



COURSE STRUCTURE
B. TECH I SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME1T01	BSC	Linear Algebra and Differential Equations	3	-	-	3	3
2	20ME1T02	BSC	Engineering Physics	3	-	-	3	3
3	20ME1T03	HSMC	English	3	-	-	3	3
4	20ME1T04	ESC	Basic Electrical & Electronics Engineering	3	-	-	3	3
5	20ME1T05	ESC	Engineering Graphics	1	-	4	5	3
6	20ME1L06	HSMC	English Communication Skills Lab	-	-	3	3	1.5
7	20ME1L07	BSC	Engineering Physics Lab	-	-	3	3	1.5
8	20ME1L08	ESC	Basic Electrical & Electronics Engineering Lab	-	-	3	3	1.5
Total number of credits								19.5

B. TECH II SEMESTER

S. No	Course Code	Course Category	Course Title	Hours per week			Total Contact Hours	Credits
				Lecture	Tutorial	Practical		
1	20ME2T01	BSC	Transform Techniques	3	-	-	3	3
2	20ME2T02	BSC	Engineering Chemistry	3	-	-	3	3
3	20ME2T03	ESC	Engineering Mechanics	3	-	-	3	3
4	20ME2T04	ESC	Thermodynamics	3	-	-	3	3
5	20ME2T05	ESC	Problem Solving Through C	3	-	-	3	3
6	20ME2L06	BSC	Engineering Chemistry Lab	-	-	3	3	1.5
7	20ME2L07	ESC	Engineering & IT Workshop	-	-	3	3	1.5
8	20ME2L08	ESC	Problem Solving through C Lab	-	-	3	3	1.5
9	20ME2M09	MC	Environmental Science	2	-	-	2	-
Total number of credits								19.5



B.TECH I SEMESTER

BSC	L	T	P	C
	3	0	0	3

20ME1T01 LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS

Pre-requisite: Basic knowledge about matrices, differentiation and integration

Course Objective: Objective of the course is to impart

- Basic understanding of mathematical methods to solve simultaneous linear systems
- Understanding of formation and solutions of ordinary differential equations
- Knowing the mathematical methods to solve applications of differential equations

Course Outcomes:

At the end of the course, student will be able to

- CO1:** Apply the knowledge to solve a system of homogeneous and non homogeneous linear equations
- CO2:** Illustrate the methods of computing eigen values and eigen vectors
- CO3:** Able to analyze the real life situations, formulate the differential equations and then applying the methods
- CO4:** Determine the solutions of linear differential equations
- CO5:** Optimize functions of several variables and able to find extreme values of constrained functions

SYLLABUS

UNIT-I: Linear systems of equations:

Rank of a matrix, Echelon form, Normal form, PAQ is in normal form, linear dependence and independence of vectors, Consistency of linear system of equations, System of linear homogeneous equations, Gauss-elimination and Gauss -Jordan methods.

UNIT-II: Eigen values & Eigen vectors:

Eigen values, Eigen vectors, Properties of Eigen values (without proofs), Cayley-Hamilton theorem (without proof), finding inverse and powers of a matrix using C-H theorem, Reduction to diagonal form, reduction of quadratic form to canonical form using orthogonal reduction, nature of quadratic forms.

UNIT-III: Ordinary Differential Equations of first order:

Linear equations, Bernoulli's equation, Exact differential equations. Equations reducible to exact equations, **Applications:** Orthogonal Trajectories, Newton's Law of cooling, Rate of decay & growth., R-L series circuits.

UNIT-IV: Linear Differential Equations higher order:

Definitions, Complete solution (without proof), Operator D, Rules to find complementary function, Inverse operator, Rules to find the particular integral (nonhomogeneous term of the form e^{ax} , $\sin(ax+b)$, $\cos(ax+b)$, polynomials in x^m , $e^{ax} V(x)$, any other function), Method of variation of parameters.

UNIT-V: Partial Differentiation:

Functions of two variables, Partial derivatives, Homogeneous functions, Euler's theorem, Total derivative, Jacobian and functional dependence, Taylor's theorem for functions of two variables. **Applications:** Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

Text Books:

1. B. S. GREWAL, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014.
2. B. V. RAMANA, Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007.

Reference Books:

1. ERWIN KREYSZIG, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.
2. N. P. BALI & Dr. MANISH GOYAL, A Text book of Engineering Mathematics, Lakshmi Publications, 9th Edition, 2014.

B.TECH I SEMESTER**BSC** **L** **T** **P** **C**
3 **0** **0** **3****20ME1T02 ENGINEERING PHYSICS**

Pre-requisite: Knowledge of basic concepts of waves, Optics, Electricity and Magnetism

Course Objective: Objective of the course is to impart

- *Knowledge* of fundamentals of Physics which helps them in the study of advanced topics of Engineering.
- *Develop* analytical capability and understand various Engineering concepts.

Course Outcomes:

At the end of the course, student will be able to

CO1: *Impart* knowledge of Physical Optics phenomenon Polarization and identify these phenomenon in natural processes

CO2: *Gain* knowledge of applications of lasers and optical fibers in various fields .

CO3: *Classify* magnetic and dielectric materials and their Engineering applications.

CO4: *Impart* knowledge of architectural acoustics and Study of Ultrasonics.

CO5: *Classify* crystal systems and analyze the crystalline structure using various X-ray diffraction techniques .

SYLLABUS**UNIT-I: Wave Optics:**

Interference: Introduction-Principle of Superposition – Coherent Sources – Interference in thin films (reflection geometry) – Colors in thin films-Newton's rings-Determination of wave length and refractive index.

Diffraction: C Introduction- Fresnel and Fraunhofer diffraction - Fraunhofer Diffraction due to Single slit, Double slit, N –slits(Qualitative) - Diffraction Grating – Resolving Power of Grating(Qualitative).

Polarizations: Introduction- Types of polarization-polarization by reflection,

refraction and Double refraction-Nicol's prism –Half and Quarter wave plates.

UNIT-II: Lasers and Fiber Optics:

Lasers:: Introduction – Characteristics of laser – Spontaneous and Stimulated emissions of radiation – Einstein's coefficients – Population inversion – Lasing action - Pumping Schemes – Ruby laser – He-Ne laser - Applications of lasers.

Fiber optics: Introduction –Principle of optical fiber-Construction- - Acceptance Angle - Numerical Aperture -Classification of optical fibers based on refractive index profile and modes .

UNIT-III: Magnetic and Dielectric Materials:

Magnetic Materials: Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr magneton – Classification of magnetic materials: Dia, para ferro, anti ferro & ferri – Domain concept of Ferromagnetism(Qualitative) - Hysteresis – soft and hard magnetic materials .

Dielectric Materials: Introduction - Dielectric polarization – Dielectric Polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientational polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation.

UNIT-IV: Acoustics and Ultrasonics:

Acoustics: Introduction – requirements of acoustically good auditorium– Reverberation – Reverberation time– Sabine's formula - Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedial measures.

Ultrasonics: Introduction - Properties - Production by magnetostriction and piezoelectric methods – Detection - Non Destructive Testing – pulse echo system through transmission and reflection modes - Applications.

UNIT-V: Crystallography and X-ray diffraction:

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC.

X-ray diffraction: Miller indices – separation between successive (hkl) planes- Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and

powder methods – powder pattern of bulk, nano materials of ZnO and calculation of lattice cell by Scherrer's formula.

Text books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering physics – D.K. Battacharya and Poonam Tandon, Oxford University press.
3. Engineering Physics by P.K.Palanisamy SciTech publications.

Reference Books:

1. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley & Sons
2. Engineering Physics – M.R.Srinivasan, New Age Publications
3. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
4. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press

B.TECH I SEMESTER

HSMC	L	T	P	C
	3	0	0	3

20ME1T03 ENGLISH**Pre-requisite:****Course Objective:**

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Course Outcomes: At the end of the course, student will be able to

- CO1** understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- CO2** ask and answer general questions on familiar topics
- CO3** employ suitable strategies to master the art of letter writing and email writing
- CO4** recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- CO5** form sentences using proper grammatical structures and correct word forms

SYLLABUS

UNIT-I A Drawer full of happiness (Detailed Study)
Deliverance (Non-detailed Study)

UNIT-II Nehru's letter to his daughter Indira on her birthday(Detailed Study)

- UNIT-III** Bosom Friend (Non-detailed Study)
Stephen Hawking-Positivity 'Benchmark' (Detailed Study)
Shakespeare's Sister(Non-detailed Study)
- UNIT-IV** Liking a Tree, Unbowed: Wangari Maathai-biography (Detailed Study)
Telephone Conversation(Non-detailed Study)
- UNIT-V** Stay Hungry-Stay foolish (Detailed Study)
Still I Rise(Non-detailed Study)

Text Books

1. "Infotech English", Maruthi Publications. (Detailed)
2. "The Individual Society", Pearson Publications.(Non-detailed)

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

B.TECH I SEMESTER

ESC	L	T	P	C
	3	0	3	3

20ME1T04 BASIC ELECTRICAL & ELECTRONICS ENGINEERING

Pre-requisite: Fundamental in Engineering Mathematics and Physics

Course Objective: Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.

1. Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
2. To explain the working principle, construction, applications of DC machines, AC machines
3. Know the fundamental of Electrical Engineering.
4. Understand .the concepts of diodes and transistors

Course Outcomes: At the end of the course, student will be able to

CO1: Analyze various electrical networks.

CO2: Understand operation of DC generators, single-phase transformer and acquire proper knowledge and working of 3-phase alternator and 3-phase induction motors

CO3: Understand operation of Sources of Energy & power transmission and distribution using single line diagrams.

CO4: Analyze operation of half wave, full wave bridge rectifiers and OP-AMPS.

CO5: Understanding operations of CE amplifier and basic concept of feedback amplifier.

SYLLABUS**UNIT-I: Electrical Circuits:**

Basic definitions - Types of network elements - Ohm's Law - Kirchhoff's Laws - Resistive networks, Inductive networks -Capacitive networks - Series - Parallel circuits - Star-delta and delta-star transformations.

UNIT-II: Electrical Machines:

Principle of operation of DC generator – EMF equation - Principle of operation of DC motor- Principle of operation of single phase transformers – EMF equation – Losses – OC & SC tests. Principle of operation of 3-Phase induction motor – Slip-torque characteristics. Principle of operation of alternators – Principle of operation of Synchronous motor - Speed-torque characteristics. Selection of electrical machines for various mechanical applications.

UNIT-III: Electrical Power Generation, Transmission and Distribution:

Sources of Energy – conventional & non-conventional, Introduction and layout of Thermal, hydel power plants, Introduction and layout of nuclear power plants, layout of solar power plants, power transmission and distribution using single line diagrams.

UNIT-IV: Diodes:

Introduction to semi-conductor physics, PN junction diode, Zener diode, half wave, full wave and bridge rectifier using diodes, Zener diode as a voltage regulator.

UNIT-V: Transistors:

PNP and NPN junction transistor, transistor as an amplifier- Transistor amplifier - Frequency response of CE amplifier - Concepts of feedback amplifier.

Text Book(s)

1. Electrical Technology by Surinder Pal Bali, Pearson Publications.
2. Electronic Devices and Circuits, R.L. Boylestad and Louis Nashelsky, 9th edition, PEI/PHI 2006.

References

1. .Electrical Circuit Theory and Technology by John Bird, Routledge Taylor & Francis Group
2. Basic Electrical Engineering by M.S.Naidu and S.Kamakshiah, TMH Publications
3. .Fundamentals of Electrical Engineering by Rajendra Prasad, PHI Publications, 2nd edition



4. .Basic Electrical Engineering by Nagsarkar,Sukhija, Oxford Publications,2nd edition
5. Industrial Electronics by G.K. Mittal, PHI

I B.TECH - I SEMESTER

ESC	L	T	P	C
	1	0	4	3

20ME1T05 : ENGINEERING GRAPHICS**Objective:**

1. To introduce the students to use orthographic projections, projections of points & simple lines.
2. To make the students draw the projections of the lines inclined to both the planes.
3. To make the students draw the projections of the plane inclined to both the planes.
4. To make the students draw the projections of the various types of solids in different positions inclined to one of the planes.
5. To represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.

Course Outcomes:**At the end of the course, the student will be able to**

1. Understand the concepts of projections and draw projections for simple entities such as points and lines.
2. Draw orthographic projections of planes and simple solids.
3. Understand the concept of sections and sectional views.
4. Develop the surfaces for various simple solids and understand the concept of intersection of two solids.
5. Analyze the 2D drawings and convert to 3D isometric views.
6. Learn computer aided drafting with AutoCAD and draw simple 2D part drawings and orthographic views using the software.

SYLLABUS**UNIT I**

Orthographic Projections: Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.

Projections of straight lines inclined to both the planes, determination of true

lengths, angle of inclination and traces.

UNIT II

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders-Simple positions

UNIT III

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one plane.

Sections of Solids: Sections and sectional views of Right regular solids- Prisms, Pyramids, Cones and Cylinder.

UNIT IV

Interpenetration of right regular solids: Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.

Development of Surfaces: Development of Surfaces of right regular solids- Prisms, Pyramids, Cones and Cylinder

UNIT V

Conversion of orthographic views to isometric view for Simple Solids such as prism, pyramid, cylinder and cone; Conversion of isometric view to orthographic views.

Computer Aided Drafting: Introduction to AutoCAD, Geometric commands, Modify commands, Annotation, Layers, display control and Properties tool bars. Creation of simple 2D part drawings and orthographic views.

Text books:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by K.L.Narayana & P. Kanniah, Scitech Publishers

Reference books:

1. Engineering Graphics for Degree by K.C. John, PHI Publishers
2. Engineering Graphics by PI Varghese, McGrawHill Publishers
3. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age
4. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers



B.TECH I SEMESTER

HSMC	L	T	P	C
	0	0	3	1.5

20ME1L06 ENGLISH COMMUNICATION SKILLS LAB

Course Objectives:

- Facilitate effective usage of functional English through role plays
- Focus on vocabulary enhancement
- Foster various nuances of phonetics and accent neutralization

Course Outcomes: At the end of the course, student will be able to

- CO1:** Acquire basic proficiency in English by learning functional aspects of English language
- CO2:** Learn the methods of enhancing vocabulary
- CO3:** Acquaint himself/herself with nuances of Phonetics

LIST OF EXPERIMENTS

- 1 Greetings and Introductions
- 2 Requesting Permission & Giving Directions
- 3 Inviting/Complaining/Congratulating
- 4 Root Words
- 5 Phonetics-Sounds and Symbols
- 6 Pronunciation Rules

References:

1. Strengthen Your Steps, Maruti Publications
2. Interact, Orient Blackswan
3. Word Power Made Easy, Pocket Books

B.TECH I SEMESTER

	L	T	P	C
BSC	0	0	3	1.5

20ME1L07 ENGINEERING PHYSICS LAB

Pre-requisite: Fundamental understanding of usage of an instrument with proper care.

Course Objective: Objective of the course is to impart

- Training Engineering graduates to handle instruments and their usage methods to improve the accuracy of measurements.

At the end of the course, student will be able to

CO1: Outcomes: The student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

CO2: Implement the basic principles of Mechanics to measure different physical parameters.

CO3: Enhance the knowledge of Usage of electronic devices in various applications

LIST OF EXPERIMENTS

1. Newton's rings –Determination of radius of curvature of Plano Convex Lens.
2. Determination of wavelength of spectral lines -Diffraction Grating
3. Determination of thickness of a spacer using wedge film and parallel interference fringes.
4. Determination of wavelength of laser source using diffraction grating
5. Determination of Numerical Aperture and bending loss of a given Optical Fiber.
6. Determination of dispersive power of prism.
7. Determination of Rigidity modulus of a material- Torsional Pendulum.
8. Determination of Acceleration due to Gravity and Radius of Gyration-Compound Pendulum.
9. Determination of Young's modulus by method of single cantilever oscillations
10. Verification of laws of vibrations in stretched strings – Sonometer.
11. Estimation of Planck's Constant using Photo electric Effect

12. Study of I /V Characteristics of Semiconductor diode.

13. I/V characteristics of Zener diode.

Magnetic field along the axis of a current carrying coil – Stewart and
Gee's apparatus

15. Energy Band gap of a Semiconductor using p - n junction diode

Reference Books

1. A Text book of Practical Physics, Balasubramanian S, Srinivasan M.N, S
Chand Publishers, 2017.

B.TECH I SEMESTER	L	T	P	C
	ESC	0	0	3
		0	3	1.5

**20ME1L08 BASIC ELECTRICAL & ELECTRONICS
ENGINEERING LAB**

Course Objectives: To understand the operation of electrical machines & electronic devices

Course Outcomes:

- CO 1** Compute the efficiency of DC shunt machine without actual loading of the machine
- CO 2** Estimate the efficiency and regulation at different load conditions and power factors for single phase transformer with OC and SC tests.
- CO 3** Analyze the performance characteristics and to determine efficiency of DC shunt motor & 3-Phase induction motor.
- CO 4** Control the speed of dc shunt motor using Armature voltage and Field flux control methods.
- CO 5** Draw the characteristics of PN junction diode & transistor
- CO 6** Determine the ripple factor of half wave & full wave rectifiers.

LIST OF EXPERIMENTS

- 1 Swinburne's test on D.C. Shunt machine (Predetermination of efficiency of a given D.C. Shunt machine working as motor and
- 2 OC and SC tests on single phase transformer (Predetermination of efficiency and regulation at given power factors).
- 3 Brake test on 3-phase Induction motor (Determination of performance characteristics).
- 4 Speed control of D.C. Shunt motor by
 - a) Armature Voltage control
 - b) Field flux control method
- 5 Brake test on D.C. Shunt Motor.
- 6 PN junction Diode characteristics A. Forward bias, B. Reverse bias. (Cut in voltage & Resistance calculations)
- 7 Transistor CE Characteristics (Input and Output).
- 8 Full wave Rectifier with and without filters.
- 9 CE Amplifiers.



- 10 RC Phase Shift Oscillator.
- 11 Class A Power Amplifier.



B.TECH II SEMESTER

	L	T	P	C
BSC	3	0	0	3

20ME2T01 TRANSFORM TECHNIQUES

Pre-requisite: Linear Algebra and Differential Equations

Course Objective: Objective of the course is to impart

- Learning the techniques of Laplace transforms to solve ordinary differential equations
- knowledge of Fourier series & Fourier transforms for piecewise continuous functions
- knowledge of solving boundary valued problems

Course Outcomes: At the end of the course, student will be able to

CO1: Able to analyze a class of integrals in terms of beta and gamma functions

CO2: Provide the techniques of Laplace transformations and able to solve problems related to digital signal processing

CO3: Analyze the general periodic functions in the form of an infinite convergent sine and cosine series

CO4: Illustrate the methods to solve the boundary value problems

CO5: Determine a solution of a discrete system using Z- transforms

SYLLABUS

UNIT-I: Special functions:

Beta function, Properties & problems, Gamma function, properties & problems, Relation between Beta and Gamma functions, Evaluation of improper integrals.

UNIT-II: Laplace Transforms (all properties without proofs):

Definition, Transforms of elementary functions, properties of Laplace transforms, Transforms of periodic functions, Transforms of derivatives and integrals, Multiplication by t^n , Division by t , Evaluation of improper integrals.

Inverse Laplace transforms–Method of partial fractions, other methods of finding inverse transforms, Convolution theorem (without proof). **Application:** Application to differential equations

UNIT-III: Fourier Series & Fourier Transforms:

Euler's formulae (without proof), Conditions of Fourier expansion, Functions having points of discontinuity, Change of interval, Even and odd functions, Half-range series.

Fourier Integral theorem (without proof), Fourier cosine & sine integral, complex form of Fourier integral, Fourier transform, Fourier sine & cosine transforms, properties of Fourier transforms (without proof), Convolution theorem (without proof), finite & infinite Fourier sine & cosine transforms.

UNIT-IV: Partial Differential Equations:

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions, solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations. Method of separation of Variables, Applications: One-dimensional wave and heat equations, two-dimensional heat equation.

UNIT-V: Z-Transforms: (all properties without proofs)

Introduction, definition, some standard z -transforms, linearity property, damping rule, some standard results, shifting U_n to the right, multiplication by n , initial and final value theorems, Inverse z -transforms, convolution theorem, evaluation of inverse z -transforms by partial fractions, applications to difference equations.

Text Books:

1. B. S. GREWAL, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2014.



2. B. V. RAMANA, Higher Engineering Mathematics, Tata MC Graw Hill, 1st Edition, 2007.

Reference Books:

3. ERWIN KREYSZIG, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2015.
4. N. P. BALI & Dr. MANISH GOYAL, A Text book of Engineering Mathematics, Lakshmi Publications, 9th Edition, 2014.

B.TECH II SEMESTER

	L	T	P	C
BSC	3	0	0	3

20ME2T02 ENGINEERING CHEMISTRY

Pre-requisite: Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

Course Objective: Objective of the course is to impart

- **Importance** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- **Outline** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.
- **Express** the increases in demand as wide variety of advanced materials are introduced; which have excellent engineering properties.
- **Classify and discuss** the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also **summarized**.
- **Relate** the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.
- **Explain** the importance and usage of water as basic material in almost all the industries;
- **Interpret** drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

Course Outcomes:

At the end of the course, student will be able to

- CO1:** **Analyze** the different types of composite plastic materials and **interpret** the mechanism of conduction in conducting polymers.
- CO2:** **Utilize** the theory of construction of electrodes, batteries and fuel cells in redesigning new engineering products and **categorize** the reasons for corrosion and study methods to control corrosion.

CO3: *synthesize* nanomaterials for modern advances of engineering technology.

summarize the techniques that detect and measure changes of state of reaction.

illustrate the commonly used industrial materials.

CO4: *differentiate* petroleum, petrol, synthetic petrol and have knowledge how they are produced.

Study alternate fuels and *analyze* flue gases.

CO5: *Analyze* the suitable methods for purification and treatment of hard water and brackish water.

SYLLABUS

UNIT-I: Polymer Technology:

Polymerisation: Introduction, methods of polymerization (addition and Condensation), Physical and mechanical properties.

Plastics: Compounding, fabrication (compression, injection, blown film and extrusion), preparation, properties and applications (PVC, polycarbonates and Bakelite), mention some examples of plastic materials used in electronic gadgets.

Elastomers: Natural rubber-Drawbacks-vulcanization, preparation, properties and applications (Buna S, thiokol and polyurethanes).

Composite materials: Fiber reinforced plastics – GFRP and Aramid FRP

Conducting polymers: Intrinsic and extrinsic conducting polymers

Biodegradable polymers: preparation and applications

UNIT-II: Electrochemical Cells And Corrosion:

Part I: ELECTROCHEMICAL CELLS: Single electrode potential, electrochemical series and uses of series, standard hydrogen electrode, calomel electrode, batteries (Dry cell, Li ion battery and zinc air cells), fuel cells (H₂-O₂, CH₃OH-O₂, phosphoric acid and molten carbonate).

Part II: Corrosion: Definition, theories of corrosion (chemical and electrochemical), galvanic corrosion, differential aeration corrosion, stress

corrosion, galvanic series, factors influencing rate of corrosion, corrosion control (cathodic protection), Protective coatings (cathodic coatings, anodic coatings, electroplating and electroless plating)

UNIT-III: Chemistry Of Materials:

Part- A: Nano materials:- Introduction, sol-gel method, characterization by (Brunauer Emmet Teller [BET]), (scanning electron microscopy [SEM]) and (transmission electron microscopy [TEM]) with example (TiO₂), applications of graphene and fullerenes, carbon nanotubes (types, preparation and applications)

Part-B: Refractories: - Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

Lubricants: - Definition, mechanism of lubricants, properties (definition and importance).

Cement: - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), deterioration of cement.

UNIT-IV: Fuels:

Introduction, calorific value, higher calorific value, lower calorific values, problems using Dulong's formula, proximate and ultimate analysis of coal sample and their significance, numerical problems, petroleum (refining-cracking), synthetic petrol (Fischer Tropsch and Bergius), petrol knocking, diesel knocking, octane and cetane ratings, anti-knocking agents, Introduction to alternative fuels (Bio-diesel, ethanol, methanol, natural gas, liquefied petroleum gas, compressed natural gas).

UNIT-V: Water Technology:

Hardness of water, determination of hardness by complexometric method, boiler troubles (priming and foaming, scale formation, boiler corrosion,

caustic embrittlement), internal treatments, softening of hard water (zeolite process and related sums, ion exchange process), potable water and its specifications, break point chlorination-desalination (reverse osmosis and electro dialysis).

Standard Books:

1. P.C. Jain and M. Jain “**Engineering Chemistry**”, 15/e, Dhanpat Rai & Sons, Delhi, (Latest edition).
2. Shikha Agarwal, “**Engineering Chemistry**”, Cambridge University Press, New Delhi, (2019).
3. S.S. Dara, “**A Textbook of Engineering Chemistry**”, S.Chand & Co, (2010).
4. Shashi Chawla, “Engineering Chemistry”, Dhanpat Rai Publishing Co. (Latest edition).

Reference:

1. K. Sesha Maheshwaramma and Mridula Chugh, “**Engineering Chemistry**”, Pearson India Edn.
2. O.G. Palana, “**Engineering Chemistry**”, Tata McGraw Hill Education Private Limited, 2009). CNR Rao and JM Honig (Eds)
3. “**Preparation and characterization of materials**” Academic press, New York (latest edition) B. S. Murthy, P. Shankar and others,
4. “**Textbook of Nanoscience and Nanotechnology**”, University press (latest edition)

B.TECH II SEMESTER

	L	T	P	C
ESC	3	0	0	3

20ME2T03 ENGINEERING MECHANICS

Objectives: The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

Course outcomes:

1. The student should be able to draw free body diagrams for FBDs for particles and rigid bodies in plane and space and problems to solve the unknown forces, orientations and geometric parameters.
2. The student should be able to determine centroid for lines, areas and center of gravity for volumes and their composites.
3. The student should be able to determine area and mass moment of inertia for composite sections
4. The student should be able to analyze motion of particles and rigid bodies and apply the principles of motion, work energy and impulse – momentum.

SYLLABUS**UNIT – I**

Objectives: The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.

Introduction to Engg. Mechanics – Basic Concepts.

Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems.

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces.

Lamis Theorem, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

UNIT II

Objectives: The students are to be exposed to the concepts of force and friction, direction and its application.

Friction: Introduction, limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction, Wedges.

Analysis of plane trusses-Method of Joints, Method of Sections.

UNIT – III

Objectives : The students are to be exposed to concepts of centre of gravity.

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures

Centre of Gravity: Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorems.

UNIT – IV

Objectives: The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.

Area moments of Inertia: Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.

UNIT – V

Objectives: The students are to be exposed to rigid motion kinematics and kinetics

Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a Particle and Analysis as a Rigid Body in Translation– Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

TEXT BOOKS :

1. Engineering Mechanics - S.Timoshenko & D.H.Young., 4th Edn - , Mc Graw Hill publications.
2. Engineering Mechanics- S S Bhavikati –New Age International Publishers

REFERENCES :

3. Engineering Mechanics, statics and dynamics – I.H.Shames, – Pearson Publ.
4. Engineering Mechanics, Ferdinand . L. Singer, Harper – Collins.
5. Engineering Mechanics statics and dynamics , A Nelson , Mc Graw Hill publications
6. Engineering Mechanics- A K Tayal
7. Engineering Mechanics , R.K.Bansal, Laxmi Publications
8. Engg. Mechanics- KL Kumar-Tata McGraw Hill publications

B.TECH II SEMESTER

ESC	L	T	P	C
	3	0	0	3

20ME2T04 THERMODYNAMICS**Course objectives:**

1. To introduce the basic laws of thermodynamics
2. To make them understand the applications of laws of thermodynamics
3. To introduce the concepts of entropy, Availability and Irreversibility
4. To make them understand the properties of Steam and use of Steam Tables
5. To introduce air standard cycles and their applications.

Course outcomes: at the end of the course, the student will be able

1. understand the basic laws of thermodynamics
2. apply the laws of thermodynamics
3. understand the concept of entropy, Availability and Irreversibility
4. understand the properties of Steam and use of Steam Tables
5. understand the use of standard cycles and their applications.

SYLLABUS**Unit I**

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics.

First law of Thermodynamics: Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics.

Unit II

Second Law of Thermodynamics: Kelvin - Planck statement and Clausius statement and their equivalence, corollaries - perpetual motion machines of second kind - reversibility and irreversibility, cause of irreversibility - Carnot cycle, heat engine, heat pump and refrigerator, Carnot theorem, Carnot efficiency.

Unit III

Entropy: Clausius inequality - Concept of Entropy- entropy equation for different processes and systems

Availability and Irreversibility: Definition of exergy and energy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.

Unit IV

Properties of Steam and use of Steam Tables: Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart- steam calorimetry.

Unit V

Air Standard Cycles: Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Comparison of Otto, Diesel and dual cycles

Refrigeration cycle: Rankine cycle, Brayton cycle.

Text Book(s)

1. P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013.
2. Yunus A. Cengel, Michael A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.

References

1. J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012.
2. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015
3. Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7/e, Wiley, 2009 R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010

B.TECH II SEMESTER

ESC	L	T	P	C
	3	0	0	3

20ME2T05 PROBLEM SOLVING THROUGH C**Pre-requisite:****Course Objective:**

- To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
- To gain knowledge of the operators, selection, control statements and repetition in C. To learn about the design concepts of arrays, strings, enumerated structure and union types and their usage. To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor. To assimilate about File I/O and significance of functions

Course Outcomes: At the end of the course, student will be able to

CO1: Understand the basic concepts of programming

CO2: Understand and Apply loop construct for a given problem

CO3: Demonstrate the use pointers

CO4: Understand the use of functions and develop modular reusable code

CO5: Understand File I/O operations

SYLLABUS**UNIT-I:**

INTRODUCTION TO COMPUTERS: Functional Components of computer, computer software, categories of memory, types of programming languages, Development of algorithms, flow charts, software development process, Computer Numbering system

BASICS OF C PROGRAMMING: Introduction to programming paradigms, Structure of C program, Data Types, C Tokens, Operators: Precedence and Associativity, Expressions Input/output statements, Assignment statements

UNIT-II:

Decision making statements: if, if else, nester if. Multi way decision making statements: else if, Switch statement. **Loop statements:** while, do while, for, Compilation process.

UNIT-III:

Introduction to Arrays: Declaration, Initialization, One dimensional array, Example Programs on one dimensional array, Selection sort, linear and binary search, two dimensional arrays, Matrix Operations, Multi-dimensional Arrays

Strings: Declaration, String operations: length, compare, concatenate, copy, String handling functions.

UNIT-IV:

FUNCTIONS: Introduction to functions: Function prototype, function definition, function call, Built-in functions, Recursion, Storage classes, Passing Arrays & Strings to the functions, Preprocessor directives

POINTERS: Pointers, Pointer operators, Pointer arithmetic, Arrays and pointers, Array of pointers, Parameter passing: Pass by value, Pass by reference, Dynamic Memory Allocation

UNIT-V:

STRUCTURES AND UNIONS: Structure, Nested structures, Pointer and Structures, Array of structures, Example Program using structures and pointers, Self-referential structures, Unions.

FILE PROCESSING: Files, Types of file processing: Sequential access, Random access, Sequential access file, Random access file, Command line arguments

Text Books:

1. Krnighan. B.W and Ritche, D.M, "The C Programming Language", Second Edition, Pearson Education, 2006
2. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.

References:

1. Pradepdey, Manas Ghosh, "Fundamentals of Computing and programming in C", First Edition, Oxford University Press, 2009.
2. Paul Deitel and Harvey Deitel, "C How to Program", Seventh Edition,



Pearson Publication.

3. E Balagursamy, "Programming in C, Sixth Edition, Tata McGraw Hill.
4. Ajay Mittal, "Programming in C A practical Approach", Pearson education



B.TECH II SEMESTER

	L	T	P	C
BSC	0	0	3	1.5

20ME2L06 ENGINEERING CHEMISTRY LAB

Pre-requisite: Acquire some experimental skills.

Course Objective: Objective of the course is to impart

- The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations.
- A few instrumental methods of chemical analysis.

Course Outcomes:

At the end of the course, student will be able to

CO1: The student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

LIST OF EXPERIMENTS

- 1 Determination of HCl using standard Na₂CO₃ solution.
- 2 Determination of alkalinity of a sample containing Na₂CO₃ and NaOH.
- 3 Determination of Mn⁺² using standard oxalic acid solution.
- 4 Determination of ferrous iron using standard K₂Cr₂O₇ solution.
- 5 Determination of Cu⁺² using standard hypo solution.
- 6 Determination of temporary and permanent hardness of water using standard EDTA solution.
- 7 Determination of Fe⁺³ by a colorimetric method.
- 8 Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
- 9 Determination of iso-electric point of amino acids using pH-metry method/conductometric method



- 10 Determination of the concentration of strong acid vs strong base (by conductometric method).
- 11 Determination of strong acid vs strong base (by potentiometric method).
- 12 Determination of Mg²⁺ present in an antacid.
- 13 Determination of CaCO₃ present in an egg shell.
- 14 Estimation of Vitamin C.
- 15 Determination of phosphoric content in soft drinks.
- 16 Adsorption of acetic acid by charcoal.
- 17 Preparation of nylon-6, 6 and Bakelite (demonstration only).

B.TECH II SEMESTER

ESC	L	T	P	C
	0	0	3	1.5

20ME2L07: ENGINEERING & IT WORKSHOP

Course Objective: To impart hands-on practice on basic engineering trades and skills.

Trade:**1. Carpentry**

- T-Lap Joint
- Cross Lap Joint
- Dovetail Joint
- Mortise and Tenon Joint

2. Fitting

- Vee Fit
- Square Fit
- Half Round Fit
- Dovetail Fit

3. House Wiring

- Parallel / Series Connection of three bulbs
- Stair Case wiring
- Florescent Lamp Fitting
- Measurement of Earth Resistance

4. Tin Smithy

- Taper Tray
- Square Box without lid
- Open Scoop
- Funnel

5. Product prototyping using 3D Printing**6. IT Workshop**

Task 1: Identification of the peripherals of a computer - Prepare a report containing the block diagram of the computer along with the configuration of each component and its functionality. Describe about various I/O Devices and its usage.

Task 2: Practicing disassembling and assembling components of a PC

Note: At least two exercises to be done from each trade.

B.TECH II SEMESTER

	L	T	P	C
ESC	0	0	3	1.5

PROBLEM SOLVING THROUGH C LAB**20ME2L08****Course Objectives:**

- Apply the principles of C language in problem solving.
- To design flowcharts, algorithms and knowing how to debug programs.
- To design & develop of C programs using arrays, strings pointers & functions.
- To review the file operations, preprocessor commands.

Course Outcomes:

- Demonstrate Knowledge on various concepts of a C language.
- Able to draw flowcharts and write algorithms.
- Able design and development of C problem solving skills.
- Able to design and develop modular programming skills.
- Able to trace and debug a program

Exercise 1:

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

Exercise 2:

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

Exercise 3:

1. Write a C program to convert a string to a long integer.

2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

Exercise 4:

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum. $1 + 1/2 + 1/3 + 1/4 + 1/5 \dots 1/n$ terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

Exercise 5:

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

Exercise 6:

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

Exercise 7:

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

Exercise 8:

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.

Exercise 9:

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

Exercise 10:

1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.
2. Write a program in C to add two numbers using pointers.

Exercise 11:

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

Exercise 12:

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

Exercise 13:

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc()function.

Exercise 14:

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc() function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

Exercise 15:

1. Write a program in C to check whether a number is a prime number or not using function.
2. Write a program in C to get the largest element of an array using the function.

Exercise 16:

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name
3. Write a program in C to remove a file from the disk.

B.TECH II SEMESTER

	L	T	P	C
MC	2	0	2	-

20ME2M09 ENVIRONMENTAL SCIENCE**Course objective:**

To understand the importance of Environment and the importance of biodiversity

Course outcomes:

- The importance of environment, Natural resources and current global environmental challenges for the sustenance of the life on planet earth.
- The concepts of the ecosystem and its function in the environment.
- 3.The biodiversity of India and the threats to biodiversity, and conservation practices to protect the biodiversity
- The various attributes of the pollution and their impacts and measures to reduce or control the pollution along with waste management practices.
- The environmental legislations of India and Social issues and the possible means
- Environmental assessment and the stages involved in EIA.

SYLLABUS**UNIT-I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES**

Introduction- Scope of Environmental Studies- Importance of Environmental Studies- Need for public awareness, Environmental ethics- Contemporary Environmentalists- Environmental Global moves: Stockholm conference, Earth summit

Concept of an ecosystem - Structure of an ecosystem- function of an ecosystem- Food chains, food webs- ecological pyramids- Energy flow in the ecosystem- Ecological succession- Nutrient cycling- 1^oproduction& 2^oproduction- Major ecosystems: Forest ecosystem- Grassland ecosystem, Desert ecosystem- Aquatic ecosystem: pond, Lake Ecosystem- Streams, river ecosystem, Oceans

UNIT-II: NATURAL RESOURCES AND CONSERVATION

Introduction and classification of natural resources-Forest resources: Use and over-exploitation- Deforestation-Timber extraction-Mining- Conservation- Water resources: Use and over utilization of surface and ground water,- Floods, drought, Dams and associated problems- Water conservation, rain water harvesting, water shed management-Energy resources: renewable energy sources –solar-wind-hydro-tidal- Ocean thermal-geo thermal-bio mass-bio gas-bio fuels- Hydrogen.- Non-renewable energy sources-coal-petroleum-natural gas-Nuclear energy

UNIT-III: BIODIVERSITY AND ITS CONSERVATION

Definition, classification- Value of biodiversity-Threats to biodiversity: habitat loss, man-wildlife conflicts- Endangered and endemic species of India-Conservation of biodiversity- Biodiversity at national and local levels, Hot-spots of biodiversity

UNIT-IV: ENVIRONMENTAL PROBLEMS

Global warming, Climate change- Acid rain, Ozone depletion- Air pollution- Water pollution- Soil pollution- Noise pollution, Nuclear hazards- Solid Waste Management: Causes, Consequences and Control methods- Solid Waste Management- Population growth and explosion, effects, control measures- Pollution case studies- Role of an individual in prevention of pollution

UNIT-V: ENVIRONMENTAL LEGISLATION & MANAGEMENT

Sustainable development- Air (Prevention and Control of Pollution) Act- Drawbacks- Water (Prevention and control of Pollution) Act- Drawbacks- Wildlife Protection Act- Drawbacks- Forest Conservation Act- Drawbacks- Environmental Protection Act- Drawbacks- Environmental Impact Assessment and its significance- Preparation of Environmental Management Plan and Environmental Impact Statement- Ecotourism

TEXT BOOKS:

1. Environmental Studies, Anubha Kaushik, C P Kaushik, New Age Publications, New Delhi
2. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
3. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
4. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

REFERENCES:

1. Text Book of Environmental Studies, Deeshita Dave & P. UdayaBhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Delhi