BRAINWARE UNIVERSITY
SCHOOL OF ENGINEERING
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Bachelor of Technology in Computer Science & Engineering – Artificial Intelligence & Machine Learning – 2023

SEMESTER – I

Course Code	Course Name	Course Type	Hours per Week			Credit(s)	Total Marks
			L	T	P		
HSMCM101	Communication Skills	HS	3	0	0	3	100
BSCM101	Semiconductor Physics	BS	3	0	0	3	100
BSCM102	Calculus & Linear Algebra	BS	4	0	0	4	100
ESCM101	Basic Electrical and Electronics Engineering	ES	3	0	0	3	100
BSCM191	Semiconductor Physics Lab	BS	0	0	3	1.5	100
ESCM191	Basic Electrical and Electronics Engineering Lab	ES	0	0	3	1.5	100
ESCM192	Engineering Graphics & Design Lab	ES	0	0	3	1.5	100
Total						17.5	700
AUM-1	Environmental Science	AU*	1	0	0	0	50

Course Code: HSMCM101
Course Name: Communication Skills
Contact Hours: 3L/Week
Credits: 3
Allotted Hours: 45L

Course Objective:
The objective of the course is to familiarize the students with the techniques of communication in English. It aims to equip the students with the ability to interact with fluency and proficiency. It shall enable the learners not only to use the English for oral practices but also to use the language as a means for written communication.
Pre-requisite(s): Basic knowledge of English
Course Outcome: After the completion of the course, students would be able to:

CO1: Equip with knowledge of English as a world language and help them identify, write, and communicate in a grammatically correct manner.

CO2: Understand and apply the strategies and theories of effective verbal and non-verbalcommunication.

CO3: Demonstrate a thorough command of English and its linguistic structures through enhancement of comprehension skills of students by cultivating an ability to read texts closely and to analyze texts writtenina wide variety of forms, styles, structures, and modes.

CO4: Prepare, explain and evaluate high quality, technical oral and written English communication for professional andworkplace environments.

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Module I: Functional Grammar [5H]
Application based Grammar will be taught using Worksheets and Correction of Errors
Noun and Pronoun, Verbs & Tenses, Adjectives and Adverbs, Article and Preposition, Conjunction, Phrases, Clause (Noun, Adjective, Adverb), Sentence Types (Simple, Compound, and Complex), Transformations (Active-Passive, Direct-Indirect), Spelling and Punctuation

Module II: Vocabulary [5H]
Building Vocabulary through worksheets and MCQ practice during classes
One-word Substitution, Homophones, Proverbs, Synonyms and Antonyms, Redundancies

Module III: Pronunciation [5H]
Practicing Pronunciation through listening and speaking activities
Clarity and fluency, Vowel and Consonant Sounds, Intonation

Module IV: Communication Theory [20H]
Definition of Communication, Types of Communication (Verbal & Non-Verbal; Formal & Informal; Intra-personal, Inter-personal, Extra-personal, Group, Mass), Flows of Communication (Vertical, Horizontal, and Diagonal), Barriers of Communication

Module V: Comprehension [10H]
- A Strange Night for Mr. Shasmal
Practicing various technical and non-technical passages for Comprehension (Summarise and answer questions based on the passage)

Text books:

1. The Collected Short Stories by Satyajit Ray- Penguin Books
2. A Handbook of Grammar -BRAINWARE
3. Intermediate English Grammar- Cambridge University Press
4. High School English Grammar- Wren and Martin.

Course Code: BSCM101
Course Name: Semiconductor Physics
Contact Hours: 3L/Week
Credits: 3
Allotted Hours: 45L

Course Objective:

The objective of the course is to familiarize the students with the knowledge of quantum mechanics and its applications. Students will learn band structure and its application in analysis of insulator, semiconductor and metal. They will also learn transport mechanism of electricity in materials and the working principle of lasing action. They will have exposure to measurement technique using one point and four point probes.

Pre-requisite(s): Knowledge of ordinary and partial differential equations and their solutions.

Course Outcome: After the completion of the course, students would be able to:

CO1: apply preliminary concepts of quantum mechanics to analyse real-world physical problems. K3 K4

CO2: understand the band structure of a material and differentiate between metals, semiconductors andinsulators to explain conductivity different materials.K2

CO3: understand carrier transport mechanism in metal-semiconductor and semiconductor-semiconductorinterfaces and evaluate the performance of various devices in terms of different types of charge transport.

CO4: identify different optical transitions in semiconductors and explain lasing action in different types oflaser devices.

CO5: understand the working principle of Hall-effect and four-probe method and applying the knowledgewould be able to explain the measured values of different physical parameters.

Module I: [10H]
Introduction to Quantum Mechanics: Wave Particle duality, De-Broglie Hypothesis, Wave Function and its physical Significance, Probability Density, Normalization of a wave function, Expectation Value, Operator Correspondence, Heisenberg uncertainty principle, Schrödinger Wave Equations (Time dependent and independent; 1D only), Particle in 1D Box with rigid walls and its Energy states.

Module II: [10H]
Electronic materials: Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

Module III: [8H]
Semiconductors: Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration andtemperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift current densities, p-n junction, p-n junction diode, Zener diode, Metal-semiconductor junction (Ohmic and Schottky).

Module IV: [10H]
Optical transitions in semiconductors: Absorption, spontaneous emission and stimulated emission; Einstein's A, B coefficients, laser, working principle of LED and laser diode, semiconductor laser, Ruby laser(qualitative), He- Ne laser(qualitative), Photovoltaic effect, solar cell and optical fiber.

Module V: [7H]
Measurements: Four-point probe for carrier density, hall mobility and hall coefficient; Hot-point probe measurement, capacitance-voltage measurements.

Text books:

1. Atomic Physics, S. N. Ghoshal, S. Chand Publishing
2. Elements of Physics-II, Dr. Subrata Kamilya, Knowledge Group Publications

Reference books:
1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, OxfordUniversity Press, New York (2007).

5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL.
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL.

Course Code: BSCM102
Course Name: Calculus & Linear Algebra
Contact Hours: 4L/Week
Credits: 4
Allotted Hours: 60L

Course Objective:

In the modern world, Calculus and linear algebra has become an important tool to describe change and motion and thus it is extensively used in many fields including but not limited to science, engineering, medicine, business, industry. The objective of the course is to familiarize the prospective engineers with techniques of Calculus. It aims to equip the students with standard concepts and tools at an intermediatelevel that will serve them well towards tackling more advanced levels of Mathematics and applications that they would find useful in their respective discipline.
Pre-requisite(s): Function, Limit and Continuity

Course Outcome:
After the completion of the course, students would be able to:
CO1: Remember various techniques of integration and apply them to evaluate improper integrals.

CO2: Understand the concepts of sequence and series and determine limits of sequences and convergence and approximate sums of series. Define, differentiate, and integrate functions represented as power series expansions, including Taylor series and apply them to evaluate various related problems.

CO3: Apply the concept of partial differentiation and multiple integration in their respective disciplines and evaluate different problems.

CO4: Understand concept of matrices, determinant and inverse of a matrix, and solve systems of linear equations using the Gauss Elimination method. Analyze operations, properties of metrices, determinant and apply them.

CO5: Apply the concept of a basis and the dimension of a vector space, the Rank-Nullity theorem, the matrix associated with a linear map, and eigenvalues and eigen vectors and evaluate different related problems.

Module I: [10H]
Single Variable Calculus: Rolle’s Theorem, Mean Value Theorems, Taylor’s and Maclaurin’s Theoremswith Remainders, Evaluation of Definite and Improper integrals; Beta and Gamma Functions and their properties.

Module-II: [10H]
Sequences and Series: Convergence of Sequence and Series, Tests for Convergence; Power Series, Taylor's Series, Series for Exponential, Trigonometric and Logarithm Functions

Module-III: [16H]

Multivariable Calculus: Functions of Several Variables, Limits and Continuity, Partial Derivatives, Total Differential, Derivatives of Composite and Implicit Functions, Extreme Values and Saddle Points, Lagrange's Method of Undetermined Multipliers. Double Integrals in Cartesian and Polar Coordinates, Change of Order of Integration, Change of Variables (Cartesian to Polar), Applications of Double Integrals to find Area and Volume,Triple integrals in Cartesian Coordinates.

Module-IV: [8H]

Matrices: Basic Operations on Matrices, Determinants, Cramer's Rule, Inverse of a Matrix using Gauss Jordan Elimination, Rank of a Matrix, Solution of System of Linear Equations: Gauss Elimination Method.

Module-V: [16H]

Vector Spaces: Vector Space, Linear Independence of Vectors, Basis, Dimension; Linear Transformations (Maps), Range and Kernel of a Linear Map, Rank, Nullity, Rank-Nullity Theorem, Inverse of a Linear Transformation, Composition of Linear Maps, Matrix associated with a Linear Map. Eigenvalues, Eigenvectors, Symmetric, Skew- symmetric, and Orthogonal Matrices, Eigen bases, Diagonalization; Inner Product Spaces, Gram-Schmidt Orthogonalization.

Text books:

1. "Calculus", George B. Thomas and Ross L. Finney, Pearson Education, 9th Edition, Reprint 2002.
2. "Advanced Engineering Mathematics", Jain R. K. and Iyengar S. R. K., NarosaPublishers, 5th Edition, 2016.
3. "Linear Algebra: A Modern Introduction", Poole D , Brooks/Cole, 2nd Edition 2005.
4. "Advanced Engineering Mathematics, Kreyszig Erwin, John Wiley & Sons, 10th Edition ,2010.
5. "Advanced Engineering Mathematics", Jain R. K. and Iyengar S.R.K, Narosa Publishers, 5th Edition 2016.

Reference books:

1. "Higher Engineering Mathematics", Grewal B. S, Khanna Publishers, 35th Edition, 2000.
2. "Engineering Mathematics, Vol.-I & Vol.-II", Pal B. K. and Das K., U. N. Dhar & Sons, 10th Edition, 2018.
3. "Advanced Engineering Mathematics", Peter V. O'Neil, Cengage Learning, ,, 7th Edition 2012.

Course Code: ESCM101
Course Name: Basic Electrical and Electronics Engineering
Contact Hours: 3L/Week
Credits: 3
Allotted Hours: 45L

Course Objective:

The objective of the course is to endow the students with strong foundation for further study of electrical and electronics courses. The students are enriched to develop the analytical skills for solving the electrical and electronics circuits. They are able to understand the basic principles and relevant behaviors of transformers, electrical machines, semi-conductor diodes and transistors.

Pre-requisite(s): NIL

Course Outcome: After the completion of the course, students would be able to:

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CO1: Describe and apply network theorems to analyze DC and AC circuits.

CO2: Explain and analyze the construction and operation of transformers, DC and AC machines.

CO3. Understand and interpret the physics of the semiconductors.

CO4: Understand and compare the characteristics and uses of different kinds of diodes and transistors.

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Module I: DC circuit [6H]
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems, Maximum power transfer theorem

Module II: A. C. Circuits [7H]
Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Three-phase balanced circuits, voltage and current relations in star and deltaconnections.Three phase power measurement by two wattmeter method.

Module III: Transformers [5H]
Laws of electromagnetic induction, Lenz's law, Fleming's right and left hand rule, Principle of self and mutual induction, Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.

Module IV: Electrical Machines [5H]
Construction, working, torque-speed characteristic and speed control of separately excited dc motor, Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, torque-slipcharacteristic.

Module V: Physics of Semiconductors: [6H]
Differentiation of insulators, metals and semiconductors in the framework of energy band theory. Intrinsic andextrinsic semiconductors, p and n- type semiconductors. Mechanism of drift/ diffusion current flow in semiconductors, mobility, effective mass, current density and conductivity, Hall effect in semiconductor.

Module VI: p-n junction and Semiconductor Diodes: [8H]
The p-n diode, formation of depletion zone, V-I characteristics of a forward and reverse biased p-n junction diode, V-I characteristics of a forward and reverse biased, Shockley's equation, Zener diode, Zener breakdown, Avalanche breakdown, V-I characteristics of Zener diode, load and line regulation with a Zener diode. Light emitting diode (LED), Photo diode, Solar cell, Varactors diode, tunnel diode. Diode as a half and full-wave rectifier, PIV rating, ripple factor, Bridge rectifier, Effect of filters

Module VII: Bipolar Junction Transistor: [8H]
Formation of junction transistor, current components in a BJT, current gains: α and β (both d.c. and a.c.) and relation between them, Transistors p-n-p and n-p-n in Common Base (CB), Common Emitter (CE) and Common Collector (CC) modes, input, output characteristics in CB and CE modes; Saturation, active and cut –off regions

Text books:

1. B. L. Thareja, A text book of Electrical Technology, Vol-I, S.Chand Publication
2. D. P. Kothari and I. J. Nagrath, —Basic Electrical Engineering, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, —Basic Electrical Engineering, McGraw Hill, 2009.
4. Electronics Fundamentals and Applications, P C Chattopadhyay and D. Rakshit, New Age InternationalPrivate Limited
5. Integrated Electronics, Millman and Halkias, Tata McGraw- Hill Edition
6. Basic Electronics , K.K.Ghosh, Platinum Publisher

Reference books:

1. B. L. Theraja, A textbook of Electrical Technology, Vol-II, S. Chand Publication
2. J. B. Gupta, "Basic Electrical Engineering", S. K. Kataria & Sons Publication
3. T. K. Nagsarkar & M. S. Sukhija, "Basic Electrical Engineering", OxfordUniversity Press
4. Fundamentals Principles of Electronics, B. Ghosh, Books & Allied Ltd
5. The Art of Electronics, P. Horowitz and W. Hill, Cambridge University Press,1989

Course Code: BSCM191
Course Name: Semiconductor Physics Lab
Contact Hours: 3P/Week
Credits: 3
Allotted Hours: 45L

Course Objective:
The primary objective of this course is to familiarize the students with the fundamental concepts of semiconductor physics, modern physics, and their various applications.
Prerequisite(s): Knowledge of graphical presentation with proper choice of unit.

After the completion of the course, students would be able to:

CO1: interpret the I-V characteristics of an p-n diode and Zener diode and measure both d.c and a.c resistances at different operating point and acquire the skill to evaluate the performance of different electronic devices.
CO2: estimate the performance Zener diode by measuring its load and line regulation and design current and voltage regulator.
CO3: measure voltage across capacitor and resistor and determine resonant frequency and quality factor of a series L-C-R circuit thereof.
CO4: categorize an optical fiber by measuring its numerical aperture and attenuation constant.
CO5: measure and explain the band-gap and carrier concentration of a semiconductor.

Module I: Forward and reverse bias I-V characteristics of a p-n junction diode and determination of r_{ac} and r_{dc}. [6H]

Module II: I-V characteristics of Zener diode in reverse bias condition and determination of r_{ac} and r_{dc}. [6H]

Module III: To draw the load and line regulation characteristics of a Zener diode and determination of percentage regulation. [6H]

Module IV: To find the resonant frequency of a series L-C-R circuit and also to determine its quality factor. [6H]

Module V: To determine the numerical aperture of optical fiber. [3H]

Module VI: To determine the attenuation co-efficient in optical fiber. [3H]

Module VII: Determination of band gap of a given semiconductor by four probe method. [6H]

Module VIII: Determination of the Hall coefficient of a semiconductor. [6H]

Module IX: Determination of Planck's constant by Einstein's photoelectric effect equation[3H]

Text Books:
1. B.Sc. Practical Physics, K. G. Mazumder and B. Ghosh, Shreedhar Publishers.
2. An Advanced Course in Practical Physics, D. Chattopadhyay, P. C. Rakshit, New Central Book Agency.

Reference Book:
1. B.Sc. Practical Physics, C. L. Arora, S. Chand Publishing House.

Course Code: ESCM191
Course Name: Basic Electrical and Electronics Engineering
Contact Hours: 3P/Week
Credits: 3
Allotted Hours: 45L

Course Objective:

The objective of the course is to familiarize the students with discrete electronic components like p-n junction diode, Zener diode, BJT, etc. and their characterizations. The students should also learn to use p-n junction diodes for rectification, Zener diode for voltage regulation. Students learn about different types of meters, parts of the motors,transformers and also aquiare knowledge of controlling speed of motor and loss determination.

Pre-requisite(s): Knowledge of drawing of graphs with proper choice of unit

Course Outcome:After the completion of the course, students would be able to:

CO1: Explain and apply the working and characteristics of different types of machines and rectifiers.

CO2: Explain and anlayze the knowledge in discrete electronic components like p-n junction diode, Zenerdiode, BJT etc. and electrical components to verify their characterizations.

CO3: Demonstrate and design the use of Zener diode as voltage regulator, p-n junction diode as rectifier andtransformer.

CO4: Verify and analyze basic circuit theorems.

CO5: Measure and calculate power in AC circuits.

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Module I: I-V characteristics of a p-n junction diode and determination of rac & rdc. [3H]

Module II: To study the forward and reverse bias characteristics of a Zener diode [3H]

Module III: To study the load and line regulation of a Zener diode voltage regulator [3H]

Module IV: To study half wave rectifier (diode semiconductor) with and without filter (Observe waveform by CRO). [3H]

Module V: To study bridge rectifier with and without filter (Observe waveform by CRO). [3H]

Module VI: To draw the static output characteristics curves of a transistor in common emitter configuration for different base currents and hence to determine ac gain (hfe) and the output admittance (hoe). [3H]

Module VII: Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors. [3H]

Module VIII: Calibration of ammeter and wattmeter [3H]

Module IX: Verification of network theorems [3H]

Module X: Sinusoidal steady state response of R-L-C circuit – impedance calculation and verification [3H]

Module XI: Demonstration of transformer. [3H]

Module XII: SC & OC test of the Transformer. [3H]

Module XIII: Three phase power measurement by two wattmeter method.(balanced circuit) [3H]

Module XIV: Starting and reversing and speed control of a DC motor. [6H]

Test books:

1. Electronics Fundamentals and Applications, P C Chattopadhyay and D. Rakshit, New Age InternationalPrivate Limited.
2. B. L. Theraja, A text book of Electrical Technology,Vol-II, S.Chand Publication

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Course Code: ESCM192
Course Name: Engineering Graphics & Design Lab
Contact Hours: 3P/Week
Credits: 1.5
Allotted Hours: 45L

Course Objective: The objective of this course is to develop the basic concept of engineering drawing. This alsoemphasizes the students to understand the projection of points, lines and surfaces, developing of surfaces andisometric views of solid surfaces.

Pre-requisite(s): Unambiguous and Clear Visualization. Sound and Pictorial Intelligence.

Course Outcome:
After the completion of the course, students would be able to:

CO1: Analyze and develop sense of Scale and drawing technique of different curves and their applications.

CO2: Develop drafting and sketching skills, to apply the applications of drawing equipment and get familiarize with Indian Standards related to engineering drawing.

CO3: Analyze concept of Orthographic Projection and to develop Orthographic Views for different objects tovisualize three dimensional objects from Orthographic Views and to draw isometric views/projections.

CO4: Familiar with AutoCAD to analyze and develop the skill of drafting in AutoCAD by using differentcommands.

Module I: INTRODUCTION TO ENGINEERING DRAWING, LETTERING, IMENSIONING, SCALES [6H]

Draw horizontal, Vertical, 30 degree, 45 degree, 60 and 75 degrees lines, different types of lines, dimensioning styles using Tee and Set squares/ drafter. Write alphabets and numerical (Vertical only), Plain scale and Diagonalscale.

Module II: GEOMETRICAL CONSTRUCTION AND CURVES [6H]

Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only) Cycloid, Epicycloid, Hypocycloid, Involute, of a circle.

Module III: PROJECTION OF POINTS, LINES, SURFACES [6H]
Introduction to Orthographic Projection : Concept of First Angle & Third Angle of projection. Projections of lines(limited to both ends in 1st quadrant) : parallel to the reference planes, inclined to the reference planes (1st Angle Method).

Module IV: PROJECTION OF REGULAR SOLIDS [6H]
Projections of solid body: Regular Polygonal Pyramid, Cylinder, Cone - inclined to only one reference plane (1stAngle Method).

Module V: ISOMETRIC PROJECTIONS [6H]
Introduction to Isometric Projections, Concept of Isometric Scale and Isometric Views. Conversion of

Orthographic views into Isometric Views/Projections : Simple Objects e.g. regular prism, pyramid, cone,

cylinder.

MODULE VI: SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS [6H]
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industryand dwellings (foundation to slab only).

MODULE VII: DEVELOPMENT OF SURFACES [6H]
Six problems on Development of surfaces of different objects.

MODULE VIII: COMPUTER AIDED DRAFTING INTERFACE [3H]

Introduction to different commands and toolbars of Auto CAD.
Draw command : Lines, Circle, Polygon, Arc, Ellipse, Polyline, Fillet, Chamfer, Hatch, Array (Rectangular & Polar)etc.

Modify Command : Offset, Trim, Extend, Erase, Fillet, Chamfer, Break, Lengthen, Copy, Move, Mirror, Stretch, Match Properties, Pedit etc.

View : Zoom All, Zoom Window, Zoom Extent etc.
Dimensioning : Dimension Setting, Linear, Aligned, Radial, Diameter, Leader, Angular etc.

Text : Text Style, Dtext, Mtext, DDedit etc.

Format : Limits, Layers, Pan etc.
Making a few simple 2D drawings in Auto CAD.

Text books:
1.Engineering Drawing, Bhatt N.D., Panchal V.M. & Ingle P.R., Charotar Publishing House, 2014
2.Engineering Drawing and Computer Graphics, Shah, M.B. & Rana B.C. Pearson Education,2008
3.Engineering Graphics, Agrawal B. & Agrawal C. M. , TMH Publication, 2012
4.Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah Scitech Publishers, 2008
5. CAD Software Theory and User Manuals.

Course Code: AUM-1
Course Name: Environmental Science
Contact Hours: 1L/Week
Credits: 0
Allotted Hours: 15L

Course Objective:
The course intends to provide preliminary concepts of natural resources, ecosystem, human health andenvironmental laws and also relate food chain and food web with respect to ecosystem.

Pre-requisite(s): Nil
Course Outcome: After the completion of the course, students would be able to:

CO1: Identify the natural resources and distinguish the different ecosystems.

CO2: Define and Visualize the preliminary concepts of environment.

CO3: Explain and Interpret the concept of food chain, food web and ecological pyramids.

CO4: Analyze the pollution of the environment and illustrate the problems related to population growth.

CO5: Describe and apply the acts to control environmental pollution.

CO6: Produce and predict solutions to control environmental pollution and population growth.

Module I: The Multidisciplinary Nature of Environmental Studies [1H]
Definition, scope and importance.

Module II: Natural Resources [2H]
Natural resources and associated problems:
a) Forest resources.
b) Water resources
c) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternateenergy sources

Module III: Ecosystems [3H]
a) Concept of an ecosystem.
b) Structure and function of an ecosystem
c) Producers, consumers and decomposers.
d) Energy flow in the ecosystem.
e) Food chains, food webs and ecological pyramids.

Module IV: Environmental Pollution [4H]
Definition, cause, effects and control measures of
i. Air pollution
ii. Water pollution
iii. Noise pollution

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Module V: Social Issues and the Environment [3H]
a) From Unsustainable to Sustainable development
b) Air (Prevention and Control of Pollution) Act.
c) Water (Prevention and control of Pollution) Act

Module VI: Human Population and the Environment [2H]
a) Population growth, variation among nations.
b) Environment and human health.

Text books:
1. Basic Environmental Engineering and Elementary Biology, Dr. Gourkrishna Dasmahapatra, Vikas Publisher,Kolkata.

2. Environmental Chemistry, A.K De, New Age International Pvt. Ltd.
3. Ecology and Environment, Sharma P.D., Rastogi Publications.
4. Environmental Chemistry, Sharma B.K., Krishna Prakashan Media (P) Ltd.
5. Environment and Ecology, Anil Kumar De & Arnab Kumar Dey, New Age International Pvt. Ltd.
6. Text Book of Environmental Studies, Asthana, D. K., S. Chand Publishing.
7. Fundamentals of Environmental Studies, M. Basu, S. Xavier, Cambridge University Press, India.

Reference books:

1. Environmental Science: Your World, Your Turn by Withgott, Jay, Pearson
2. Textbook of Environmental Studies for Undergraduate Courses, E. Bharucha, Universities Press.