N. Cooper, "Introduction to Modern Physics" 6th Edition, Tata Mc Graw Hill, 1997.
6	M. C. Jain, "Engineering Physics", 1st Edition, Vol. I and II, Phi Publications, 2009.
Reference Books	
1	C. Kittle, "Mechanics", Berkeley Physics Course, Vol-I, 2nd Edition, McGraw Hill Education 2017.
2	Wilson and J.F.B Hawkes, "Optoelectronics", 3rd Edition, Prentice Hall Europe, 1998.

PRACTICAL CONTENT

Introduction: Applied Physics lab acquaints the students with fundamental laboratory equipment and their usage. The students gain hands on experience of conducting various experiments.

Course Objectives:

- To make the students learn the usage of basic instruments in sciences like CRO, multimeter, Vernier Callipers, breadboard etc.
- To perform various experiments related to mechanics and optics.

Pre-requisites: None

Course Outcomes: Having successfully completed this course, the student will be able to

- Learn to work on a variety of instruments to be used later on.
- Understand and correlate mechanics, electronics, optics and electromagnetic theory with experiments.

Pedagogy: Hands on experience on laboratory equipment with self-explanatory lab manuals.

Evaluation Scheme:

Continuous Assessment Practical (CAP)	10marks
End Term Internal Practical (ETIP)	15marks

Preliminary study

1. To determine the least count a) Vernier calipers, b) Screw gauge, and c) Spectrometer, and to learn how to take measurements with them.
2. To study the construction and working of mercury vapor and sodium vapor lamps.
3. To study the working of a spectrometer, its different parts and uses.
4. To study the errors in measurement, least count, significant digits in calculation, log error and percentage error.

List of Experiments (Minimum eight experiments to be performed)

1. Measurement of logarithmic decrement of a damped harmonic oscillator.
2. To determine the acceleration due to gravity using bar pendulum.
3. To determine the acceleration due to gravity using kater's pendulum.
4. To determine the moment of inertia of a flywheel about its axis of rotation.
5. To determine the Young's modulus of the material of a given bar by bending.
6. To study different modes of oscillations using coupled pendulum.

7. To determine the frequency of A.C. mains using sonometer and an electromagnet.
8. To determine the refractive index of a prism using spectrometer.
9. To determine the wavelength of sodium vapour lamp by Newton's Ring.
10. To determine the wavelength of sodium light using diffraction grating.
11. To determine the specific rotation of cane sugar solution with the help of polarimeter.
12. To find the wavelength of He-Ne Laser using transmission diffraction grating.
13. To determine the numerical aperture of an optical fiber.
14. To determine the value of e/m by J J Thompson method.
15. To determine plank's constant.

Reference Books

1. Geeta Sanon, "B. Sc. Practical Physics", 1st Edition, R. Chand and Company, 2010.

2. Indu Prakash and Rama krishana, "A textbook of Practical Physics", 11th Edition, Kitab Mahal, 2011.

3. C L Arora, "Practical Physics", 28th Edition, S. Chand & Company Ltd., 2007.

4. Manjeet Singh, Surender Duhan and Anita Devi, "Applied Physics Theory and Experiments", 1st Edition, Vayu Education of India Publications, 2011.

APPLIED CHEMISTRY	
Course Code: BAS-105 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: 1

Introduction: Applied Chemistry essentially deals with a wide variety of topics related to Water Technology, Catalysis, Phase Rule, Nano-chemistry, Composite materials and Instrumental Techniques; from the development and characterization of new materials to the development of the technology to effectively apply knowledge in their field.

Course Objectives:

- The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.
- It aims to impart theoretical and technical knowledge applicable to various industries e.g. Textile, Petrochemicals, Heavy Chemical Industries, Food, Metallurgy etc.

Pre-requisite: None

Course Outcomes: Having successfully completed this course,

- Students earn principles underlying various methods of Water technology, Nano-chemistry, Composite materials and Instrumental method of analysis.
- Build a strong foundation of various applications of chemistry.
- Young graduates gain knowledge of interdisciplinary branches of the chemistry like Physical, Analytical, Nanotechnology, Materials Science, Industrial and Instrumental Techniques
- The students will acquire comprehensive knowledge and Basic platform for the research on different types of composite materials; Synthesis, characterization and evaluation of Nanomaterials and their applications

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with regular tutorial classes to enhance the problem-solving ability.

Contents

UNIT-I	8 Hours
Water Technology: Introduction and specification of water, Total Hardness and its determination (EDTA method)-(Numericals), Alkalinity-(Numericals), Boiler feed water, boiler problems – scale, sludge, priming & foaming, caustic embrittlement & corrosion : causes & prevention, Water Softening by Internal Treatment: carbonate & phosphate conditioning, colloidal conditioning &calgon treatment Water Softening by External Treatment: Lime-Soda Process, (Numericals), Zeolite & Ion-Exchange Process-(Numericals). Water for Domestic use: Disinfection by Breakpoint chlorination.	
UNIT-II	8 Hours
Catalysis and Phase Rule: Catalyst and its characteristics, Types of catalysts, Concept of promoters, inhibitors and poisons, autocatalysis, physisorption, chemisorption, surface area. Theories of catalysis: Intermediate compound formation theory, adsorption or contact theory. Homogenous catalysis: Acid-Base catalysis-Types, Kinetics & Mechanism, Enzyme catalysis- Kinetics & Mechanism (Michaelis-Menten equation), Heterogeneous Catalysis: Langmuir Hinshelwood mechanism and kinetics. Phase rule-Definition of various terms, Gibb's Phase rule & its derivation, Application of phase rule to one component system- The water system and sulphur system Application of phase rule to two component system- The Lead-Silver system (Pattinson's process), $FeCl_3$-water system.	
UNIT-III	6 HOUR
Instrumental Methods of Analysis: Spectral Analysis: Electromagnetic radiations, Regions of electromagnetic spectrum and types of spectra, Lambert-Beer's Law (Numericals), Instrumentation and applications of UV-Vis and Infrared Spectroscopy. Thermal Analysis: Basic principle, instrumentation and applications of Thermo gravimetric analysis (TGA), Differential thermal analysis (DTA) and Differential scanning calorimetry (DSC) to quantitative analysis.	
UNIT IV	6 HOUR
Nanochemistry and Composite Materials: Nanoscience & nanotechnology; Top-down and bottom up approaches for nanomaterial synthesis, properties of nanomaterials, Properties and applications of nanoscale materials: Carbon nanotubes, fullerenes, nano-metals, and biological nanomaterials Practical applications of nanomaterials in different areas Introduction, advantages of composite materials. Roles of matrix in composites, classification of matrix material and reinforcements. Fiber-reinforced composites and structural composites.	

Text Books

1	S. Rattan, "Text book on Engineering Chemistry", 7th Ed., S. K. Kataria & Sons, 2013.
2	P.C. Jain & M. Jain, "Engineering Chemistry", 16th Ed., Dhanpat Rai Publishing Co., 2013.

Reference Books	
1	P.W. Atkins, "The Elements of Physical Chemistry", 6th Ed., Oxford University Press, 2012.
2	B.S. Bahl, G.D. Tuli, A. Bahl, "Essentials of Physical Chemistry", 24th Ed., S. Chand & Co., 2000.
3	D. A. Skoog, F. J. Holler and A. N. Timothy, "Principle of Instrumental Analysis", 6th Ed., Saunders College Publishing, Philadelphia, 2016.
4	O. G. Palanna, Engineering Chemistry, McGraw Hill Education (India) Pvt Ltd., 2017.
5	K. Sesha Maheswaramma, Mridula Chugh, Engineering Chemistry, 1st Ed., Pearson India Education Services Pvt. Ltd, 2016.

PRACTICAL COMPONENT

Introduction: Applied Chemistry Lab acquaints the students with fundamental laboratory equipments and their usage. The students gain hands on experience of conducting various experiments.

Course Objectives:

- The aim of this course is to make the students learn Iodometric titrations, Argentometric titration, complexometric titration, acid/base reactions, redox reactions etc.
- Also experiments on basic instruments like pH meter, Conductivity meter, Ostwald viscometer, Stalagmometer, UV visible spectrophotometer etc. would be carried out

Course Outcomes: Having successfully completed this course, the student will be able to

- Learn to work on a variety of instruments to be used later on.
- Young graduates gains knowledge of interdisciplinary branches of the chemistry namely Engineering, Inorganic, Physical, Analytical, nanotechnology, Industrial and Instrumentation Techniques

Pedagogy: Hands on experience on laboratory equipment with self-explanatory lab manuals.

Evaluation Scheme:

Continuous Assessment Practical (CAP)	10marks
End Term Internal Practical (ETIP)	15marks

List of Experiments (Minimum Eight experiments to be performed)

1. Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.
2. Determine the amount of Oxalic acid and Sulphuric acid in one litre of solution, given standard sodium hydroxide and Potassium Permanganate.
3. Determine the amount of copper in the copper ore solution, provided hypo solution.

4. Determine the amount of chloride ions present in water using silver nitrate (Mohr's precipitation method)
5. Determination of Alkalinity in the water sample.
6. Determine the strength of $KMnO_4$ solution using sodium oxalate.
7. Determine the surface tension of a liquid using drop weight method.
8. Determine viscosity of a given liquid (density to be determined).
9. Determine the cell constant of a conductivity cell and titration of strong acid/strong base conductometrically.
10. To determine of the solution of (a) λ_{max} of the solution of $KMno_4$ (b) verify beers law and find out the concentration of unknown solution using spectrophotometer
11. Determination concentration of iron in the given sample using Spectrophotometer
12. Determination of eutectic point and congruent melting point for a two component system by method of cooling curve
13. Determine the concentration and dissociation constants of polyprotic acid potentiometrically

REFERENCE BOOKS:

1. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, 6th edition, Pearson Education, 2009.
2. S.K. Bhasin and Sudha Rani, Laboratory Manual on Engg. Chemistry, Dhanpat Rai Publishing Company, 2006.
3. Sunita Rattan, Experiments in Applied Chemistry, S.K. Kataria & Sons, Delhi, 2011.
4. Janet Macfall, Catherine Deininger, Atricia Thomas-Laemont, Environmental Science Lab Manual, 2nd Edition, Kendall Hunt Publishing, 2017.

ENGINEERING MECHANICS	
Course Code: BMA-110 Contact Hours: L-3 T-0 P-2 Course Category: OEC	Credits: 4 Semester: 1

Introduction: Engineering mechanics deals with the various types of forces, their analysis and applications. The students need to design applications and this subject gives basic knowledge for designing and algorithm development for software applications.

Course Objective:

- To make the student comfortable with the concepts of forces and their applications. This course is also a prerequisite for further courses of Mechanical Stream like Machine Design, Theory of Machines, Strength of Materials, Fluid Mechanics.

- The students are to be provided hands on practical exposure on topics covered in the course.

Pre-Requisites: NIL

Course Outcomes:

Having successfully completed this course the student will be able to:

- Get familiarized with the different types of forces acting on the elements.
- Distinguish between the desirable and non-desirable forces.
- Analyze the basic mechanical elements under various types of loads.
- Approach solving a mechanics problem in a systematic manner.

Pedagogy: The classroom sessions will be aimed at creating a strong theoretical basis with strong emphasis on the application part and tutorial sessions will give concentrated attention to individual student.

Theory Contents:

UNIT I	11 Hours
Force Systems: Introduction, Laws of Mechanics, Force Systems - Force, moment & couple, Varignon's theorem, Resultant of concurrent and non-concurrent forces, Free Body Diagram, Equilibrium conditions, Application to various problems. **Friction:** Introduction, Laws of Dry Friction, Coefficients of Friction, Angle of Friction, Cone of friction, Applications of Friction in Wedges, Ladder, Inclined Plane.	
UNIT II	11 Hours
Centroid and Centre of gravity: Introduction, Centre of gravity, Centroids of lines, Areas & Volumes, Centroid of Composite bodies, Pappus theorems.	

Moment of Inertia: Introduction, Moment of Inertia of Area, Polar Moment of Inertia, Radius of gyration, Parallel axis and Perpendicular axis theorem, Moment of inertia of composite areas, MOI about an arbitrary axis, Radius of gyration, Moment of Inertia of masses, Moment of Inertia of Solids of Revolutions **Trusses:** Introduction, Various types of trusses, Perfect and imperfect truss, Assumption in the truss analysis, Analysis of perfect plane trusses by the method of joints and method of section.	
UNIT III	10 Hours
Kinematics of Particles: Equation of motion, Rectilinear motion and plane curvilinear motion, Rectangular coordinates, Normal and tangential components. **Kinetics of Particles:** Work energy equation, Conservation of energy, Principle of Impulse and momentum, Linear and angular momentum, D'Alembert's principle, Conservation of momentum, Impact of bodies, Co-efficient of restitution, Loss of energy during impact.	
UNIT IV	10 Hours
Kinematics of Rigid Bodies: Concept of rigid body, Rotation, translation and general plane motion of rigid bodies, Analysis by relative velocity and instantaneous center of rotation methods. Application to various problems. **Kinetics of Rigid Bodies:** Rotary motion and torque, Moment of momentum, Laws of Rotary motion, Torque and angular momentum, Kinetic energy due to rotation, Work energy principle and principle of conservation of energy applied to rigid bodies, Equation of motion.	
Text Books	
1.	D. S. Kumar, Engineering Mechanics, S.K. Kataria & Sons, Delhi, 2006.
2.	I. B. Prasad: A Text Book of Applied Mechanics, Khanna Pub. Delhi.
3.	A.K. Tayal: Engineering Mechanics (Statics and Dynamics) Umesh Pub. Delhi.
Reference Books	
1.	I. H. Shames, Engineering Mechanics—Statics and Dynamics, 4th Edition, Prentice Hall ofIndia, 1996.
2.	F.P. Beer and E.R. Johnston, Vector Mechanics for Engineers – Statics, McGraw Hill BookCompany, 2000.

BASIC ELECTRICAL ENGINEERING	
Course Code :BEC-110 **Contact Hours**: L-3 T-0 P-2 **Course Category**: OEC	**Credits**: 4 **Semeste**r : 1, 2

Introduction: To impart basic knowledge of electrical engineering with an understanding of fundamental knowledge.

Course Objective: The aim of this course is to:

- Prepare the students to develop the ability of solving real world problems, going a step ahead of what they have studied in school. The curriculum is so designed that the students get an
- Provide students with in-depth knowledge of everyday systems and phenomena surrounding them.
- Make student understand the classical laws with modern devices which will enhance the ability of students to apply fundamentals to various applications.

Course Outcome: Having successfully completed this course, the student will be able to:

- Gain knowledge and comprehend various fundamentals of electrical engineering.
- Build a sound foundation of applications of electrical engineering.
- Identify and analyze relationship between different principles of electrical engineering and integrate them for various field of engineering.
- Evaluate and apply the quantitative and qualitative aspects of electrical engineering to innovate devices in the constantly competitive Technologies

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with periodic tutorial classes to enhance the problem-solving ability.

Contents

UNIT-I	11 Hours
Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star Delta Transformation, Application of theorems for the Analysis of dc circuits.	
UNIT-II	10 Hours
A. C. Circuit: Basics of AC, effective, average and maximum values, form factor and k-factor, different types of AC power, R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor- representations, Response of R-L, RC and R-L-C circuit to sinusoidal input, Resonance-series and parallel Circuits, Q-factor, Bandwidth.	
UNIT-III	10 Hours
Measuring Instruments: Principles, construction and application of moving coil, moving iron, dynamometer type, induction type instruments, extension of range of ammeter, voltmeter (shunt and multiplier), Two-wattmeter method, for the measurement of power	
UNIT-IV	11 Hours
Transformer and Electrical Machines: Construction and working principles, phasor diagrams of single-phase Transformer, Emf equation, equivalent circuit, regulation and efficiency, auto transformer. Rotating Machines DC Machines: Construction and working principles of dc motor and generator and its characteristics, applications of DC machines.	
Text Books	
1	Vincent DEL TORO, "Electrical Engineering Fundamental's", Prentice Hall India, Ed 2011.
2	J. Edminister, M. Nahvi, K. Rao, "Electric Circuits," Schaum's Outline Series, 2017.
Reference Books	
1	Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (1986), "Engineering Circuit Analysis", (p. 74), New York: McGraw-Hill
2	Fitzgerald, Arthur Eugene, David E. Higginbotham, and Arvin Grabel, "Basic Electrical Engineering," McGraw-Hill Series in Electrical Engineering, Auckland: McGraw-Hill, 1981, 5th ed. (1981).

WORKSHOP PRACTICES	
Course Code: BMA-120 Contact Hours: L-0 T-1 P-2 Course Category: OEC	Credits: 2 Semester: 1

Introduction: Students of all branches need to know basics of workshop practice, so that they can give shape to their projects and also understand Mechanical / hardware aspects in Industry. Workshop Practice acquaints the students with fundamental mechanical workshop equipment, their usage and hardware development. The students gain hands on experience of making various jobs in the shops.

Course Objectives:

The aim of this course is to equip students with skills that are essential for their academic projects as well as through-out their entire engineering career. The students make jobs using workshop tools in various shops like Fitting, Sheet Metal, Foundry, Welding etc.

Pre-Requisites: NIL

Course Outcomes:

Having successfully completed this course the student will be able to:

- Aware herself of the safety precautions while working in workshop;
- Understand working and usage of workshop tools and equipment.
- Use different manufacturing processes (fitting, welding, foundry, sheet-metal working, etc) required to manufacture a product from the raw materials.
- Develop practical engineering aptitude in manufacturing applications.
- Use the tools for projects in college and industry.

Pedagogy: Hands on experience on workshop tools and equipment with self-explanatory lab manuals.

Contents:

UNIT I	11 Hours
Safety Precautions and Knowledge of Hand Tools: Introduction to Workshop Practice and various tools used indifferent shops; general safety precautions on different shop floors. Study about first aid. **Foundry Shop:** Introduction of foundry shop and its tools, to make a sand mould with single piece pattern or two piece patterns. **Exercises** 1. Preparation of sand 2. Sand moulding process	
UNIT II	11 Hours
Fitting Section: Introduction of fitting operations, Study of hand tools and measuring instruments, Hacksaw cutting practice, Filing practice, Male female joints, Jobs made out of MS Flats. **Exercises** 1. Flat Joint or L Joint 2. Drilling and tapping	
UNIT III	10 Hours
Welding: Identify welding materials and processes, Gas and Electric arc welding and its equipment, Use of welding equipment and tools and accessories, Electric arc welding, Edge preparations, Exercises making of various joints. Bead formation in horizontal, vertical and overhead positions. **Exercises** 1. Welding Practice: Butt joint or Lap joint or T joint	
UNIT IV	10 Hours
Sheet Metal Work: Introduction to sheet metal, Study and demonstration of sheet metal tools, joints and operations procedure, making jobs out of GI sheet metal. **Exercises** 1. Simple Development of the job, to make lap and seam joints. 2. Rectangular or Cylindrical container or Hexagon shape.	
Text Books	
1.	Shop Theory, J. Anderson and E.E. Tatro, McGraw Hill, 2017.
2.	Juneja B.L., Workshop/Manufacturing Practices, Cengage, 2019
Reference Books	
1.	Hazra Choudhary , Elements Of Workshop Technology I & II, Media Promoters, 2008.

Engineering Graphics Lab	
Course Code: BMA-130 Contact Hours: L-0 T-1 P-2 Course Category: OEC	Credits: 2 Semester: 1

Introduction: Engineering Graphics develops basic concepts for advance courses like Machine Drawing/Design, Computer Graphics, and Computer Aided Design. Manufacturing drawings are an integral part of any production company. They provide most efficient and clear information about the parts to be produced and act as a language for engineers to communicate. The subject not only provides basic knowledge required as above but also develops visualization capability in students so that they can become creative and organized.

Course Objectives: The aim of this course is to provide a base for visualizing and drawing objects in different views which is an essential tool for a design engineer as well as graphics designer.

Pre-Requisites: NIL

Course Outcomes:

Having successfully completed this course the student will be able to:

- Recognize different standards that are used in engineering drawings.
- Visualize and plot various projections of objects and are able to develop surfaces to solid model.
- Communicate engineering aspects of a part with other engineers and technicians.

Pedagogy: The lab sessions are aimed at providing the students an exposure to traditional methods of engineering drawing on drawing sheets by using drawing tools. This gives the students an exposure to using these tools and helps them better understand intricacies and appreciate this art.

Content:

UNIT I	12 Hours
General: Importance, Significance and scope of engineering drawing, Lettering, Dimensioning, Orthographic Projection, B.I.S. Specifications, Engineering curves. **Projections of Point and Lines:** Introduction of planes of projection, Reference and auxiliary planes, projections of points and Lines in different quadrants, traces, inclinations, and true lengths of the lines, projections on Auxiliary planes, shortest distance, intersecting and non-intersecting lines.	
UNIT II	12 Hours
Projections of Plane Figures: Different cases of plane figures (of different shapes) making	

different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one of both reference planes). Obtaining true shape of the plane figure by projection. **Projection of Solids:** Simple cases when a solid is placed in different positions, Axis faces and lines lying in the faces of the solid making given angles.	
UNIT III	9 Hours
Section of Solids: Introduction, conventions, sections of various solids**.** **Development of Surfaces:** Method of development, Development of surfaces of oblique solids.	
UNIT IV	9 Hours
Projections: Perspective, orthographic, isometric and oblique projections, isometric scale, isometric drawing. **Computer Aided Drafting:** Basic concepts and use.	
Text Books	
1.	Bhatt N.D., Elementary Engineering Drawing, Charotar Publishing House, 2014.
Reference Books	
1.	Gill P.S., A text book of Engineering Drawing, S.K.Kataria & sons, 2013
2.	K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International Private Limited, 2011.
3.	Sharma S.C., Kumar Navin, Engineering Drawing, Galgotia Publications, 2003.
4.	Narayana, K.L. and Kannaiah, P., A Textbook on Engineering Drawing , Tata McGraw Hill, 2012

COMMUNICATION SKILLS	
Course Code: HMC-110 Contact Hours: L-3 T-1 P-0 Course Category: HMC	Credits: 4 Semester: 1, 2

Introduction: This course facilitates communication skills development by exposing the students to various nuances of effective communication. The course provides an in-depth understanding of several key concepts of Communication like importance and functions of communication, barriers to communication, active listening, group discussions, presentation skills etc. The course also provides valid inputs on the *ethical* dimension of communication to enable the students to be ethical communicators.

The highlight of the course is special emphasis on Employment Communication i.e. job application and resume writing along with preparing and appearing for Interviews. The students are also acquainted with various forms of business correspondence used in organizations on a regular basis like agenda and minutes of meetings, business letters, reports etc.

Course Objectives:

- To enable students to evaluate their personal communication styles and improve upon it.
- To help the students understand the contemporary trends in communication.
- To facilitate the students in becoming aware of different communication theories and their application.
- To encourage students to develop their own unique style of communication.

Pre-requisites: None

Course Outcomes – After completion of the course, the students should be able to:

- Evaluate and analyze their personal communication style while adapting their communication style to better expression of their ideas at workplace.
- Enhance their knowledge of contemporary trends for effective Communication
- Effective comprehension and application of different Communication theories.
- Synthesis their own unique communication style.

Pedagogy: Apart from interactive class teaching, various individual and group assignments are given. Group discussions, JAMs, role plays and presentations are conducted in class to enable students to practically apply the theories learnt during the course.

Contents

UNIT-I	10 Hours
Introducing Communication: Importance and function of Communication, Communication Cycle, Characteristics and Types of Communication, Channels and Medium of Communication, 7 C's of Communication, Barriers to Communication. Ethics of Communication (plagiarism, language sensitivity towards gender, caste, race, disability etc.	
UNIT-II	11 Hours
Everyday Communication: Non-Verbal Language (Symbols, Appearance, Paralanguage and Body Language, Proxemics, Chronemics), Listening Skills (Importance, Barriers, Essentials of Good Listening), Communication Skills (greetings, introducing, making requests, asking and giving permission, offering help and giving instructions and directions etc.), Understanding Telephone Skills (handling calls, leaving a message, asking and giving information and instructions etc.), Net Etiquettes.	
UNIT-III	11 Hours
Presentations & Employment Communication: Classroom Presentations (purpose, types, preparing and presenting - use of visual aids/ power point presentations), Group Discussion (purpose, strategies, guidelines etc.), Job Application (Resume and Cover Letter), Interview Skills (purpose, types of interviews, guidelines and preparing for facing the interviews). Presentation, Group discussion and Mock interview practice should be undertaken in class.	
UNIT-IV	10 Hours
Writing on the Job: Formal and Informal Writing, Basics of Paragraph Writing**,** Email Writing, Letters at the workplace, Meeting documentations (Agenda and Minutes of meeting etc.), Report Writing (characteristics, types, structure of formal report).	
Text Books	
1.	M. Raman and S. Sharma. Technical Communication: Principles and Practice, 3rd Edition, Oxford University Press, 2011.
2.	M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill Publications, 2005.
Reference Books	
1.	Lewis and Hedwig, Body Language: A Guide for Professionals, New Delhi, Response Books, 2000
2.	Sides and H. Charles, How to Write & Present Technical Information, Cambridge, CUP, 1999.
3.	S. Kumar and P. Lata. Language and Communication Skills for Engineers, Oxford University Press, 2018.
4.	Hasson, Gill. Brilliant Communication Skills. Pearson Education, 2012.

PROGRAMMING IN C LANGUAGE	
Course Code: BCS- 101 Contact Hours: L-3 T-0 P- 2 Course Category: OEC	Credits: 4 Semester: 1

Introduction: This course briefs about basic introduction to computers and its corresponding concepts in benefit of students coming from non-computer background. Apart from this, programming concepts are also discussed in this course using C programming language.

Course Objective:

- To provide an understanding of basic computer architecture including Number System. Discussion of computer history and overview of operating systems.
- To impart adequate knowledge on the need and concept of algorithms and programming.
- Develop, execute and document computerized solution for various problems using the features of C language.
- To enable effective usage of arrays, structures, functions, pointers and to implement the concepts of file organization.

Pre-requisite: None

Course Outcome: After studying this course students will be able to :

- Explain the fundamentals of computers and programming.
- Apply problem solving skills in programming.
- Learn logic development
- Develop and run computer programs in C language

Pedagogy: Classroom teaching which focuses on developing understanding of students to digest the concepts of subject with large number of examples.

Contents

UNIT-I: Introduction to Computer system and Basics Programming fundamentals	12
Introduction to computer systems, ALU, registers, memory. Concepts of the finite storage, bits bytes, kilo, mega and gigabytes. Idea of program execution at micro level. **Introduction to system software:** operating systems, compilers, assemblers, interpreter and multi-user environments. Concept of flow chart and algorithms, algorithms to programs. Logic development for solving problems, development of flow chart and algorithms	
UNIT-II: Programming using C	12
Concept of variables, program statements and function calls from the library (Printf for example), C data types: int, char, float etc., C expressions, arithmetic operation, relational and logic operations, C assignment statements, extension of assignment of the operations. C primitive input output using getchar and putchar, exposure to scanf and printf functions, C Statements, conditional executing using if, else , switch case, goto and break statements.	
UNIT-III: Concept of Sub-programming	09
Concept of loops in C using for, while and do-while. **Arrays:** single and two--dimensional arrays, initializers, array parameters, example of iterative programs using arrays and use in matrix computations. Functions, parameters and return values, standard library functions.	
UNIT-IV: Pointers, Strings and Structure	09
Pointers, relationship between arrays and pointers, Call by reference. Array of pointers, passing arrays as arguments. **Character strings:** processing strings using loops, and string library functions **Structure and Unions:** structure concepts, structures as parameters, arrays of structures.	

Text Books

1.	Mastering C, 2nd Edition, K R Venugopal,Sudeep R Prasad, McGraw Hill Education, 2017
2.	Let Us C, 13th Edition, Yashavant Kanetkar, BPB Publications, ISBN:978-8183331630, 2013.
3.	Fundamentals of Computers, 6th Edition, V Rajaraman, PHI Learning, 2014.

Reference Books

	Programming in ANSI C, 6th Edition, McGraw Hill Education (India) Private Limited E Balagurusamy, ISBN:978-1259004612, 2012.
	The C Programming Language, B W Kernighan, Dennis Ritchie, 2nd Edition, 2015.
	The Complete Reference C, Herbert Schildt, Tata McGraw Hill, 4th Edition, 2017.

APPLIED MATHEMATICS – II	
Course Code: BAS-102 Contact Hours: L-3 T-1 P-0 Course Category: BAS	Credits: 4 Semester: 2

Introduction: Mathematics is used in almost every field of engineering be it computer science and information technology wherein it may be used in modelling, machine learning, image processing etc., or by electrical engineers for signal processing, control engineering or by mechanical engineers for design, modelling, manufacturing etc. But the problem faced by engineers is to how to apply the basic mathematical concepts in engineering problem which they would be dealing in coming years. The course covers linear ordinary differential equations of higher order, partial differential equations with application to heat and wave equations, introduction and applications of Laplace transforms, functions of complex variables.

Course Objectives:

- To introduce students the theory and concepts of differential equations and their applications, Laplace transformations which will equip them with adequate knowledge of mathematics to formulate and solve problems analytically.
- Students will be equipped with the understanding of the fundamental concepts of functions of complex variable and their calculus.

Prerequisite: Ordinary differential equations of first order, calculus of functions of more than one variable, complex numbers.

Course Outcomes: Having successfully completed this course, the student will be able to

- Determine the solution of ordinary linear differential equations of higher order using operator method, method of variation of parameters and method of undetermined coefficients.
- Learn the applications of partial differential equations viz., heat and wave equations.
- Evaluation of Laplace and inverse Laplace transforms and their applications in solving initial and boundary value problems.
- Have a strong foundation of calculus of complex functions like analyticity, Cauchy-Riemann relations, harmonic functions and transformations.
- Acquire the skill of contour integration to evaluate complicated real integrals via residue calculus.

Pedagogy: Apart from class room teaching, main focus is to enhance problem solving ability supported by weekly assignments and discussing individual's doubts.

Content

UNIT-I	10 Hours
Differential Equations : Linear differential equations of higher order with constant coefficients, simultaneous linear differential equations, method of undetermined coefficients and Variation of parameters, Solution of homogeneous nonlinear differential equations (Cauchy's and Legendre's form).	
UNIT-II	11 Hours
Partial differential equations: Method of separation of variables, solving one dimensional heat and wave equations. **Laplace Transforms**: Basic properties of Laplace and inverse Laplace transform, convolution theorem. Laplace transform of unit step function, Dirac-delta function and periodic function. Applications of Laplace transform to initial and boundary value problems.	
UNIT-III	9 Hours
Complex Analysis-I: Functions of a complex variable, limits, continuity and differentiability of complex functions, analytic functions, Cauchy-Riemann equations. Some standard transformations, simple conformal mapping and bilinear transformations.	
UNIT-IV	12 Hours
Complex Analysis-II : Complex line integrals, Cauchy's integral theorem and integral formulae, zeroes, poles and singularities, complex Integration, Taylor's and Laurent's series, calculation of residues, residue theorem and its applications.	

Text Books	
1.	D. G. Zill and W. S. Wright, "Advanced Engineering Mathematics", 6th Edition, The Jones and Bartlett Learning Publishers, 2016.
2.	Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House Pvt. Ltd.2012.
3.	Grewal, B. S. , "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017
Reference Books	
4.	George B. Thomas Jr., Ross L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson Education India, 2010
5.	Greenberg M., "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, 1998
6.	Kreyszig. E. , "Advanced Engineering Mathematics", 10thEdition, John Wiley & Sons, 2010.

APPLIED PHYSICS – II	
Course Code: BAS-104 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: 2

Introduction: Applied physics is a subject rooted in the basic concepts of the physics with the utilization of scientific principles in various technological applications, devices and systems. The course covers the wide ranging topics of physics which form the underlying physical principles of electromagnetic theory, solid state physics, sensors and modern devices. The syllabus is a perfect blend of classical laws with modern devices which will enhance the ability of students to apply fundamentals to various applications.

Course Objectives:

- To introduce students with the wide ranging topics of physics which form the underlying physical principles of electromagnetic theory, solid state physics, sensors and modern devices.
- To prepare the students to develop the ability of solving real world problems, going a step ahead of what they have studied in school.
- To impart them an in-depth knowledge of everyday systems and phenomena surrounding them and underlying principles of physics behind those phenomenon.
- To enhance the ability of students to apply fundamentals to various applications.

Pre-requisites: None

Course Outcomes:

Having successfully completed this course, the student will be able to

- Gain knowledge and comprehend various fundamental principles of physics.
- Build a sound foundation of applications of physics.
- Identify and analyze relationship between different principles of physics and integrate them for various applications.
- Evaluate and apply the quantitative and qualitative aspects of physics to innovate devices in the constantly competitive Technologies.

The comprehensive list of experiments in the lab will correlate and enhance the analytical skills and develop the ability of the students to think beyond the usual.

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with periodic tutorial classes to enhance the problem-solving ability.

Theory Content

UNIT-I	7 Hours
Electro Magnetic Theory Electromagnetic Waves, Equation of Continuity, Maxwell's Equations, Displacement Current, Wave Equation, Poynting Theorem, Propagation of Electromagnetic Waves in Free Space, Dielectric and Conducting Medium, Skin Depth.	
UNIT-II	7 Hours
Solid State Physics Space lattice, Unit cell and Translation Vector, Miller Indices. Lorentz classical free electron theory and its limitations, Quantum theory of free electron, Fermi level, Density of states. Bloch Theorem and Kronig-Penney model (Qualitative), E-K diagram and Brillouin zones, Band structure in Metals, Semiconductors and Insulators, Intrinsic and Extrinsic Semiconductors, Fermi Energy Level for Undoped and Doped Semiconductors, PN Junction and Zener Diode.	
UNIT-III	8 HOUR
Physics of Sensors Sensor, Signals and Response, Sensor Characteristics (Transfer Function, Sensitivity, Calibration, Span, Accuracy, Non-linearity, Saturation, Repeatability, Dead Band, Resolution and Selectivity), Static and Dynamic Response, Sensor Classifications, Direct and Complex Sensors. Resistive Sensors (Temperature, Strain/Piezo-resistive, Moisture, Gas/Chemical Sensor), Capacitive Sensors (Capacitor formula, Dielectric Constant), Piezoelectric Sensors (QCM), Hall Sensor, Thermoelectric Sensor, IR sensors, Light sensors (LDRs), Gravitational Sensors.	
UNIT IV	6 HOUR
Modern Devices Biomedical Devices (MRI, CT and Ultrasonography), Scanning Electron Microscope, Cathode Ray Oscilloscope.	

Text Books	
1	H. K. Malik and A. K. Singh, "Engineering Physics",2nd Ed, Mc Graw Hill, 2017.
2	D.J. Griffith, "Introduction To Electrodynamics ",4th Edition, Pearson Education India Learning Private Limited, 2015.
3	Arthur Beiser, Shobhit Mahajan and S. Choudhury, "Concepts of Modern Physics", 7ThEdition, Mc Graw Hill, 2015.
4	Handbook of Modern Sensors: Physics, Designs, and Applications, Jacob Fraden,4th Edition, Springer, 2010.
Reference Books	
1	F. K. Richtmyer, E. H. Kennard, And J. N. Cooper, "Introduction To Modern Physics", 6th Edition, Tata Mc Graw Hill, 1997.

PRACTICAL CONTENT (25 Marks)

Introduction: Applied Physics lab acquaints the students with fundamental laboratory equipment and their usage. The students gain a hands-on experience of conducting various experiments and reproducing fundamental results.

Course Objectives: The aim of this course is to make the students learn the usage of basic instruments in sciences like CRO, multimeter, Vernier Calipers, breadboard, etc. and to perform various experiments related to semiconductor physics, sensors and modern devices.

Pre-requisites: None

Course Outcomes: Having successfully completed this course, the student will be able to

- Learn to work on a variety of lab instruments.
- Understand and correlate mechanics, electronics, optics and electromagnetic theory with experiments.

Pedagogy: Hands on experience on laboratory equipment with self-explanatory lab manuals.

Evaluation Scheme:

Continuous Assessment Practical (CAP)	10marks
End Term Internal Practical (ETIP)	15marks

Preliminary study

1. Working and connection of a bread board.
2. To study the working of a digital mulitmeter and measurement of resistance, dc voltages, capacitance.
3. To study the working of a CRO and measurement of voltage and frequency of signals coming from a function generator.
4. AC bridges for measurement of capacitance, inductance etc.

List of Experiments (Minimum eight experiments to be performed)

1. To study the IV characteristics of a PN junction diode, Zener Diode and LED.
2. To study the charging and discharging of a capacitor to find the time constant.

3. To find the thermal conductivity of a poor conductor by Lee's disk method.

4. To study Hall effect and to measure carrier concentration and Hall coefficient for unknown semiconductor.

5. Measurement of high resistance by ballistic galvanometer.

6. To trace the B-H curve for a ferromagnetic material using CRO and to find the magnetic parameters from the B-H hysteresis loop.

7. Study of semiconductor devices (PN junction, Metal-insulator semiconductor diode etc) by current-voltage (I-V) and capacitance-voltage (C-V) measurements using semiconductor parameter analyzer.

8. To determine the resistivity of Semiconductors by Four Probe Method at different temperatures and to calculate Band-Gap from it.

9. To study and calibrate temperature transducers.

10. To study the gas sensing response characteristics (I-V characteristics) of Gas Sensors.

11. To study response and IV characteristics of infrared (IR) Sensor.

12. To measure the frequency of a sine-wave voltage obtained from signal generator and to obtain lissajous pattern on the CRO screen by feeding two sine wave voltages from two signal generator.

Reference Books

1. Geeta Sanon, "B. Sc. Practical Physics", 1st Edition, R. Chand and Company, 2010.

2. Indu Prakash and Ramakrishana, "A textbook of Practical Physics", 11th Edition, Kitab Mahal, , 2011.

3. C L Arora, "Practical Physics", 28th Edition, S. Chand & Company Ltd., 2007.

4. Manjeet Singh, Surender Duhan and Anita Devi, "Applied Physics Theory and Experiments", 1st Edition, Vayu Education of India Publications, 2011.

ENVIRONMENTAL SCIENCES	
Course Code: BAS-106 Contact Hours: L-2 T-1 P-2 Course Category: BAS	Credits: 4 Semester: 2

Introduction: A scientific study of the natural world and how it is influenced by people. It Surveys environmental studies, examining ecological, socioeconomic, and technological factors that influence the quality of life on Earth.

Course Objectives:

- Environmental science prepares students for career success in environmental monitoring and remediation, natural resources and conservation, public health, industrial environmental management.
- The curriculum is so designed that the students get an in-depth knowledge of the environment and various issues arising due to mismanagement of resources.

Pre-requisites: None

Course Outcomes: Having successfully completed this course,

- Students will demonstrate the ability to plan and execute experiments that demonstrate the use and understanding of modern instruments, accurate quantitative measurements, appropriate recording skills, safe lab practices.
- Understand and evaluate the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales
- Students will demonstrate interpretative skills including the ability to analyze data statistically, assess reliability, interpret results and draw reasonable conclusions.
- Young graduates gains comprehensive knowledge of interdisciplinary branches like Toxicology, Green Technology, synthesis and applications of Eco friendly polymers.

Pedagogy: Classroom teaching which focuses upon relating the textbook concepts with real world phenomena, along with periodic tutorial classes to enhance the problem-solving ability.

Theory Contents

UNIT-I	6 Hours

Natural Resources, Conservation and Management:

Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water. Mineral resources: Environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs renewable and non-renewable energy sources. Resource Management-Concept of Sustainable development, Environmental Management Systems, Environmental Impact Assessment, Biodiversity- conservation and threats.

UNIT-II	8 Hours

Environmental Pollution and Control:

Air Pollution: Types of air pollutants; Source, effects, sink & control of common air pollutants (CO, oxides of nitrogen & sulphur, hydrocarbons and particulates), Photochemical smog, acid rain, greenhouse effect, global warming, Carbon dioxide sequestration and the concept of Carbon Credits Water Pollution: Classification of pollutants and their sources, Waste water treatment (Primary, secondary and tertiary treatment), Impact of water pollution on hydrological ecosystems. Solid and Hazardous Waste Pollution: Classification, waste treatment and disposal methods: Sanitary landfill, thermal processes, chemical and biological processes, disposal methods for nuclear waste, nuclear disaster (case study), disposal methods for e-waste. Green Technology And Green Chemistry: Introduction to concept of Green Technology and Zero Waste Technology, Green Chemistry & its basic principles, Atom Economy, evaluation of feedstock, reaction types, methods, reagents and solvents.

UNIT-III	8 HOUR

Fuels and Alternate Energy Sources:

Classification, Calorific value of fuels (gross and net), Dulong's formula, Determination of calorific value of fuels using bomb's calorimeter, Determination of calorific value of fuels using Boy's Gas Calorimeter (Numericals). Liquid fuels-petroleum chemical composition, fractional distillation, Cracking – Thermal & catalytic cracking, Octane & Cetane numbers with their significance. Analysis of flue gases (Orsat's Apparatus)-(Numericals), Combustion of fuels. Use of alternate energy sources including solar energy harnessing (photovoltaics), wind energy, hydroenergy, geothermal energy, ocean energy, biodiesel, power alcohol, biomass energy.

UNIT IV	6 HOUR

Chemical Toxicology and Eco-Friendly Polymers

Toxicology: terminology & toxic effects, chemical interactions, impact of toxic chemicals on enzymes, Biochemical effects of arsenic, mercury, lead, chromium, & cadmium. Polymers-Introduction: Functionality of monomer, polymerization, degree of polymerization, Number average and weight average molecular weight of polymers. Environmental degradation of polymers: Biodegradable, Photo-biodegradable polymers, Hydrolysis &

Hydro-biodegradable polymers Biopolymers & Bioplastics.	
Text Books	
1	Ranu Gadi, Sunita Rattan, Sushmita Mohapatra. A Text book of Environmental Studies (with experiments), 4th Ed., S.K. Kataria & Sons, 2014.
2	S. Rattan, "Applied Chemistry", S.K.Kataria& Sons, 2013.
3	S.S.Dara, D.D.Mishra. A Textbook of Environmental Chemistry and Pollution Control (With Energy, Ecology, Ethics and Society) S. Chand and Company Pvt. Ltd. (India), 2011.
Reference Books	
1	Richard T. Wright, Environmental Science, 9thEdition, Pearson Education, 2007.
2	Gerard Kiely, Environmental Engineering, special Indian edition The McGraw-Hill Companies, 2007.
3	E. Barucha, Textbook of Environmental Studies for Undergraduate Courses, Universities Press (India) Pvt. Ltd., 2005.
4	C.N. Sawyer, P.L. McCarty, and G.F. Parkin, "Chemistry for Environmental Engg. and Science", 5th Ed., The McGraw-Hill Companies, 2003.
5	R. Rajagopalan, Environmental studies from crisis to cure, 3rd edition, Oxford University Press., 2016.

PRACTICAL COMPONENT

Introduction: Environmental Studies Lab acquaints the students with fundamental laboratory equipments and their usage. The students gain hands on experience of conducting various experiments.

Course Objectives:

- The aim of this course is to make the students learn the usage of basic instruments in Sciences like BOD Incubator, Bomb Calorimeter, pH meter, conductivity meter etc.
- Students will demonstrate interpretative skills including the ability to analyze data statistically, assess reliability, interpret results and draw reasonable conclusions.

Course Outcomes:

Having successfully completed this course, the student will be able to

- Learn to work on a variety of instruments to be used later on.
- Understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales

Pedagogy: Hands on experience on laboratory equipments with self-explanatory lab manuals.

Evaluation Scheme:

Continuous Assessment Practical (CAP)	10marks
End Term Internal Practical (ETIP)	15marks

List of Experiments (Minimum eight experiments to be performed)

1. Determination of Hardness in the water sample.
2. Determination of Dissolved Oxygen (DO) in the water sample.
3. Determination of Biological oxygen demand (BOD) in the water sample.
4. Determination of Chemical oxygen demand (COD) in the water sample.
5. Determination of pH, conductivity in different drinking water samples and preparation of report.
6. Determination of Residual Chlorine in the water sample.
7. Determination of Ammonia in the water sample.
8. Determination of Calorific Value of fuels using Bomb calorimeter.
9. Determination of Free Carbon Dioxide in the water sample.
10. Determination of Total Dissolved Solids in the water sample.
11. Estimation of sulphur in given coal sample gravimetrically
12. Determination of molecular weight of polystyrene sample using viscometric method
13. Acetylation of primary amines using green methodology
14. Preparation of urea formaldehyde resin.

REFERENCE BOOKS:

1. Standard Methods for the Examination of Water and Wastewater, American Public Health Association (APHA), American Water Works Association (AWWA) & Water Environment Federation (WEF), 2005.
2. Experiments in Applied Chemistry, Sunita Rattan, Publ.: S.K. Kataria& Sons, Delhi, Edition 2011.
3. Laboratory Manual on Engg. Chemistry, S.K. Bhasin and Sudha Rani, DhanpatRai Publ. Comp., New Delhi, Edition 2009.