FACULTY OF ENGINEERING

Scheme of Instruction & Examination

and

Syllabi

B.E. III-Semester & IV-Semester

of

Four Year Degree Programme

In

COMPUTER SCIENCE AND ENGINEERING

(With effect from the academic year 2017 – 2018)
(As approved in faculty meeting held on 26 July 2017)

Issued by
Dean, Faculty of Engineering

Osmania University, Hyderabad

SCHEME OF INSTRUCTION & EXAMINATION
B.E. III - SEMESTER
(**COMPUTER SCIENCE AND ENGINEERING**)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of examination			Credits
			L	T	Pr/Drg	Contact Hrs / wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	BS 301 MT	Engineering Mathematics-III	3	1	-	4	30	70	3	3
2	ES 934 EC	Basic Electronics	3	-	-	3	30	70	3	3
3	PC 301 CS	Data Structures	3	1	-	4	30	70	3	3
4	PC 302 CS	Discrete Mathematics	3	1	-	4	30	70	3	3
5	PC 303 CS	Logic and Switching Theory	3	1	-	4	30	70	3	3
6	MC 916 CE	Environmental Sciences	3	-	-	3	30	70	3	3
Practical / Laboratory Courses										
7	ES 361 EE	Electrical Engineering Lab	-	-	2	2	25	50	3	1
8	ES 955 EC	Basic Electronics Lab	-	-	2	2	25	50	3	1
9	PC 351 CS	Data Structures Lab	-	-	2 x 2	4	25	50	3	2
Total			**18**	**4**	**8**	**30**	**255**	**570**		**22**

BS: Basic Sciences ES: Engineering Sciences MC: Mandatory Course
PC: Professional Course HS: Humanities and Sciences
L: Lectures T: Tutorials Pr : Practicals Drg: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ.Exam)

Note: 1) Each contact hour is a Clock Hour
2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.
3) Students admitted into B.E./B.Tech. courses under lateral entry scheme (through ECET) from the academic year 2017-18 should undergo the following bridge course subjects at III Semester (CBCS).
(1) ES 154 CS Computer Programming Lab
(2) MC 156 EG Engineering English Lab

Course Code	Course Title						Core/Elective
BS 301 MT	**ENGINEERING MATHEMATICS – III**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce the concept of functions of complex variables and their properties
- To formulate partial differential equations and to introduce methods to solve first order linear and non-linear partial differential equations
- To study Fourier series and its applications to partial differential equations

Course Outcomes:

- Able to determine the analyticity of complex functions and expand functions as Taylor and Laurent series
- Able to evaluate complex and real integrals using residue theorem
- Able to learn expansion of Fourier series
- Able to find solutions of first order and second order partial differential Equations

UNIT-I

Functions of Complex Variables: Limits and continuity of function, differentiability and analyticity, necessary & sufficient conditions for a function to be analytic, Cauchy-Reimann equations in polar form, harmonic functions, complex integration, Cauchy's integral theorem, extension of Cauchy's integral theorem for multiply connected regions, Cauchy's integral formula, Cauchy's formula for derivatives and their applications.

UNIT-II

Residue Calculus: Power series, Taylor's series, Laurent's series, zeros and singularities, residues, residue theorem, evaluation of real integrals using residue theorem, bilinear transformation, and conformal mapping.

UNIT-III

Fourier Series: Fourier series, Fourier series expansions of even and odd functions, convergence of Fourier series, and Fourier half range series.

UNIT-IV

Partial Differential Equations: Formation of first and second order partial differential equations, solution of first order equations, Lagrange's equation, Nonlinear first order equations, Charpit's method, higher order linear equations with constant coefficients.

UNIT-V

Fourier Series Applications to Partial Differential Equations: Classification of linear second order partial differential equations, Separation of variables method (Fourier method), Fourier series solution of one dimensional heat and wave equations, Laplace's equation.

Suggested Reading:

1) R.K.Jain & S.R.K Iyengar, **Advanced Engineering Mathematics**, Narosa Publication, 4th Edition, 2014.
2) B.S.Grewal, **Higher Engineering Mathematics**, Khanna Publications, 43rd Edition, 2014.
3) Gupta & Kapoor, **Fundamentals of Mathematical Statistics**, Sultan Chand & Sons, New Delhi, 2014.
4) Erwin Kreyszig, **Advanced Engineering Mathematics**, 9th Edition, 2012.
5) James Brown and Ruel Churchill, **Complex Variables and Applications,** 9th Edition,2013.

Course Code	Course Title						Core/Elective
ES 934 EC	**BASIC ELECTRONICS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives

- Analyze the behavior of semiconductor diodes in Forward and Reverse bias.
- Design of Half wave and Full wave rectifiers with L, C, and LC & CLC Filters.
- Explore V-I characteristics of Bipolar Junction Transistor n CB, CE & CC configurations.
- Explain feedback concept and different oscillators.
- Analyze Digital logic basics and Photo Electric devices.

Course Outcomes

- Explain VI characteristics of Semiconductor diode, BJT, FET and MOSFET
- Calculate ripple factor, efficiency and % regulation of rectifier circuits
- Analyze feedback amplifiers, BJT oscillator circuits, Opamp, basic digital logic gates and data acquisition system

UNIT-I

Semi Conductor Theory: Energy Levels, Intrinsic and Extrinsic Semiconductors, Mobility, Diffusion and Drift current. Hall Effect, Characteristics of P-N Junction diode, Parameters and Applications.

Rectifiers: Half wave and Full wave Rectifiers (Bridge, center tapped) with and without filters, ripple regulation and efficiency. Zener diode regulator.

UNIT-II

Bipolar Junction Transistor: BJT, Current components, CE, CB, CC configurations, characteristics, Transistor as amplifier. Analysis of CE,CB,CC Amplifiers(qualitative treatment only).

JEET: Construction and working, parameters, CS, CG, CD Characteristics, CS amplifier.

UNIT-III

Feedback Concepts – Properties of Negative Feedback Amplifiers, Classification, Parameters .

Oscillators – Barkhausen Criterion, LC Type and RC Type Oscillators and Crystal Oscillators. (Qualitative treatment only)

UNIT-IV

Operational Amplifiers – Introduction to OP Amp, characteristics and applications – Inverting and Non-inverting Amplifiers, Summer, Integrator, Differentiator, Instrumentation Amplifier.

Digital Systems: Basic Logic Gates, half, Full Adder and Subtractors.

UNIT-V

Data Acquisition systems: Study of transducer (LVDT, Strain gauge, Temperature, Force).

Photo Electric Devices and Industrial Devices: Photo diode, Photo Transistor, LED, LCD, SCR, UJT Construction and Characteristics only.

Display Systems: Constructional details of C.R.O and Applications.

Suggested Reading:

1) Jocob Millman, Christos C. Halkias and Satyabrata Jit, **Electronics Devices and Circuits**, 3rd Edition, McGraw Hill Education (India) Private Limited, 2010.
2) Rama Kanth A. Gaykward, **Op-AMPS and Linear Integrated Circuits**, 4th Edition Prentice Hall of India, 2000.
3) M. Morris Mano, **Digital Design**, 3rdEdition, Prentice Hall of India, 2002.
4) William D Cooper, and A.D. Helfrick, **Electronic Measurements and Instrumentations Techniques**, 2nd Edition, Prentice Hall of India, 2008.
5) S.Shalivahan, N. Suresh Kumar, A. Vallava Raj, **Electronic Devices and Circuits,** 2nd Edition., McGraw Hill Education (India) Private Limited, 2007.

Course Code	Course Title						Core/Elective
PC301CS	**DATA STRUCTURES**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming Language in C & C++	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce the time and space complexities of algorithms.
- To discuss the linear and non-linear data structures and their applications.
- To introduce the creation, insertion and deletion operations on binary search trees and balanced binary search trees.
- To introduce various internal sorting techniques and their time complexities

Course Outcomes:

- Able to analyze the time and space complexities of algorithms.
- Able to implement linear, non-linear data structures and balanced binary trees
- Able to analyze and implement various kinds of searching and sorting techniques.
- Able to find a suitable data structures and algorithms to solve a real world problem.

UNIT–I

Performance and Complexity Analysis: Space Complexity, Time Complexity, Asymptotic Notation (Big-Oh), Complexity Analysis Examples.
Linear List-Array Representation: Vector Representation, Multiple Lists Single Array.
Linear List-Linked Representation: Singly Linked Lists, Circular Lists, Doubly Linked Lists, Applications (Polynomial Arithmetic).
Arrays and Matrices: Row And Column Major Representations, Sparse Matrices.

UNIT –II

Stacks: Array Representation, Linked Representation, Applications (Recursive Calls, Infix to Postfix, Postfix Evaluation).
Queues: Array Representation, Linked Representation.
Skip Lists and Hashing: Skip Lists Representation, Hash Table Representation, Application- Text Compression.

UNIT- III

Trees: Definitions and Properties, Representation of Binary Trees, Operations, Binary Tree Traversal.
Binary Search Trees: Definitions, Operations on Binary Search Trees.
Balanced Search Trees: AVL Trees, and B-Trees.

UNIT –IV

Graphs: Definitions and Properties, Representation, Graph Search Methods (Depth First Search and Breadth First Search)

Application of Graphs: Shortest Path Algorithm (Dijkstra), Minimum Spanning Tree (Prim's and Kruskal's Algorithms).

UNIT -V

Sorting and Complexity Analysis: Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Closest Pair Of Points, and Heap Sort.

Suggested Reading:

1) Sartaj Sahni, **Data Structures--Algorithms and Applications in C++**, 2nd Edition, Universities Press (India) Pvt. Ltd., 2005.
2) Mark Allen Weiss, **Data Structures and Problem Solving using C++**, Pearson Education International, 2003.
3) Michael T. Goodrich, Roberto Tamassia, David M. Mount, **Data Structures and Algorithms in C++**, John Wiley & Sons, 2010.

Course Code	Course Title						Core/Elective
PC 302 CS	**DISCRETE MATHEMATICS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce concepts of set theory, arithmetic, logic, and proof techniques.
- To understand the use of mathematical and logical notation to define and formally reason about discrete structures like trees, graphs and partial orders.
- To introduce generating functions and recurrence relations and to find asymptotic growth rates of different functions.

Course Outcomes:

- Able to use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers.
- Able to produce convincing arguments, analyze basic mathematical proofs and discriminate between valid and unreliable arguments.
- Able to model and solve real-world problems using graphs and trees, both quantitatively and qualitatively.
- Able to formulate problems and solve the recurrence relations and to find asymptotic growth rates of different functions.

UNIT- I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logical Equivalence, Logical Implication, Use of Quantifiers, Definitions and the Proof of Theorems.

Set Theory: Set and Subsets, Set Operations, and the Laws of Set theory, Counting and Venn Diagrams.

Properties of the Integers: The well – ordering principle, Recursive Definitions, Division Algorithms, Fundamental theorem of Arithmetic.

UNIT-II

Relations and Functions: Cartesian Product, Functions onto Functions, Special Functions, Pigeonhole Principle, Composition and Inverse Functions, Computational Complexity.

Relations: Partial Orders, Equivalence Relations and Partitions.

Principle of Inclusion and Exclusion: Principles of Inclusion and Exclusion, Generalization of Principle, Derangements, Rock Polynomials, Arrangements with Forbidden Positions.

UNIT–III

Generating Functions: Introductory Examples, Definition And Examples, Partitions Of Integers, Exponential Generating Function, Summation Operator.

Recurrence Relations: First – order linear recurrence relation, second – order linear homogenous recurrence relation with constant coefficients, Non homogenous recurrence relation, divide and conquer algorithms.

UNIT-IV

Algebraic Structures: Algebraic System – General Properties, Semi Groups, Monoids, Homomorphism, Groups, Residue Arithmetic, Group Codes and their Applications.

UNIT -V

Graph Theory: Definitions and examples, sub graphs, complements and graph Isomorphism, Vertex degree, Planar graphs, Hamiltonian paths and Cycles, Graph Coloring, Euler & Hamiltonian graphs, and Chromatic number.

Trees: Definitions, properties and Examples, Rooted Trees, Spanning Trees and Minimum Spanning Trees.

Suggested Reading:

1) Mott Joe L Mott, Abraham Kandel, and Theodore P Baker, **Discrete Mathematics for Computer Scientists & Mathematicians**, Prentice Hall NJ, 2nd Edition, 2015.
2) Jr. P. Tremblay and R Manohar **Discrete Mathematical Structures with Applications to Computer Science**, McGraw Hill, 1987.
3) R.K.Bisht and H.S.Dhami, **Discrete Mathematics** Oxford Higher Education, 2015
4) Bhavanari Satyanarayana, Tumurukota Venkata Pradeep Kumar and Shaik Mohiddin Shaw, **Mathematical Foundation of Computer Science,** BSP, 2016
5) Ralph P. Grimaldi **Discrete and Combinatorial Mathematics**, 5th Edition, Pearson, 2004.

Course Code	Course Title						Core/Elective
PC 303 CS	**LOGIC AND SWITCHING THEORY**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce concepts of Boolean logic, Postulates and Boolean Theorems.
- To understand the use of logic minimization methods and to solve the Boolean logic expressions
- To understand how to design the combinational and sequential circuits.
  To introduce and realize the adder circuits
- To understand the state reduction methods for sequential circuits.

Course Outcomes:

- Able to apply the concepts of Boolean logic, Postulates and Boolean Theorems to solve the Boolean expressions.
- Able to solve the Complex Boolean logic expressions using Minimization methods.
- Able to design the combinational, sequential circuits and Various adder circuits.
- Able to apply state reduction methods to solve sequential circuits.

UNIT-I

Boolean Algebra: Axiomatic definition of Boolean Algebra Operators, Postulates and Theorems, Boolean Functions, Canonical Forms and Standard Forms, Simplification of Boolean Functions Using Theorems and Karnaugh Map Method.

UNIT-II

Minimization of Switching Functions: Quine-McCluskey Tabular Method, Determination of Prime Implicants and Essential Prime Implicants.

Combinational Logic Design: Single-Output and Multiple-Output Combinational Circuit Design, AND-OR, OR-AND and NAND/NOR Realizations, Exclusive-OR and Equivalence functions.

UNIT–III

Design of Combinational Logic Circuits: Gate Level design of Small Scale Integration (SSI) circuits, Modular Combinational Logic Elements- Decoders, Encoders, Priority encoders, Multiplexers and De-multiplexers.

Design of Integer Arithmetic Circuits using Combinational Logic: Integer Adders – Binary Adders, Subtractors, Ripple Carry Adder and Carry Look Ahead Adder, and Carry Save Adders.

UNIT-IV

Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices.

Introduction to Sequential Circuit Elements: Latch, Various types of Flip-Flops and their Excitation Tables.

UNIT -V

Models of Sequential Circuits: Moore Machine and Mealy Machine, Analysis of Sequential Circuits-State Table and State Transition Diagrams. Design of Sequential Circuits-Counters. Moore and Mealy State Graphs for Sequence Detection, Methods for Reduction of State Tables and State Assignments.

Suggested Reading:

1) M Morris Mano and Michael D Ciletti, **Digital Design**, Prentice Hall of India, Fourth Edition, 2008.
2) Zvi Kohavi, **Switching and Finite Automata Theory**, Tata McGraw Hill, 2nd Edition, 1979.

Course Code	Course Title						Core/Elective
MC916CE	**ENVIRONMENTAL SCIENCES**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives

- To study the basic concepts, sources of water, floods and their impact on environment
- To know the ecosystems and energy resource systems
- To understand the Biodiversity concepts and their advantages
- To study the different pollutions and their impact on environment
- To know the social and environment related issues and their preventive measures

Course Outcomes

- Awareness of effects of hazardous environment.
- Idea about optimum utilization of natural resources.
- Be a catalyst in moving towards Green technologies
- Information about rules and regulations of pollution control

UNIT-I

Environmental Studies: Definition, scope and importance, need for public awareness.
Natural resources: Water resources; use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams:benefits and problems. Effects of modern agriculture, fertilizer- pesticide problems, water logging and salinity.

UNIT-II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).
Energy resources: Growing energy needs, renewable and non-renewable energy sources. Land Resources, land as a resource, land degradation, soil erosion and desertification.

UNIT-III

Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity.

UNIT-IV

Environmental Pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution; solid and liquid waste management.
Environment Protection Act: Air, water, forest and wild life Acts, enforcement of environmental legislation.

UNIT-V

Social Issues and the Environment: Water conservation, watershed management, and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle, and disaster management in India.

Suggested Reading:

1) A.K. De, **Environmental Chemistry**, Wiley Eastern Ltd.
2) E.P. Odum, **Fundamentals of Ecology**, W.B. Sunders Co., USA.
3) M.N. Rao and A.K. Datta , **Waste Water Treatment**, Oxford and IBK Publications.
4) Benny Joseph, **Environmental Studies**, Tata McGraw Hill, 2005.
5) V.K. Sharma, **Disaster Management**, National Centre for Disaster Management, IIPE,1999.
6) **Green Building Council of India**, Teri Document.

Course Code	Course Title						Core/Elective
ES361EE	**ELECTRICAL ENGINEERING LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- To learn practical electric AC & DC circuits.
- To learn operation and performance characteristics of electrical machines by conducting various tests practically.

Course Outcomes:

- Awareness about various electric safety rules to be followed while working with electrical equipment
- Explore themselves in designing basic electric circuits
- Identify requirements for electric machines for domestic and industrial purpose

List of Experiments:

1) Verification of Kirchoff's Laws
2) Verification of Thevinin's & Norton's Theorems
3) Study of Three-Phase Balanced Circuits
4) Measurement of Power by Two – Wattmeter Method
5) Study of Single – Phase RLC Series Circuits
6) Magnetization Curve of a Separately Excited DC Generator
7) Load Characteristics of Shunt Generator
8) Performance Characteristics of Shunt Motor
9) Speed Control of DC Shunt Motor
10) O.C. and S.C. Tests on Single – Phase Transformer
11) Load Test on Single – Phase Transformer
12) Load Test on Three – Phase Induction Motor

Note: A Minimum of TEN experiments should be conducted in the Semester.

Course Code	Course Title						Core/Elective
ES 955 EC	**BASIC ELECTRONICS LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- Demonstrate the characteristics of Semiconductor diodes
- Realize the filters and Rectifiers.
- Verify the characteristics of different transistor Configurations.
- Design of Biasing Circuits for BJT and FET Amplifiers.
- Design different circuits using Operational Amplifiers.

Course Outcomes:

- Plot Characteristics of diode and transistor
- Calculate ripple factor, efficiency and % regulation of rectifier circuits
- Analyze feedback amplifiers and BJT oscillator circuits
- Demonstrate Opamp, data converter and strain gauge measurement

List of Experiments:

1) CRO-Applications, Measurements of R, L and C using LCR meter, Colour code method soldering practice.
2) Characteristics of Semiconductors diode (Ge, Si and Zener).
3) Static characteristics of BJT-Common Emitter.
4) Static characteristics of BJT-Common Base.
5) Static characteristics of FET.
6) RC-Phase Shift Oscillator.
7) Hartley and Colpitt's Oscillators.
8) Common Emitter Amplifier.
9) Astable Multivibrator.
10) Full-wave rectifier with and without filters using BJT.
11) Operational Amplifier as Amplifier,Integrator.
12) Strain Gauge Measurement.
13) Analog-to-Digital and Digital to Analog Converters.

Suggested Reading:

1) David Bell A., Operational Amplifiers and Linear ICS, Prentice Hall of India, 2005.
2) David Bell A., Laboratory for Electronic Devices and Circuits, Prentice Hall of India, 2007.

Note: A Minimum of TEN experiments should be conducted in the Semester.

Course Code	Course Title						Core/Elective
PC351CS	**DATA STRUCTURES LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming Language in C & C++	-	-	-	2x2	**25**	**50**	**2**

Course Objectives:

- To develop skills to design and analyze simple linear and non linear data structures, such as stacks, queues and lists and their applications.
- To gain programming skills to implement sorting and searching algorithms.
- To Strengthen the ability to identify and apply the suitable data structures for the given real world problem
- To Gain knowledge in practical applications of data structures

Course Outcomes:

- Able to understand various data structures such as stacks, queues, trees, graphs to solve various computing problems.
- Able to implement various kinds of searching and sorting techniques, and know when to choose which technique
- Able to decide a suitable data structures and algorithms to solve a real world problem.

Programming Exercise using C++:

1) Implementation of Singly Linked List, Doubly Linked List and Circular List.
2) Implementation of Stacks, Queues (using both arrays and linked lists).
3) Infix to Postfix conversion, evaluation of postfix expression.
4) Polynomial arithmetic using linked list.
5) Implementation of Binary Search and Hashing.
6) Implementation of recursive and iterative traversals on binary tree.
7) Implementation of Binary Search Tree.
8) Implementation of operations on binary tree (delete entire tree, copy entire tree, mirror image, level order, search for a node etc.)
9) Implementation of Selection, Shell, Merge and Quick sorts.
10) Implementation of Heap Sort.
11) Implementation of operations on AVL trees.
12) Implementation of traversal on Graphs.
13) Implementation of B-Trees.

Note : To debug these programs it is recommended to use a debugging tool.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. IV - SEMESTER
(**COMPUTER SCIENCE AND ENGINEERING**)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of examination			Credits
			L	T	Pr/Drg	Contact Hrs / wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	BS 421 MT	Mathematics And Statistics	3	1	-	4	30	70	3	3
2	ES 422 EC	Signals And System Analysis	3	-	-	3	30	70	3	3
3	PC 401CS	Computer Organization	3	1	-	4	30	70	3	3
4	PC 402 CS	Object Oriented Programming Using Java	3	1	-	4	30	70	3	3
5	PC 403 CS	Programming Languages	3	1	-	4	30	70	3	3
6	PC 404 CS	Microprocessors And Interfacing	3	1	-	4	30	70	3	3
Practical / Laboratory Courses										
7	PC 451 CS	Java Programming Lab	-	-	2	2	25	50	3	1
8	PC 452 CS	Microprocessors	-	-	2	2	25	50	3	1
9	PC 454 CS	Mini Project	-	-	2x2	4	25	50	3	2
10	MC 453 HS	Society Outreach Program	-	-	2	2	50	--	3	2 units
Total			**18**	**5**	**10**	**33**	**305**	**570**		**22**

BS: Basic Sciences ES: Engineering Sciences MC: Mandatory Course
PC: Professional Course HS: Humanities and Sciences
L: Lectures T: Tutorials Pr : Practicals Drg: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

Note: 1) Each contact hour is a Clock Hour
2) The practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.

Course Code	Course Title						Core/Elective
BS421MT	**MATHEMATICS AND STATISTICS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce transforms like Laplace, Fourier and to study their properties
- To introduce number theory and its applications
- To provide the knowledge of probability distributions like uniform, normal and exponential distributions, Tests of significance, correlation and regression.

Course Outcomes:

- Able to solve differential equations using Laplace and Fourier transforms
- Able to solve problems in elementary number theory
- Able to apply various probability distributions to solve practical problems, to estimate unknown parameters of populations and apply the tests of hypotheses.
- Able to perform a regression analysis and to compute and interpret the coefficient of correlation

UNIT- I

Laplace Transforms: Introduction of Laplace transforms, sufficient condition for existence of Laplace transform, Laplace transform of Derivatives, Laplace transform of integrals, Translation theorems (I & II shifting theorems), Differentiation of Laplace transform
(Multiplication by t), Integration of Laplace transform (Division by t), convolution theorem, Solving initial value problems using Laplace transform.

UNIT- II

Fourier Transforms: Introduction, Fourier integrals, Fourier sine and cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier sine and cosine transforms, Finite Fourier sine and cosine transforms, Properties of Fourier transforms, Convolution theorem for Fourier transforms.

UNIT- III

Number Theory: Divisibility and Modular arithmetic, integer representation, primes and GCD, solving congruences and applications, Introduction to cryptography.

UNIT- IV

Probability: Random variables, Uniform, Normal, Exponential distributions, Mean, median, mode and standard deviation, Conditional probability and Baye's theorem, Tests of significance, t-test, F-test and χ^2 test.

UNIT- V

Curve Fitting: Curve fitting by method of least squares**,** correlation and regression, types of correlations, Karl Pearson's coefficient of correlation, Spearman's rank correlation coefficient, equal ranks, equations to the lines of regression.

Suggested Reading:

1) R.K.Jain & S.R.K Iyengar, **Advanced Engineering Mathematics**, Narosa Publication, 4th Edition, 2014.
2) B.S.Grewal, **Higher Engineering Mathematics**, Khanna Publications, 43rd Edition, 2014.
3) Vasishtha and Gupta**, Integral Transforms, Krishnan Prakashan Publications**, 2014.
4) Erwin Kreyszig, **Advanced Engineering Mathematics**, John Wiley &Sons, 10th Edition, 2012.
5) James S.Kraft and Lawrence C.Washington, **An Introduction to Number Theory and Cryptography**, CRC press, 2016.

Course Code	Course Title						Core/Elective
ES422EC	**SIGNALS AND SYSTEM ANALYSIS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	-	-	-	**30**	**70**	**3**

Course Objectives:

- To learn basic concepts related to signals & systems.
- To familiarize with basic operations on signals mathematical representation of periodic, aperiodic signals continuous discrete systems.
- To understand convolution, correlation operations on continuous signals.
- To analyze the response of systems on application of step, ramp inputs using Fourier & Z transforms.

Course Outcomes:

- Able to differentiate signal like discrete time, continuous time, power, energy, periodic, aperiodic, even, odd.
- Able to define the system by an impulse response with properties: memory less, causal, stable.
- Able to understand the properties of FT, Z-transform & LT.

UNIT- I

Signal Analysis: Analogy between vectors and signals, Orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, Closed or complete set of orthogonal functions, Orthogonality in complex functions, Exponential and sinusoidal signals, Concepts of Impulse function, Unit step function, Signum function.

UNIT-II

Fourier Transform: Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.

UNIT-III

Signal Transmission Through Linear Systems: Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

UNIT–IV

Convolution & Correlation of Signals: Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms. Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

UNIT- V

Z-Transform: Fundamental difference between continuous and discrete time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z- transform, properties of Z-transforms.

Suggested Reading:

1) Lathi B.P., **Signals Systems & Communications**, B.S. Publications, 1st Edition, 2006.
2) Alan V. Oppenheim, Alan.S.Willsky, S Hamid Nawab, **Signals Systems**, Prentice Hall of India, 2nd Edition, 2007.
3) Simon Haykin and Van Veen, **Signals and Systems** , Wiley India, 2nd Edition, 2008.

PC401CS	**COMPUTER ORGANIZATION**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To understand the Instruction Set Architecture: Instruction format, types, various addressing modes
- To understand the basic components and design of the CPU: the ALU and control unit
- To understand the parallelism both in terms of a single processor and multiple processors
- To understand the I/O Organization, Interrupt-driven I/O, and DMA

Course Outcomes:

- Able to understand the Instruction Set Architecture: Instruction format, types, various addressing modes
- Able to understand the basic components and design of the CPU: the ALU and control unit write multi threaded programs with synchronization.
- Able to understand the parallelism both in terms of a single processor and multiple processors
- Able to understand the I/O Organization, Interrupt-driven I/O, DMA

UNIT -I

Data Representation: Data types, Complements, Fixed and Floating Point representations, and Binary codes.
Overview of Computer Function and Interconnections: Computer components, Interconnection structures, Bus interconnection, Bus structure, and Data transfer.

UNIT-II
Register Transfer Micro operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic, Logic and Shift micro operations, Arithmetic Logic Shift Unit. **Basic Computer Organization and Design:** Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instruction, Input-Output and Interrupt.

UNIT-III
Micro programmed Control: Control memory, Address Sequencing, Micro program example, Design of Control Unit.
Central Processing Unit: General Register Organization, Stack Organization, Instruction formats, Addressing modes, Data Transfer and Manipulation, and Program control.
Computer Arithmetic: Addition and Subtraction, Multiplication, Division, and Floating Point Arithmetic Operations.

UNIT-IV

Memory Organization: Memory Hierarchy, Main Memory, RAM and ROM, Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory Management hardware.

UNIT–V

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), I/O Processor, Serial Communication.

Pipeline Processing: Arithmetic, Instruction and RISC Pipelines.

Assessing and Understanding Performance: CPU performance and its factors, Evaluating performance.

Suggested Reading:

1) Morris Mano M, **Computer System Architecture**, Pearson Education India, 3rd Edition, 2007.
2) William Stallings, **Computer Organization and Architecture**, PHI, 7th Edition, 2008.
3) David A Patterson, John L Hennessy, **Computer Organization and Design**, Morgan Kaufmann, 5th Edition, 2013.
4) Carl Hamacher, Zvonko Vranesic, Safwat Zaky, **Computer Organization,** Tata McGraw-Hill Education , 5th Edition, 2002

Course Code	Course Title						Core/Elective
PC402CS	**OBJECT ORIENTED PROGRAMMING USING JAVA**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming Language in C & C++	3	1	-	-	**30**	**70**	**3**

Course objective:

- To introduce fundamental object oriented concepts of java programming such as classes, inheritance, packages and interfaces.
- To introduce concepts of Java I/O streams, exception handling and multi threading.
- To use various classes and interfaces in java collection framework and utility classes.
- To introduce GUI programming using AWT controls and Swings
- To introduce serialization, Networking and Object Class.

UNIT-I

Object Oriented System Development: Understanding Object Oriented Development, Understanding Object Concepts, Benefits of Object Oriented Development.

Java Programming Fundamentals: Introduction, Overview of Java, Data Type, Variables and Arrays, Operators, Control statements, Classes, Methods, Inheritance, Packages and Interfaces, Inner Classes.

UNIT-II

I/O basics, Stream and Byte classes, Character Streams, Reading Console input and output, Print Writer Class, String Handling, Exceptions Handling, Multithreaded Programming.

UNIT-III

Exploring Java Language, Collections Overview, Collections Interfaces, Collections Classes, Iterators, Random Access Interface, Maps, Comparators, Arrays, Legacy classes and interfaces, Sting Tokenizer, BitSet, Date, Calendar, Timer.

UNIT-IV

Introducing AWT working With Graphics: AWT Classes, Working with Graphics.

Event Handling: Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces.

AWT Controls: Control Fundamentals, Labels, Using Buttons, Applying Check Boxes, CheckboxGroup, Choice Controls, Using Lists, Managing Scroll Bars, Using TextField, Using TextArea, Understanding Layout Managers, Menu bars and Menus, Dialog Boxes, FileDialog, Handling events by Extending AWT Components, Exploring the controls, Menus and Layout Managers.

UNIT-V

Introduction to Swing Package, Java I/O classes and interfaces, Reading and Writing Files, Serialization, Introduction to Java Network Programming, Object Class, Exploring Image package

Suggested Reading:

1) Herbert Schildt, **The Complete Reference Java**, 9th Edition, Tata McGraw Hill, 2005.
2) Bruce Eckel, **Thinking in Java**, 4th Edition, Pearson Education
3) Dietel and Dietel, **Java: How to Program,** 5th Edition, Prentice Hall
4) James M Slack, **Programming and Problem solving with JAVA**, Thomson Learning, 2002
5) C Thomas Wu, **An Introduction to Object Oriented programming with Java**, Tata McGraw Hill, 2005.
6) Kathy Sierra, Bert Bates ,**Head First Java**, 2nd Edition, **A Brain-Friendly Guide**, Publisher: O'Reilly Media, February 2005.

Course Code	Course Title						Core/Elective
PC403CS	**PROGRAMMING LANGUAGES**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- To introduce the major programming paradigms, and the principles and techniques involved in design and implementation of modern programming languages.
- To introduce notations to describe syntax and semantics of programming languages.
- To analyze and explain behavior of simple programs in imperative languages using concepts such as binding, scope, control structures, subprograms and parameter passing mechanisms.
- To introduce the concepts of ADT and object oriented programming for large scale software development.
- To introduce the concepts of concurrency control and exception handling.

Course Outcomes:

- Able to understand the programming paradigms of modern programming languages.
- Able to introduce notations to describe syntax and semantics of programming languages.
- Able to analyze the behavior of simple programs in imperative languages.
- Able to understand the concepts of ADT and object oriented programming for large scale software development.

UNIT-I

Preliminary Concepts: Reasons for Studying Concepts of Programming Languages, Programming Domains, Language Evaluation Criteria, Influences on Language Design, Language Categories, Language Design Trade-offs, Implementation Methods, Programming Environments, Evolution of the Major Programming Languages.

Describing Syntax and Semantics: General Problem of Describing Syntax, Formal Methods of Describing Syntax, Attribute Grammars, Describing the Meaning of Programs.

UNIT-II

Names, Binding, Type Checking, and Scopes: Names, Variables, The Concept of Binding, Type Checking, Strong Typing, Type Compatibility, Scope, Scope and Lifetime, Referencing Environments, Named Constants.

Data Types: Primitive Data Types, Character String Types, User- Defined Ordinal Types, Array Types , Associative Arrays, Record Types, Union Types, Pointer and Reference Types.

Expressions and Assignment Statements: Arithmetic Expressions, Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Short-Circuit Evaluation, Assignment Statements, Mixed- Mode Assignment.

UNIT-III

Statement-Level Control Structures: Selection Statements, Iterative Statements, Unconditional Branching, Guarded Commands.

Subprograms: Fundamentals and Design Issues for Subprograms, Local Referencing Environments, Parameter –Passing Methods, Parameters That are Subprograms Names, Overloaded Subprograms, Generic Subprograms, Design Issues for Functions, User-Defined Overloaded Operators.

Implementing Subprograms: The General Semantics of Calls and Returns, Implementing "Simple" Subprograms, Implementing Subprograms with Stack-Dynamic Local Variables, Nested Subprograms, Blocks, Implementing Dynamic Scoping.

Abstract Data Types: The Concept of Abstraction, Introduction to Data Abstraction, Design Issues for Abstract Data Types, Language Examples, Parameterized ADT, Encapsulation Constructs, Naming Encapsulation.

UNIT-IV

Object Oriented Programming: Design Issues, Object Oriented Programming in Smalltalk, C++, Java, C#, Ada 95, Ruby, The Object Model of JavaScript, Implementation of Object Oriented Constructs.

Concurrency: Subprogram level Concurrency, Semaphores, Monitors, Massage Passing, Ada Support for Concurrency, Java Threads, C# Threads, Statement-Level Concurrency.

Exception Handling and Event Handling: Introduction to Exception Handling, Exception Handling in Ada, C++ and Java, Introduction to Event Handling, Event Handling with Java.

UNIT- V

Functional Programming Languages: Introduction, Mathematical Functions, Fundamentals of FPL, LISP, Introduction to Scheme, COMMON LISP, ML, Haskell, Application of Functional Programming Languages and A Comparison of Functional and Imperative Languages.

Logic Programming Languages: Introduction to Predicate Calculus, Predicate Calculus and Proving Theorems, An Overview of Logic Programming. The Origins, Basic Elements and Deficiencies of Prolog, Applications of Logic Programming.

Scripting Languages: Key concepts, Case Study: Python(From the Suggested Reading 2).

Suggested Reading:

1) Robert .W. Sebesta**, Concepts of Programming Languages** , Pearson Education, 8th Edition, 2008.
2) Watt,Wiley Dreamtech **, Programming Languages** , 1st Edition 2004 3. Louden , Cengage, **Programming Languages**, 2nd Edition, 2003.
3) Ghezzi , John Wiley,**Programming Languages**, 3rd Edition, 1998.
4) Pratt and Zelkowitz**, Programming Languages Design and Implementation** , PHI/Pearson Education, 4th Edition ,2001.

Course Code	Course Title						Core/Elective
PC404CS	**MICROPROCESSORS AND INTERFACING**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	3	1	-	-	**30**	**70**	**3**

Course Objectives:

- Able to understand the architecture and organization of microprocessor along with instruction coding formats.
- Able to understand, write programs in assembly language
- Able to understand the memory and addressing concepts for interfacing I/O devices to the microprocessor.
- Able to understand software/ hardware interrupts and further write programs to perform I/O using handshaking and interrupts
- Able to have an understanding of digital interfacing and system connections.

Course Outcomes:

- Able to understand the architecture and organization of microprocessor.
- Able to write programs in assembly language.
- Able to apply knowledge for interfacing I/O devices to the microprocessor.
- Able to understand software/ hardware interfacing and system connections.

UNIT –I

8085 Architecture: Introduction to microprocessors , 8085 Processor Architecture, Internal operations, Instructions and timings. Programming the 8085 - Introduction to 8085 instructions, Addressing modes and Programming techniques with Additional instructions.

UNIT-II

Stacks and Subroutines, Interfacing Peripherals - Basic Interfacing concepts, Interfacing output displays, Interfacing input keyboards. Interrupts - 8085 Interrupts, Programmable Interrupt Controller (8259A). Direct Memory Access (DMA) - DMA Controller (Intel 8257), Interfacing 8085 with Digital-to-Analog and Analog-to-Digital converters.

UNIT-III

Programmable Peripheral Interface (Intel 8255A), Programmable Communication Interface
(Intel 8251), Programmable interval timer (Intel 8253 and 8254), Programmable Keyboard/
Display controller (Intel 8279). Serial and Parallel Bus standards RS 232 C, IEEE 488.

UNIT-IV

Introduction to 8086 Microprocessor : Architecture, Pin details of 8086, Minimum and Maximum mode. Segment flags, memory banks, Interrupts and Interrupt responses. Hardware and software Interrupt applications, Interrupt example.

UNIT –V

Addressing modes, Instruction set of 8086 and assembler directives. Assemble Language Programming – Modular Programming – Linking and Relocation – Stacks – Procedures - Macros

Suggested Reading:

1)Ramesh S. Gaonkar, **Microprocessor Architecture, Programming, and Applications with the 8085**, Prentice Hall India, 5th Edition , 2002.

2)Douglas V Hall, **Microprocessors and Interfacing**, TMGH. 2 Edition 2006.

3)N. Senthil Kumar, M. Saravanan, S. Jeevananthan ,S.K. Shah ,**Microprocessors and Interfacing** ,OXFORD UNIVERSITY PRESS 2016

Course Code	Course Title						Core/Elective
PC451CS	**JAVA PROGRAMMING LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Programming Language in C & C++	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- Write programs using classes, inheritance and abstract classes.
- Write multi threaded programs with synchronization.
- Write real world applications using java collection frame work and I/O classes
- Write Event driven GUI programs using AWT/Swing

Course Outcomes:

- Able to understand the usage of abstract classes.
- Able to write multi threaded programs with synchronization.
- Able to implement real world applications using java collection frame work and I/O classes
- Able to write Event driven GUI programs using AWT/Swing

1) Write a program to calculate salary of n employees using concept of classes with constructors and methods.
2) Write a program to demonstrate e-commerce website using inheritance, abstract class and dynamic polymorphism.
3) Write a program to demonstrate various arithmetic calculations using packages.
4) Write a program to demonstrate client-server environment using multithreading.
5) Write a program to demonstrate mutual exclusion using thread synchronization.
6) Write a program to demonstrate Linked list class.
7) Write a program to demonstrate Hash set and Iterator classes.
8) Write a program to demonstrate Enumeration and Comparator interfaces.
9) Write a program to accept data and display output in key, value pair.
10) Write a program to create a registration form with different controls, menus and demonstrate event handling.
11) Write a program to copy data from one file to another file.
12) Write a program to merge contents of two files and display output on console.
13) Write a program to illustrate Serialization.
14) Write a program to retrieve web page using URL class.
15) Write a program to load and display image and perform gray scale.

Note: A minimum of Ten Programs should be done by the end of the semester.

Course Code	Course Title						Core/Elective
PC452CS	**MICROPROCESSORS LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2	**25**	**50**	**1**

Course Objectives:

- Write simple assembly language programs using 8085 instruction set
- Write programs to interface various peripheral devices with 8085.
- Design simple applications using 8086 Microprocessor.

Course Outcomes:

- Able to write assembly language programs using 8085 instruction set
- Able to apply programming skills for interfacing various peripheral devices with 8085.
- Able to develop applications using 8086 Microprocessor.

PART A: **8085 Programming using Microprocessor Trainer Kit**

1) Simple programming examples using 8085 instruction set. To understand the Use of various instructions and addressing modes.
   E.g. : Addition, Subtraction, Multiplication, Division, Compliment, Searching,
   Sorting, Data Block moves, Data Block comparisons, arithmetic problems etc.
   Note: Minimum 10 programs
2) Interfacing and programming of 8255. (e.g.: traffic light controller)
3) Interfacing and programming of 8254.
4) Interfacing and programming of 8279.

PART B: 8086 Programming

1) Simple programming examples using 8086 Microprocessor
   E.g. : Addition, Subtraction, Multiplication, Division, Compliment, Searching,
   Sorting, Data Block moves, Data Block comparisons, arithmetic problems etc.
   Note: Minimum 10 programs

Note: A minimum of Ten experiment should be conducted at this semester.

Course Code	Course Title						Core/Elective
PC454CS	**MINI PROJECT**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2x2	**25**	**50**	**2**

Course Objectives:

- Write simple assembly language programs using 8085 instruction set
- Write programs to interface various peripheral devices with 8085.
- Design simple applications using 8086 Microprocessor.

Course Outcomes:

- Able to write assembly language programs using 8085 instruction set
- Able to apply programming skills for interfacing various peripheral devices with 8085.
- Able to develop applications using 8086 Microprocessor.

The students are required to carry out mini project that involves usage of

C/C++/JAVA/Microprocessors/Microcontroller Programming, etc.,

The emphasis will be on the usage of various data structures.

The department will appoint a project coordinator who will be incharged of the following:

- Grouping of students (a maximum of three in group)
- Allotment of project guides
- Project monitoring at regular intervals

All the projects are to be evaluated by a monitoring committee comprising of project coordinator and the supervisor on the basis of an oral presentation, demonstration, mini project report and Viva-Voce.

Course Code	Course Title						Core/Elective
MC453HS	**SOCIETY OUTREACH PROGRAM**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
NIL	-	-	-	2	**50**	**---**	**2 Units**

Course Objectives:

- To prepare the students to sensitize the society on social issues, particularly on environment, health and literacy.
- To prepare the students to learn the concept PAY BACK TO SOCIETY .
- To change the attitude of the society.

Course Outcome:

- Able to find the scientific solutions for a specific problem in the society.
- Able to demonstrate the leadership qualities.
- Able to bring out their talent.
- Able to develop interpersonal skills and team-spirit.

The Society Outreach Program gives students the opportunity to understand and involve in community service. Projects are student-led and may encompass the activities related to the following:

Environmental issues,
Health education for the community and sanitation,
Communal harmony and peace education,
Legal Awareness/Rights,
Human rights and rights of vulnerable groups;
Panchayats and development issues;
Women's Empowerment and
Social issues and gender issues.
Awareness on Solid waste management and any possible solutions;
Awareness on natural resources, solar energy and wind energy;
Awareness of work culture, punctuality, discipline, cleanliness in house and surroundings, and Intake of quality food;

Note:

The students are required to make a study and/or participate in society outreach programmes and submit a report.

The department will appoint a project coordinator who will be incharge of the following:

- Grouping of students (a maximum of three in group) • Allotment of project guides
- Project monitoring at regular intervals

The students shall give a presentation for about 30 minutes they have worked/ studied. The work carried out, the report and the presentation carry 50 marks.