

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)



Vision and Mission of the Department

- **Vision**

“To create professionally competent and globally acceptable IT engineers with social awareness”.

- **Mission**

- Educating budding engineers for, **industry, academia, research** and **entrepreneurial** pursuit through rigorous implementation of IT curriculum
- Inculcating IT skills to develop **innovative solutions** relevant to **global issues**
- **Imparting values** to practice social and **professional ethics**.

Program Specific Outcomes (PSOs)

At the end of program, students should be able to

- **PSO a:** An ability to understand, analyze and develop computer programs in the areas related to algorithms, web development and database management
- **PSO b:** An ability to apply knowledge of software engineering principles and practices for multidisciplinary applications to meet the needs of the industry and society

Program Outcomes (POs)

At the end of program, students should be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, social and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

S.Y.B.Tech.
2020 Pattern
Syllabus Structure

Second Year B. Tech. Information Technology (SYBT) - Semester III (Pattern 2020)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/TW		
ES21201IT	DISCRETE MATHEMATICS	TH	3	1	-	20	30	20	30	25	125	4
ITUA21202	DIGITAL ELECTRONICS AND MICROPROCESSOR	TH	3	1	-	20	30	20	30	25	125	4
ES21203IT	DATA COMMUNICATION AND NETWORKING	TH	3	-	2	20	30	20	30	25	125	4
ITUA21204	FUNDAMENTALS OF DATA STRUCTURES	TH	3	-	2	20	30	20	30	25	125	4
ITUA21205	COMPUTER ORGANIZATION	TH	3	-	-	20	30	20	30	0	100	3
ITUA21206	IT WORKSHOP - I	CE	1	-	4	-	-	-	-	50	50	3
ES21207IT	CRITICAL THINKING & PROBLEM SOLVING	CE	1	-	2	-	-	-	-	50	50	2
M2	MANDATORY COURSE	AU	-	-	-	-	-	-	-	-	-	-
	TOTAL		17	2	10	100	150	100	150	200	700	24

Note- Subjects having only CE components have TW.

Theory: 1Hr. = 1 Credit, Practical: 2 Hrs. = 1 Credit Tut: 1 hr. = 1 Credit, Audit Course: No Credits

Mandatory Courses: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge.

Second Year B. Tech. Information Technology (SYBT) - Semester IV (Pattern 2020)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/OR/TW		
ES22201IT	PROBABILITY AND STATISTICS	TH	3	-	2	20	30	20	30	25	125	4
ITUA22202	DATA STRUCTURE AND FILES	TH	3	-	2	20	30	20	30	25	125	4
ITUA22203	COMPUTER NETWORKS	TH	3	-	2	20	30	20	30	25	125	4
ITUA22204	SOFTWARE ENGINEERING	TH	3	1	-	20	30	20	30	25	125	4
ES20205	UNIVERSAL HUMAN VALUES2	TH	2	1	-	20	30	20	30	25	125	3
ITUA22206	IT WORKSHOP - II	CE	1	-	4	-	-	-	-	50	50	3
ES22207IT	SOFT SKILLS (ES)	CE	1	-	2	-	-	-	-	50	50	2
M2	MANDATORY COURSE	AU	-	-	-	-	-	-	-	-	-	-
	TOTAL		16	2	12	100	150	100	150	225	725	24

Note- Subjects having only CE components have TW.

Theory: 1Hr. = 1 Credit, Practical: 2 Hrs. = 1 Credit, Tutorial: #1 hr. = 1 Credit, Audit Course: No Credits

Mandatory Courses: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge

Discrete Mathematics (ES21201IT)

Teaching Scheme:	Examination Scheme					
Credits : 4	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week: 3Hrs/week	20	30	20	30	25	125
Tutorials/ week : 1Hrs/week						

Pre-requisites: Basic mathematics , Statistics, Probability

Course objectives :

- To study basic of logic and set theory
- To understand notion of functions and relations
- To study basic principles of algebraic structures
- To study fundamental principles of graphs
- To study fundamental principles of trees elementary combinatorial processes
- To build mathematical model for any problem under study
- To understand applied discrete mathematics

Course Outcomes:

Upon completion of the course, students will be able to

1. Demonstrate the use of logical arguments, proof techniques and set theory principles
2. Determine type, properties and solution of relations and functions
3. Demonstrate different algebraic structures
4. Solve the problems using graph methods and algorithms
5. Apply tree models and methods to obtain solutions of applications involving searching, prefix code and vertex connectivity
6. Determine and Enlist the applied discrete mathematics

Unit I: Introduction to Discrete Structures and Set Theory

Mathematics and the Notion of Abstraction, Continuous Mathematics and Discrete Mathematics – Discretization, Significance of Discrete Mathematics in Computer Engineering, Continuous Structures and Discrete Structures, Sets and the Need for Sets – Naïve Set Theory (Cantor Set Theory), Axiomatic Set Theory, Need for Sets, Representation of Sets – Enumeration (Tabular Form), Standard Symbols, Set-Builder Notation, Venn Diagram (Venn-Euler Diagram), Types of Sets – Bounded and Unbounded Sets, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Null Set or Empty Set, Universal Set or Universe, Power Set, Operations on Sets – Union, Intersection, Complementation, Symmetric Difference, Cardinality of a Set – Cardinality of a Finite Set, Cardinality of an Infinite Set, Quotient Set, Disjoint Sets, Addition Principle (Inclusion-Exclusion Principle)

Unit II - Relations and Functions

Cartesian Product, Relations, Paths and Digraphs, Properties and Types of Binary Relations, Manipulation of Relations, Transitive Closure and Warshall’s Algorithm, Equivalence Relations and Partitions, Partially Ordered Sets (Posets) and Hasse Diagram, Lattices, Chains and Anti-Chains, Functions, Types of Functions – One-to-One (Injective), Onto (Surjective) and One-to-One Correspondence (Bijective), Invertible Functions, Mathematical Functions, Exponential and Logarithmic Functions, Recursively Defined Functions, Discrete Numeric Functions, Generating Functions, Recurrence Relations, The Pigeonhole Principle, Ramsey Theory

Case Study on : Applications of Relations – Electronic Circuit Design, n-Ary Relations and their Applications, Databases and Relations and Structured Query Language (SQL), Applications of Functions

– Job Scheduling Problem, Countability of Rational Numbers Using Cantor Diagonalization Argument.

Unit III – Graph Theory

Graphs, types of graphs, representation of graph, Paths and Circuits – Eulerian and Hamiltonian, Planer Graphs, Graph Colouring, Isomorphism of Graphs, Subgraphs and Isomorphism of Subgraphs
Case Study: Usage of graph in real time applications

Unit IV – Trees

Trees and Weighted Trees, Spanning Trees and Minimum Spanning Trees, Prim’s and Kruskal’s Algorithm, Isomorphism of Trees and Subtrees, Prefix Codes
Case Study : Usage of trees in real time applications

Unit V: Algebraic Structures and Morphisms

Algebraic Structures with One Binary Operation – Semigroups, Monoids and Groups, Product and Quotient of Algebraic Structures, Isomorphism, Homomorphism and Automorphism, Free Monoids and Languages, Automata, Finite-State Machines, The Monoid of a Finite-State Machine, The Machine of a Monoid, Cyclic Groups and their Application in Fast Adders, Cosets, Normal Subgroups, Codes and group Codes, Algebraic Structures with Two Binary Operations – Rings, Integral Domains and Fields, Boolean Algebra and Boolean Ring

Unit VI – Galois Theory and Applied Discrete Mathematics

Galois Theory – Connection Between Field Theory and Group Theory, Finite Projective Geometry – Finite Geometry, Projective Geometry over Finite Fields, Axioms of Projective Geometry, Use of Finite Projective Geometry in the Development of the Fastest Indian Supercomputer *Eka* by Dr. Narendra Karmarkar – An Interconnection Scheme Between n Processors and m Memory Modules that Reduce the Number of Connections from mn to $O(\sqrt[3]{n})$

Applied Discrete Mathematics: Mathematical modelling for any problem statement., Signal Processing on Graphs, Image Processing on Arbitrary Graphs, Applications of Graph Theory in Software – Graph Database, Web Graph, Applications of Graph Theory in Hardware – Register Allocation by Graph Coloring, Floor planning

Tutorials

- 1 Problem solving and Mathematical Representation on sets operations.
- 2 Solve the problems on Mathematical Induction and discuss about its applicability
- 3 Explain Countable and Un-Countable Infinite set and Prove the theorem accordingly with examples
- 4 Applications of Relations – Electronic Circuit Design, n -Ary Relations and their Applications, Databases and Relations and Structured Query Language(SQL)
- 5 Applications of Functions – Job Scheduling Problem, Countability of Rational Numbers Using Cantor Diagonalization Argument.
- 6 Mathematical representations for any five types of graph.
- 7 Problem solving on Minimum Spanning Trees
- 8 Problem solving on groups and rings.
- 9 Select the data set and build mathematical model by applying discrete mathematics
- 10 Write up on Use of Finite Projective Geometry in the Development of the Fastest Indian Supercomputer *Eka* by Dr. Narendra Karmarkar – An Interconnection Scheme Between Processors and Memory Modules that Reduce the Number of Connections from o

Text books :

1. Bernard Kolman, Robert C. Busby and Sharon Ross, *Discrete Mathematical Structures*, Prentice-Hall of India Private Limited.
2. Alan Doerr and Kenneth Levasseur, *Applied Discrete Structures for Computer Science*, Galgotia Publications Pvt. Ltd.
3. C. L. Liu, *Elements of Discrete Mathematics*, Tata McGraw-Hill.

Reference Books :

1. Dr. K. D. Joshi, *Foundations of Discrete Mathematics*, New Age International Limited, Publishers, January 1996.
2. Richard Johnsonbaugh, *Discrete Mathematics*, Pearson.

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| | <ol style="list-style-type: none">3. Kenneth H. Rosen, <i>Discrete Mathematics and its Applications</i>, Tata McGraw-Hill.4. Norman L. Biggs, <i>Discrete Mathematics</i>, Oxford University Press. |
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Digital Electronics and Microprocessor (ITUA21202)

Teaching Scheme:	Examination Scheme					
Credits : 4	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week : 3Hrs/week Tutorials/ week : 1 Hrs/ week	20	30	20	30	25	125

Pre-requisites: Basic Electronics Engineering

Course objectives :

- To learn and understand basic digital circuit design techniques.
- To learn and understand the design of digital circuits using combinational logic.
- To learn and understand the design of digital circuits using sequential logic.
- To learn and understand the design of Counter circuits.
- To learn and understand the basics of Logic Families and PLD's.
- To learn and understand the design of digital circuits using VHDL and basics of Microprocessor.

Course Outcomes:

Upon completion of the course, students will be able to

1. Simplify Boolean algebraic expressions for designing digital circuits using K-Maps.
2. Apply digital concepts in designing combinational circuits.
3. Apply digital concepts in designing sequential circuits.
4. Apply digital concepts in designing Counters.
5. Understand the basics of Logic Families and Design digital circuits using PLA and PAL.
6. Design digital circuits using VHDL and Understand the basics of Microprocessor.

Unit I: Number System and Logic Minimization Techniques

Number System: Introduction, Binary number System, Sign-Magnitude representation, One's and Two's complement representation, Binary arithmetic, 2's complement arithmetic, Octal number System, Hexadecimal number System, Basic theorems and properties.

Logic minimization: Representation of truth-table, Sum of Product (SOP) form, Product of Sum (POS) form, Simplification of logical functions, Minimization of SOP and POS forms using K-Maps up to 4 variables and Quine-McCluskey Technique, realization of logic gates.

Unit II - Combinational Logic

Design of Combinational Logic: Code converter - BCD, Excess-3, Gray code, Binary Code. Half- Adder, Full Adder, Half Subtractor, Full Subtractor, Binary Adder (IC 7483), BCD adder, Look ahead carry generator, Multiplexers (MUX): MUX (IC 74153, 74151), MUX tree, DE multiplexers (DEMUX)-Decoder. (IC 74138, IC 74154). DMUX Tree, Implementation of SOP and POS using MUX, DMUX, Comparators, Parity generators and Checker, One bit, Two bit , 4-bit Magnitude Comparator.

Unit III: Sequential Logics

Flip-flop: SR, JK, D, T; Preset & Clear, Master and Slave Flip Flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flip Flop.

Registers: Buffer register, shift register (SISO, SIPO, PISO& PIPO), Applications of shift registers.

Unit IV: Counters

<p>Counters: Asynchronous counter. Synchronous counter, ring counters, Johnson Counter, Modulus of the counter (IC 7490).</p> <p>Synchronous Sequential Circuit Design: Models – Moore and Mealy, State diagram and State Tables, Design Procedure, Sequence generator and detector.</p>	
<p>Unit V: Logic Families & PLD's</p>	
<p>Classification of logic families: Unipolar and Bipolar Logic Families, Characteristics of Digital ICs: Speed, power dissipation, figure of merits, fan-out, Current and voltage parameters, Noise immunity, operating temperature range, power supply requirements. Transistor-Transistor Logic: Operation of TTL, TTL characteristics. CMOS: CMOS Inverter, CMOS characteristics, CMOS configurations- Wired Logic, Open drain outputs. Interfacing: TTL to CMOS and CMOS to TTL.</p> <p>PLDs: - PLA, PAL, Design Example: Any 4 Variables SOP function using PLDs.</p>	
<p>Unit VI: VHDL & Introduction to Microprocessor</p>	
<p>VHDL: Design Entity, Architecture, Modeling Styles, Design Examples: VHDL for Combinational Circuits-Adder, MUX.</p> <p>Introduction to Microprocessor: Introduction of Ideal Microprocessor, Data Bus, Address Bus, Control Bus, Microprocessor Based System- Basic Operation, Microprocessor Operation, Microprocessor Architecture, Instruction Set.</p>	
Text books :	<ol style="list-style-type: none"> 1. R. P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, 2003, ISBN0 – 07 – 049492 – 4. 2. J. Bhaskar, "VHDL Primer" 3rd Edition, Pearson Edition. 3. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL Design", McGraw Hill, ISBN–13:978-1-25-902597-6. 4. G.K.Kharate, "Digital Electronics", Oxford University Press.3.
Reference Books :	<ol style="list-style-type: none"> 1. John Yarbrough, "Digital Logic applications and Design" Thomson. 2. Flyod "Digital Principles", Pearson Education. 3. Malvino, D.Leach "Digital Principles and Applications", 5th edition, Tata Mc- Graw Hill. 4. Douglas L. Perry, "VHDL Programming by Example", Tata McGraw Hill. 5. G. K. Kharate, "Digital Electronics", Oxford University Press.

Tutorial List: Digital Electronics and Microprocessor

1	Number system conversion and 2's compliment arithmetic.
2	Realize Full Adder and Sub tractor using a) Basic Gates and b) Universal Gates.
3	Design and implement Code converters-Binary to Grey and BCD to Excess-3.
4	Design and Realization of BCD Adder using 4-bit Binary Adder (IC 7483).
5	Design of Ripple Counter using JK-Flip Flops.
6	Design 3 bit Synchronous Up/Down Counter using JK-Flip Flop.
7	Design and implement Mod -N counter using IC-7490.
8	Simulation of - Full adder using VHDL.
9	Simulation of - 4:1 MUX using VHDL.
10	Mini project: Nowadays digital electronics deals with the logic gates, flip-flops, CMOS – the foundation for modern computers and digital communications. Students are expected to apply their knowledge to design and develop a simple digital system as a part of this project.

Data Communication and Networking (ES21203IT)

Teaching Scheme:	Examination Scheme					
Credits : 4	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures/Week :3Hrs/week Practicals/ week :2 Hrs/ week	20	30	20	30	25	125

Course objectives :

- To understand the concepts of data communication.
- To learn the transmission media and its use.
- To study the functions of TCP/IP and OSI layers.
- To Study the modulation and demodulation techniques.
- To understand the functionalities of Data link layer
- To study multiple access and collision detection techniques

Course Outcomes:

After completion of the course, student will be able to

1. Differentiate the analog and digital signals and their characteristics.
2. Categories various modulation and multiplexing techniques.
3. Identify and use various transmission media in various network scenarios.
4. Understand OSI layers, TCP/IP protocol stack and describe various network topologies.
5. Exercise error correction techniques.
6. Compare and describe multiple access methods.
7. Work in a group to understand, prepare and present a given case study.

Unit I : Fundamentals of Signals

Analog and Digital: Analog and Digital Data, Analog and Digital Signals, Periodic and Non-periodic Signal
Periodic Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals
Bandwidth

Digital Signals: Bit Rate, bit Length, Digital Signal as a Composite Analog Signal, Transmission of Digital Signals

Transmission Impairment: Attenuation, Distortion, Noise

Data Rate Limits: Noiseless Channel: Nyquist Bit Rate, Noisy Channel: Shannon Capacity

Performance: Bandwidth, Throughput, Latency (delay)

Unit II :Modulation and Multiplexing Techniques

Digital-to-digital Conversion: Line Coding, Line Coding Schemes, Block Coding, Scrambling, Analog to digital Conversion: Pulse Code Modulation (PCM), Delta Modulation (DM), ADM Transmission modes: parallel transmission, serial transmission, Analog-to-analog Conversion: Amplitude Modulation, Frequency Modulation, Phase Modulation, Multiplexing: Frequency-Division Multiplexing (FDM), Wavelength-Division Multiplexing Synchronous Time-Division Multiplexing, Statistical Time-Division Multiplexing
Spread Spectrum: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum.

Unit III: Transmission Media and Switching

Guided Media: Twisted-Pair, Coaxial and Fiber-Optic Cable. Unguided Media: Radio Waves, Microwaves, Infrared. (RJ45, RJ11, BNC, SC/ST etc.) Circuit-switched Networks: Three Phases, Packet switching : Datagram networks, Virtual circuit networks

Brief introduction of Digital Subscriber Line: ADSL, HDSL, SDSL, VDSL (DMT).

Unit IV: Layer Model and Topologies	
The OSI Model: Layered Architecture, peer-to-peer Processes, Encapsulation of Layers in the OSI Model, TCP/IP Protocol Suite, LAN, MAN, WAN, Topologies like star, mesh, bus, hybrid etc. Addressing: Physical & logical Addresses, Connecting devices: Hubs, Repeaters, Active hubs, Bridges, Switches, Routers, Gateway	
Unit V :Error Control and Data Link Control	
Types of errors: Redundancy, detection versus correction, forward error correction versus retransmission, Block coding: error detection, error correction, CRC, polynomial, checksum, hamming code, hamming distance DLC Services: Framing, Flow and error control DLL Protocols: Simple protocol, Stop n wait, Go back to N, Selective repeat HDLC Protocol: configurations and transfer modes, frames, control field. Point-to-point Protocol (PPP) : Framing, Transition Phases, Multiplexing, Multilink PPP	
Unit VI: Multiple Access	
Random access: Aloha, Slotted Aloha, Carrier Sense Multiple Access (CSMA), Carrier Sense Multiple Access with Collision Detection (CSMA/CD), Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). Controlled access: reservation, polling, token passing. Channelization: Frequency Division Multiple Access (FDMA), Time-Division Multiple Access (TDMA), Code Division Multiple Access (CDMA).	
Text books :	1. Fourauzan B., "Data Communications and Networking", 5th edition, McGraw-Hill Publications 2. Stallings William., "Data and Computer Communications", Sixth Edition, Prentice Hall of India
Reference Books:	1. Andrew S. Tenenbaum, "Computer Networks", Pearson 2. Douglas E. Comer, "Computer Networks and Internets", Pearson Education

Data Communication and Networking Laboratory	
1	Network Representation on Network Simulator tool
2	Configuration of initial Switch setting using secure Passwords and SSH
3	Study of DCE, DTE, straight and cross cables
4	Implementation of basic connectivity in a small network.
5	Identify MAC and IP addresses.
6	To examine the ARP table.
7	Implementation of wireless LAN.
8	Study of Basic router configuration and introduction of iOS.
9	To design subnets as per given requirement.
10	Study of campus wide network and prepare a report.

Fundamentals of Data Structures (ITUA21204)

Teaching Scheme:	Examination Scheme					
Credits : 4	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week : 3Hrs/week Practicals/ week : 2 Hrs/ week	20	30	20	30	25	125

Pre-requisites: Fundamentals of Programming Languages

Course objectives :

- To understand the different ways of data representation.
- To develop the ability to analyze algorithms.
- To enable students to write algorithms for solving problems with the help of fundamental data structures.
- To understand concepts about searching and sorting techniques.
- To study the implementation and applications of linear data structures.

Course Outcomes:

Upon completion of the course, students will be able to

1. Summarize appropriate constructs of a programming language including pointers and file handling.
2. Recognize algorithmic foundations and basics of analysis of algorithms.
3. Select appropriate searching and/or sorting techniques in the application development.
4. Apply various linear data structures using sequential organization for problem solving and programming.
5. Apply various linear data structures using linked organization for problem solving and programming.
6. Use advanced linear data structures stack and queue for problem solving and programming.

Unit I :Pointers in C and File Handling

Introduction to Pointers, Dynamic memory allocation, Pointer to pointer, Pointer to single and multidimensional arrays, Array of pointers, String and structure manipulation using pointers, Pointer to functions. Pointer to file structure and basic operations on file, File handling in C.

Unit II : Introduction to Data Structures and Analysis of Algorithms

Concept of data, Data object, Data structure, Abstract Data Types (ADT), Concept of primitive and non-primitive, Linear and non-linear, Static and dynamic, Persistent and ephemeral data structures. Use of data structures in coding, **Analysis of algorithm:** frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Big 'O', 'Ω' and 'Θ' notations, Best, Worst and Average case analysis of an algorithm.

Unit III :Searching and Sorting Techniques

Need of searching and sorting, Linear & Binary search, Bubble sort & complexity Analysis, Selection sort & complexity analysis, Insertion Sort & Complexity Analysis, Merge Sort & complexity Analysis, Quick Sort & complexity Analysis..

Unit IV: Linear Data Structures using sequential Organization

Concept of Linear data structures and sequential organization, Concept of ordered list, Multidimensional arrays and their storage representation: row major and column major form and address calculation .Representation of sparse matrix using arrays, algorithms for sparse matrix addition, simple and fast transpose, polynomial representation using arrays .Analysis of these algorithms

Unit V: Linear Data Structures using Linked Lists

Concept of linked organization, singly linked list, doubly linked list, Circular linked list. Linked list as an ADT. Representation and manipulations of polynomials using linked lists, Comparison of a sequential and linked memory organization, Concept of Generalized Linked List, Representation polynomial using GLL.	
Unit VI : Linear Data Structures-Stack and Queue	
Stacks: Concept of stack, Push and pop operation, Stack implementation using array and linked list, Application of stack for expression conversion and evaluation, Recursion concept and use of internal stack. Queues: Concept of queue & its application, Priority queue concepts and operations, Doubly ended queue concepts and operations, Circular queue concepts and operations, Multi-stack and Multi-queue concepts.	
Text books :	1.R. Gilberg, B. Forouzan, “Data Structures: A pseudo code approach with C”, Cenage Learning, ISBN 9788131503140. 2. E. Horowitz , S. Sahani, S. Anderson-Freed, “Fundamentals of Data Structures in C”,
Reference Books :	1. A. Aho, J. Hopcroft, J. Ulman, “Data Structures and Algorithms”, Pearson Education, 1998, ISBN-0-201-43578-0 2. Y. Langsam, M. Augenstein and A. Tannenbaum, “Data Structures using C and C++”, 2 nd Edition, Prentice Hall of India, 2002, ISBN-81-203 -1177-9 3. J. Tremblay, P. Soresan, “An introduction to data structures with Applications”, 2 nd edition, Tata McGraw-Hill International Editions, 1984, ISBN-0-07-462471-7.

Fundamentals of Data Structures Laboratory	
1	In a class, some students like math, some like science, and some both the subjects. Find the students who like (i) Math only i.e. (M) - (MnS), (ii) Science only i.e. (S) - (MnS), (iii) Either Math or Science (MuS) .
2	Perform matrix operations with pointers.
3	Create a database for inventory system of a shop using array of structures and perform following operations on it: i. Add record ii. Display Database iii. Search record (Use linear search algorithm) iv. Delete record v. Update records vi. Sort records using bubble sort
4	Create database for employees of an organization using sequential file and perform following operations: i. Add records ii. Display records iii. Search record iv. Modify record v. Delete record
5	Sort the set of strings in ascending order using Insertion sort and descending order by using Selection sort (Display pass by pass output) . Search a particular string using binary search with and without recursion
6	a) Implement Quick Sort and Merge Sort to sort the given list of numbers. Display corresponding list in each pass. (with recursion)
7	Accept conventional matrix and convert it into sparse matrix using structure and Perform addition of two sparse matrices. Implement simple and fast transpose algorithms on sparse matrix.
8	Implement a singly linked list(SLL) as an ADT.
9	Implement any database using doubly linked list (DLL) and perform database operations.
10	Implement stack ADT using linked list. Write a program for infix to postfix conversion using stack. Also, evaluate the postfix expression.
11	Implement the circular queue.
12	Implement a priority Queue for a list of patients using linked list.
*All assignments to be implemented using C/C++ on Linux platform (gcc/g++ compiler). Use of eclipse and Codeblocks etc. editors is also allowed.	

Computer Organization (ITUA21205)

Teaching Scheme:	Examination Scheme					
Credits : 3	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week : 3Hrs/week	20	30	20	30	--	100

Prerequisites: Basics of Electronics Engineering

Course Objective

- To understand the structure, function and characteristics of computer systems
- To understand the design of the various functional units and components of digital computers
- To identify the elements of modern instructions sets and explain their impact on processor design,
- To explain the function of each element of a memory hierarchy, identify and compare different methods for computer Input Output,
- To compare simple computer architectures and organizations.

Course Outcomes

After completion of the course, student will be able to

1. Explain processor structure & its functions.
2. Solve problems based on computer arithmetic.
3. Obtain knowledge about micro-programming of a processor.
4. Discover Instruction level processing
5. Understand concept related to memory and IO organization.
6. Understand concepts related to multicore Computers.

Unit I - Computer Evolution and Performance Measures

Computer Organization and Architecture, Designing for Performance (performance assessment), Evolution of Intel x86 Architecture , A brief history of computers, CISC vs RISC: Speed, Throughput. Von Neumann Architecture, A top level view of Computer function and interconnection- Computer Components, Computer Function, Interconnection structure, bus interconnection.

Unit II – Computer Arithmetic

The Arithmetic and Logic Unit, Addition and subtraction of signed numbers, Multiplication of positive numbers, Signed operand multiplication, Booths algorithm, Fast multiplication, Integer division, Floating point representation and operations – IEEE standard

Unit III – The Control Unit

Instruction level parallelism and superscalar processors - Super scalar verses super pipelined, constraints, Design Issues- Instruction level and machine parallelism, Instruction issue policy, Register renaming, Machine parallelism, Hardwired control, Micro-programmed control- micro instructions, Micro program sequencing, Wide branch addressing

Unit IV - Processor Structure

Architecture of 8086, Processor organization, Register organization- User visible registers, control and status registers, Instruction Cycle- The indirect cycle and data flow, Instruction pipelining- pipelining strategy, Types of operands, Data transfer, arithmetic, logical, Conversion, input-output, **Addressing modes and formats** - Immediate, Direct, indirect, register, register indirect Displacement and stack, Instruction Formats-

length, variable length instructions and pseudo codes	
Unit V – Computer Memory system	
Characteristics of memory system, The memory hierarchy, Cache Memory- Cache memory principles, Elements of cache design- Cache address, Size, Mapping functions, Replacement algorithms, Write policy, Line size, Number of cache, One level and two level cache, Performance characteristics of two level cache-locality & operations, organization of a cache memory unit, Fetch and write mechanisms	
Unit VI – MultiCore Processors	
Why Multicore? Architecture: Multicore & Multiprocessor, Hardware Performance Issues, Software Performance Issues, Multicore Organization, Applications, Advantages and challenges, Examples, Recent trends in Multicore, case study on multicore processor	
Text books :	<ol style="list-style-type: none"> 1. W. Stallings, Computer Organization and Architecture: Designing for performance, Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 7th Edition. 2. Zaky S, Hamacher, Computer Organization, 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5, 5th Edition.
Reference Books :	<ol style="list-style-type: none"> 1. John P Hays, Computer Architecture and Organization, McGraw-Hill Publication, 1998, ISBN:978-1-25-902856-4, 3rd Edition. 2. Miles Murdocca and Vincent Heuring, Computer Architecture and Organization- an integrated approach, Wiley India Pvt. Ltd, ISBN:978-81-265-1198-3, 2nd Edition. 3. A. Tanenbaum, Structured Computer Organization, Prentice Hall of India, 1991 ISBN: 81 – 203 – 1553 – 7, 4th Edition. 4. Patterson and Hennessy, Computer Organization and Design, Morgan Kaufmann Publishers In, ISBN 978-0-12-374750-1, 4th Edition

IT Workshop-I (ITUA21206)

Teaching Scheme:	Examination Scheme					
Credits : 3	CIE	ISE	SCE	ESE	TW	Total
Lectures / Week : 1 Hrs/week Practicals/ week : 4 Hrs/ week	--	--	--	--	50	50

Prerequisites : Data Structure and Files, Object Oriented Programming, Basic knowledge of database management system

Course Objectives:

- To learn and understand fundamentals core Java.
- To learn and understand applications of object oriented programming using core Java.

Course Outcomes:

After studying this course, students will be able to:

1. Apply fundamental concepts Object Oriented programming in Core Java.
2. Handle different types of exceptions raised during java programming.
3. Develop database applications.
4. Develop client side programming using HTML,CSS and Javascript.
5. Develop server side programming using Servlet,JSP.

UNIT I- Introduction To Core JAVA

Introduction to Java; History and features of Java, Comparison with C and C++, JDK, JRE, and JVM (Java Virtual Machine), First Java Program , Data types, variables ,constants, literals, and Operators ,String, Array, Control Flow statements, OOPS and its application in Java-Classes and Objects, Getters/Setters, Methods, Scanner class, Constructors, Super and this keyword, Modifiers, Static keyword, Encapsulation, Protection of data, Inheritance, Is-A Relationship, Types of inheritance, extends and implements keywords, Polymorphism Compile time polymorphism -- Overloading of methods, Run time polymorphism -- Overriding of methods, Static and Dynamic Binding, Abstraction, Interfaces and Abstract classes, Abstract and non-abstract methods, Memory management in Java, Heap, Stack, Packages

UNIT II – Exception Handling And JDBC

Exception Handling-Try-catch block, Multiple Catch Block, Nested try block, Finally block, Throw and Throws Keyword, Final vs Finally vs Finalize

JDBC-JDBC Drivers, steps to connect to Database, Connectivity with Oracle, Connectivity with MySQL, Connectivity with Access without DSN, DriverManager, Types of JDBC statements: Statement, Prepared statement, Callable statement, Database Metadata, Resultset Metadata, ResultSet, types of ResultSet,

IT Workshop- I Laboratory

1. Exercises on Java basics-

Installation of JDK, source code editor and HelloWorld program.

Write a program to check **Pass /Fail** result.

Write a program to check odd /even number.

Write a program to convert temperature from Celsius to Fahrenheit and vice versa.

Write a program to calculate simple and compound interest.

2. Java String Programs

Write a program to convert string to char and char to string.

Write a program to check palindrome.

Write a program to find duplicate characters in a string.

3. Java Array Programs

Write a program to calculate average numbers using array.

Write a program to add to matrix using multidimensional array

4. Write a program called IncomeTaxCalculator for salaried Employee. Design employee class with attributes like Emp_id, Emp_name, Age, Annual_income, Tax etc and calculate total income tax for a particular financial year.(Use java methods)

Hint:**Slab rate**

IT rate

Upto Rs. 5 lacs

Nil

From Rs. 5 lacs- Rs. 10 lacs

10% on additional amount

From Rs. 10 lacs- Rs. 50 lacs

20% on additional amount

Above Rs. 50 lacs

30% on additional amount

5. Write a program called PensionContributionCalculator for salaried Employee. Design employee class with attributes like Emp_id, Emp_name, Age, Salary, Employee_contribution, Employer_contribution etc. and calculate total pension contribution (Use Constructors).

Hint:

Employee's Age

Employee Rate (%)

Employer Rate (%)

55 and below

20

17

above 55 to 60

13

13

above 60 to 65

7.5

9

above 65

5

7.5

6. Write a program to calculate area and perimeter of basic geometric figures using method

overloading.

7. Design a bank account class with constructor and methods to deposit, to withdraw from, change the name, charge a fee and print a summary of the account using toString() method. Derive saving and current account from Account, overrides method and print summary of saving and current account. Use Final.
8. Design Vehicle class hierarchy to implement different kinds of inheritance. Use Super, this, static keywords.
9. Design Shape class hierarchy. Implement Polymorphism on draw method.
10. Implement the concepts of Abstract class, Interface on Document class. Implement multiple interface through interfaces.
11. Design web page using HTML and CSS for opening a bank account.
12. Design and Validate bank account registration form using javascript.
13. Implement exception handling in java.
14. Implement Java application connectivity with MySQL/Oracle database for Bank application and perform CRUD operations.
15. Implement event handling with AWT.
16. Implement GUI Java application connectivity with MySQL/Oracle database for your application using AWT.
17. Implement event handling with Swings.
18. Implement GUI Java application connectivity with MySQL/Oracle database for your application using swings.
19. Generate web application using servlet,Jsp,tomcat in Eclipse.
20. Connect that web application to the database and display. jsp page as a result.
21. Mini Project

Textbooks:	1. Jeff Friessen; “Beginning java 6 platform from Novice to Professional”, Apress/Springer,9788181288769 2. Gallardo, Burnette, McGrover ,“ Eclipse in action: a guide for java Developers”, Manning,9788177224986
Reference Books:	1. Khalid A Mughal, “A programmer’s guide to Java SCJP Certification”, Third Edition, Pearson Education ,978-81-317-2688-4

Critical Thinking & Problem Solving (ES21207IT)

Teaching Scheme:	Examination Scheme					
Credits : 2	CIE	ISE	SCE	ESE	TW	Total
Lectures / Week : 1Hrs/week						
Practicals/ week : 2 Hrs/ week	--	--	--	--	50	50

Prerequisites: Computational Science

Course Objective

- To learn and understand how to design the solution to computational problem
- To Solve computational problems using various problem-solving aspects.

Course Outcomes

After completion of the course, student will be able to

1. Apply problem solving concept to design a solution to computational problem.
2. Recognize clear thinking, critical thinking, and clear writing.

Unit I – Critical Thinking

Introduction to Critical Thinking, Types of thinking, Why Engineers Need Critical Thinking Skills?, Types of Reasoning Skills, Clear Thinking, Critical Thinking, and Clear Writing, Skills We Need for Critical Thinking, Five Parts of Critical Thinking, Steps to Critical Thinking, 9 Elements of critical thinking, Rules for Critical Thinking, Levels of critical thinking, Exploring Your Personal Critical and Creative Thinking Skills.

Unit II – Problem Solving

Planning your solution-Communicating with computer, organizing the solution, testing the solution, coding the solution, software development cycle.

Programming Structure - modules and their functions, cohesion & Coupling, Local and global variable, parameters, return values, variable names and data dictionaries, four logic structures. Problem solving with sequential logic structure - The sequential logic structure, solution development. Problem Solving with Decisions – decision logic structure, multiple if/then/else instructions, straight-through logic, positive logic, negative logic, logic conversion, decision tables. Problem solving with loops and case logic structures.

Critical Thinking & Problem Solving Laboratory

I. This assessment is designed to test your critical reasoning skills. It is divided into 5 sections that will assess your ability to identify the key problems in complex scenarios, to pick out common errors in reasoning, to provide necessary assumptions for arguments, to recognize that problems can be solved in a variety of ways, and to distinguish valid/invalid and probable/improbable conclusions. Each section will

consist of 3-4

questions and you will have to complete the assignment.

Section 1: Key Question, Problem, or Issue

1. Pick out the key, or primary, question.
2. Pick out the primary problem that creates further problems.
3. Pick out the issue, limited scope.

Section 2: Information and Evidence

1. Interpreting claims and best evidence in a set.
2. Identifying bias.
3. Identifying the fallibility of experts.

Section 3: Assumptions and Context

1. Pick out a valid assumption for the argument.
2. Provide the necessary assumption for the argument.
3. Picking out context. (In what way does the argument fail to recognize context?)

Section 4: Perspectives and Plausible Solutions

1. Solve a problem with a set of solutions.
2. Pick out the best counter position.
3. Pick out a possible different perspective.

Section 5: Conclusions and Implications

1. Pick out the least probable conclusion.
2. Pick out the most probable conclusion.
3. Pick out the valid conclusion.
4. Identify the error in reasoning (reverse reasoning from conclusion).

II. Define a problem and Organize the problem.

1. Analyze the problem and prepare Problem Analysis chart
2. Identify different modules and develop interactivity chart
3. Extend and organize the information in the problem analysis chart using Input-Procession-Output (IPO Chart)
4. Write algorithms and draw flowchart for different modules
5. Test the solution.

Text books:	1. Maureen Spanrkle, “Problem Solving and Programming Concepts”, Pearson, 2011, ISBN-13: 978-0132492645.
Reference Books:	1. Joyce Farrell, “Programming Logic and Design”, Cengage Learning, ISBN-13:978-1285776712. 2. R G Dromey, “How to Solve it by Computer”, Pearson Education, 2008, ISBN 13: 978-8131705629.

S.Y.B.Tech.
2020 Pattern
Semester -IV
Syllabus Structure

Probability and Statistics (ES22201IT)

Teaching Scheme:	Examination Scheme					
Credits : 4	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week : 3Hrs/week Lab/ week : 1 Hrs/ week	20	30	20	30	25	125

Prerequisites:

Course Objective

- To give an exposure to the students the basic concepts of Probability and Statistical methods and their application.
- To serve as a foundation to analyse problems in Science and Engineering applications through Statistical testing Method.
- To introduce computing with R

Course Outcomes

1. Understand basics of probability including conditional probability and Bayes rule
2. Solve basic problems arising in engineering that involve discrete and continuous probability distributions.
3. Perform hypothesis testing with theory of estimation
4. Use statistical concepts such as means, variances and various types of graphs to analyze datasets using computational software such as R Perform various tests of hypothesis and significance
5. Understand confidence intervals and perform statistical inference such as hypothesis testing and regression

Unit I: Basic Ideas in Probability

Experiments, Outcomes and Probability, Events, Conditional Probability, Bayes theorem, Random Variables and Expectations

Unit II – Probability distributions

Discrete Distributions: Binomial distribution, Poisson's distribution, Continuous Distributions: Normal Distribution, joint probability distribution

Unit III: Markov Chains and Hidden Markov Models

Markov Chains and Hidden Markov Models Markov Chains, Estimating Properties of Markov Chains, Hidden Markov Models and Dynamic Programming, Introduction to Stochastic Processes – Markov process classification of states – Examples of Markov Chains, Stochastic Matrix, limiting probabilities

Unit IV: Sampling Theory

Population and Sample, Statistical inference, Sampling with and without replacement, Random samples, Population parameters, Sample statistics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Unbiased estimates and efficient estimates, point estimate and Interval Estimates, Confidence Interval estimates of population parameters, Confidence intervals for variance of a Normal distribution, Maximum likelihood estimates.

Unit V: Tests of Hypothesis and Significance

Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value. Special tests of significance for large samples and small samples (F, chi-square, z, t- test), ANOVA

Unit VI: Correlation and Regression

Correlation, Rank correlation, Regression Analysis, Linear and Non-linear Regression, Multiple regression, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves. Non parametric statistic test: Signed rank test, Wilcoxon Rank-sum tests

Tutorial List: Probability and Statistics

1 Installing R and basic operations and concepts in R

2 A research group collected the yearly data of road accidents with respect to the conditions of following and not following the traffic rules of an accident-prone area. They are interested in calculating the probability of accident given that a person followed the traffic rules. The table of the data is given as follows:

Condition	Follow traffic rule	Does not follow traffic rule
Accident	50	500
No accident	2000	5000

3 In an entrance examination there are twenty multiple choice questions. Each question has four options, and only one of them is correct. Find the probability of having seven or less than seven correct answers if a student attempts to answer every question at random. (Binomial Distribution in R)

4 Let us assume that the test scores an entrance exam fits a normal distribution where the mean test score is 67, and the standard deviation is 13.7. Calculate the percentage of students scoring 80 or more in the exam?
(Normal distribution in R)

5 Perform mean, mode, median for the given dataset

6 Variance, standard deviation, quartiles, inter quartiles in R

7 Hypothesis testing in R

8 Linear Regression in R

Text books:

1. A Modern Introduction to Probability and Statistics: Understanding Why and How: F.M. Dekking C. Kraaikamp, H.P. Lopuhaa L.E. Meester (Springer)
2. Probability And Statistics for Computer Scientists (Second Edition): Michael Baron (CRC Press)

Reference Books:

1. Probability & Statistics for Engineers & Scientists: Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers Keying Ye: Prentice Hall 2
Probability and Statistics for Data Science, Math + R + Data: Norman Matloff (CRC Press, Taylor and Francis group)

Data Structures and Files (ITUA22202)

Teaching Scheme:	Examination Scheme					
Credits : 4	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week : 3Hrs/week Practicals/ week : 2 Hrs/ week	20	30	20	30	25	125

Pre-requisites: Basics of Programming Languages, Fundamentals of Data Structures, Object oriented programming

Course objectives :

- To study data structures and their implementations using OOP (C++) and applications.
- To study some advanced data structures such as trees, graphs, tables.
- To study the representation, implementation and applications of data structures.
- To choose the appropriate data structure for modeling a given problem.
- To learn different file organizations.

Course Outcomes:

After completion of the course, student will be able to

1. Represent, select, implement and apply tree data structures for problem solving and programming.
2. Represent, select, implement and apply graph data structures for problem solving and programming.
3. Represent, select, implement and apply symbol table data structures for problem solving and programming.
4. Understand heap ADT and its implementations.
5. Understand different multi way trees.
6. Understand and implement various file organization techniques.

Unit I :Trees

Difference in linear and non-linear data structure, Basic tree concepts, Binary trees and their properties, Representation using sequential and linked organization, Full and complete binary trees, Conversion of general tree to binary tree, Binary tree as an ADT. Recursive and non-recursive algorithms for binary tree traversals, Binary search trees, and Binary search tree as ADT, Concept of threaded binary tree, Creation and Traversal of in-order threaded binary tree, Applications of trees

Unit II : Graphs

Graph as an ADT, Representation of graphs using adjacency matrix and adjacency list, Depth First Search and Breadth First Search traversal. Prim's and Kruskal's algorithms for minimum spanning tree, Shortest path using Dijkstra's algorithm, Topological sorting, Applications of Graphs.

Unit III :Symbol tables using hashing techniques

Symbol Table : Notion of Symbol Table, Static & dynamic tree table, Hash tables: Basic concepts, Hash function, Characteristics of good hash function, Different key-to-address transformations techniques, Synonyms or collisions, Collision resolution techniques- linear probing, Quadratic probing, Rehashing, Chaining without replacement and Chaining with replacement, Applications..

Unit IV: Symbol tables using other techniques	
Heap: Heap definition, Heap properties, Types of heap , Heap data structure, Applications of heap: heap sort implementation , Priority queue, Huffman algorithm, Concept of OBST , AVL Trees and algorithms	
Unit V : Multi way trees	
Basic of m-way search tree, Concept of red and black trees, B tree implementation, Concept of B+ -tree, Splay trees, R-Trees, Quad tree, Applications.	
Unit VI: File Organization	
External storage devices, file organization - Sequential file organization, Direct file organization, Index sequential file organization, their implementation and comparison, Multi-indexed Files, Inverted Files.	
Text books :	<ol style="list-style-type: none"> 1. Horowitz and Sahani, —Fundamentals of Data Structures in C++, University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926. 2. R. Gillberg, B. Forouzn, —Data Structures: A Pseudo code approach with C++, Cenage Learning, ISBN 9788131503140.
Reference Books :	<ol style="list-style-type: none"> 1. YedidyahLangsam, Moshe J Augenstein, Aron M Tenenbaum, —Data Structures using C and C++, Pearson Education, ISBN 81-317-0328-2. 2. A Michael Berman, —Data Structures via C++: Objects by Evolution, Oxford University Press, ISBN:0-19-510843-4. 3. M. Weiss, —Data Structures and Algorithm Analysis in C++, 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0. 4. Brassard & Bratley, —Fundamentals of Algorithmics, Prentice Hall India/Pearson Education, ISBN 13-9788120311312. 5. Goodrich, Tamassia, Goldwasser, —Data Structures and Algorithms in C++, Wiley publication, ISBN-978-81-265-1260-7

Data Structures and Files Lab

1	Construct an expression tree from postfix/prefix expression and perform recursive inorder, preorder and post order traversals. For expression tree, perform non-recursive inorder, preorder and post order traversals.
2	Create a binary search tree (BST) of and perform following operations: i) Insert ii) Display inorder iii) Search a node iv) Find height of the tree v) level wise display iv) Delete v) Mirror
3	Construct an inorder threaded binary search tree. Traverse threaded binary tree it in inorder and preorder.
4	Create a graph using adjacency list representation. Perform graph traversal using using BFS and DFS.
5	Use the map of the area around the college as the graph. Identify the prominent land marks as nodes and find minimum distance to various land marks from the college as the source. Represent this graph using adjacency matrix. Find the shortest path using Dijkstra's algorithm.
6	A business house has several offices in different countries; they want to lease phone lines to connect them with each other and the phone company charges different rent to connect different pairs of cities. Business house want to connect all its offices with a minimum total cost. Represent using appropriate data structure. Apply Prim's algorithm to find minimum total cost.
7	Represent any real world graph using adjacency list /adjacency matrix. Find minimum spanning tree using Kruskal's algorithm.
8	Store data of students using hashing function for roll number and implement linear probing using chaining without replacement and chaining with replacement algorithm
9	a) The internship is offered to students based on rank obtained in second year of graduation. Create suitable non-linear data structure to identify next topper student for internship. (Create max-heap). b) Sort the student data in ascending order of grades.
10	Implement an index sequential file for any Database and perform all database operations on it b)iii. Modify a record iv. Delete a record
11	Implement direct access file for any Database and perform following operations on it i) Create Database ii) Display Database iii) Search a record
<p>*All assignments to be implemented using C/C++ on Linux platform (gcc/g++ compiler). Use of eclipse and Codeblocks is allowed.</p>	

Computer Networks (ITUA22203)

Teaching Scheme:	Examination Scheme					
Credits : 4	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week : 3Hrs/week Practicals/ week : 2 Hrs/ week	20	30	20	30	25	125

Prerequisites : Digital Electronics, Fundamentals of Data Communication

Course objectives :

- To study the fundamentals of networking
- To understand functionalities of Physical and Data link layer
- To understand the functionalities of Network Layer
- To study various protocols at Transport and Application Layer
- To learn different techniques for routing and routing configuration.
- To learn and demonstrate VLAN, ACL and NAT in networking

Course Outcomes :

After completion of the course, student will be able to

1. Explore network design issues
2. Understand the functions of OSI layers & TCP/IP protocol stack
3. Understand the functionality of network layer
4. Understand the functionality of Transport and Application Layer
5. Analyze the routing requirements for a given network/LAN and decide the most appropriate routing strategy.
6. Design Switched networks and demonstrate the concepts of VLAN and ACL for switched networks.

Unit I – Explore the Network:

LANs, WANs, and the Internet, The Network as a Platform, Network Components, Network connecting devices, IEEE standards. Addressing: Physical & logical Addresses, Port Addresses, Specific Addresses. Rules of Communication: Communication Fundamentals, Rule Establishment, Message Encoding, Message Formatting and Encapsulation, Message Size, Message Timing, Message Delivery options.

Unit II -Network Protocols, Physical Layer and Data Link Layer

Network Protocols and Standards: Protocols, Protocol Suites, Standard Organization, Benefits of using layered Model, OSI Reference Model, TCP/IP Protocol Model, Data Transfer in the Network: Data Encapsulation and Data Access.

Physical Layer Protocols, Network Media, Data Link Layer Protocols, Media Access Control.

Types of Errors: Redundancy, Detection Versus Correction, Forward Error Correction Versus Retransmission.

Ethernet IEEE standards, Standard Ethernet, Fast Ethernet, Gigabit Ethernet.

Ethernet Protocol, LAN Switches, Address Resolution Protocol.

Unit III – Network Layer	
Network Layer Protocols, Routing, Routers, Configuring a Cisco Router.	
IP Addressing: IPv4 Network Addresses, IPv6 Network Addresses, Connectivity Verification.	
sub netting IP Networks: sub netting an IPv4 Network, Addressing Schemes, Address Schemes, Design consideration for IPv6	
Unit IV - Routing Essentials	
Introduction to Routing, Router Functions and Configuration, Routing Decisions and Operations, Routing Table, Static Routing and Default Routing, Dynamic Routing and Protocols, The Routing table, Static vs. Dynamic Routing..	
Unit V – Switched Networks	
Introduction to Switching, Switched and Converged Networks, Switching Domains, Switch Configuration and Security, Virtual LANs, Inter-VLAN Routing, Access Control Lists, NAT for IPv4.	
Unit VI – Broadband Networks	
Basic overview of various technologies : MPLS, VPN, B-ISDN, Frame Relay: Architecture and layers, ATM: Cell format, Architecture, Layers, VCC, VPC, Fast Ethernet and Gigabit Ethernet : concepts and details	
Text books :	<ol style="list-style-type: none"> 1. S. Tanenbaum : "Computer, Networks", PHI Publication, 4th edition, ISBN: 8178087855 2. Fourauzan B., "Data Communications and Networking", 5th Edition, TataMcGraw- Hill, Publications, ISBN: 0 – 07 – 058408 – 7 3. Kurose, Ross —Computer Networking a Top Down Approach Featuring the Internet, Pearson, ISBN-10: 0132856204
Reference Books :	<ol style="list-style-type: none"> 1. Routers and Routing Basics CCNA 2 Companion Guide- Webdell Odom, Rick McDonald. 2. CCNA Routing and Switching 200-125 Official Cert. Guide Library. 3. Cisco CCNA Command Guide- An introductory Guide for complete beginners

Computer Network Laboratory

1	Study of basic TCP/IP network commands and utilities (eg: ping, ifconfig, tracert, arp, tcpdump, whois, host, netsat, nslookup, ftp, telnet etc...)
2	Configure a router (Ethernet & Serial Interface) using router commands including access lists on any network simulator (eg. Packet Tracer)
3	Network design and implementation for small network using Packet Tracer
4	Network design & implementation of VLAN on Packet Tracer
5	Network analysis as well as packet header study with the help of any protocol analyzer/ packet sniffer.(eg: wireshark)
6	Installation and Configuration of Remote Login Service Telnet/SSH and access it through Telnet/SSH client
7	Installation and Configuration of FTP server and access it through FTP Client
8	Installation and configuration of DHCP Server in Wireless Environment using an Access Point (Packet Tracer)
9	Case Study of existing College network with IP Address Scheme.

Software Engineering (ITUA22204)

Teaching Scheme:	Examination Scheme					
Credits :4	CIE	ISE	SCE	ESE	PR/OR/TW	Total
Lectures / Week : 3Hrs/week Tutorials/ week : 1Hrs/week	20	30	20	30	25	125

Prerequisites: Basic programming skill

Course Objective

- To learn and understand the principles of Software Engineering
- To understand the nature of software complexity in various application domains, disciplined way of software development and software lifecycle process models.
- To introduce principles of agile software development, the SCRUM process and agile practices.
- To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
- To know methods of capturing, specifying, visualizing and analyzing software requirements.
- To understand concepts and principles of software design and architecture.
- To apply Test Cases and Design principles to S/W project development.

Course Outcomes

After completion of the course, student will be able to

- 1 Compare and choose a process model for a software project development.
- 2 Identify unique features of various software applications to write in SRS also to identify domains and classify software applications.
- 3 Describe principles of agile development, discuss the SCRUM process and distinguish agile process model from other process models.
- 4 Understand the importance of risk management and configuration management & apply risk management strategies and configuration management techniques to various projects.
- 5 Describe project management technique & apply software testing strategies.
- 6 Apply advanced software engineering techniques for global software development.

Unit I - Introduction to Software Engineering

Nature of Software, The Software Process, Software Myths, A Generic Process Model, Prescriptive Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Specialized Process Models, Unified Process

Unit II - Agile Methodology

Agile Development: Agile manifesto, agility and cost of change, agility principles, myth of planned development, toolset for the agile process.

Extreme Programming: XP values, process, industrial XP, SCRUM - process flow, scrum roles, scrum cycle description, product backlog, sprint planning meeting, sprint backlog, sprint execution, daily scrum meeting, maintaining sprint backlog and burn-down chart, sprint review and retrospective.

Agile Practices: test driven development, refactoring, pair programming, continuous integration, exploratory testing versus scripted testing

Unit III – Requirement analysis

Requirements Capturing: requirements engineering (elicitation, specification, validation, negotiation, prioritizing requirements (Kano diagram) - real life application case study.

Requirements Analysis: basics, scenario based modeling, UML models: use case diagram and class

diagram, data modeling, data and control flow model, behavioral modeling using state diagrams - real life application case study, software Requirement Specification

Unit IV - Risk Management , Configuration Management

Project Risk Management: Risk Analysis & Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Risks Monitoring and Management, The RMMM plan for case study project .

Software Configuration Management: SCM basics, SCM repository, SCM process, SCM tools such as GitHub, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools).

Unit V – Testing & Software Quality Assurance

Software Quality, Achieving Software Quality: Software engineering methods, Project Management techniques. Quality control and quality assurance. Software Reliability, SQA Tools, Goals and Metrics, **Introduction to Software Testing:** Principles of Testing, Testing Life Cycle, Phases of Testing, Types of Testing, Verification & Validation, Defect Management, Defect Life Cycle, Bug Reporting, GUI Testing, Test Management and Automation.

Software Process Improvement (SPI): What is SPI, SPI Process, The CMMI, The People CMM, Case study: SPI frameworks.

Unit VI - Advanced Software Engineering

Maintenance & Reengineering: Software Maintenance, Software Supportability, Reengineering, Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering

Emerging software engineering trends: technology evolution, process trends, collaborative development, test-driven development, global software development challenges.

List of Tutorial for Software Engineering

Smooth conduction of tutorial student should make a group of two and submit their project title to subject instructor at start of the semester.

1. Identify a problem, formulate problem statement and define scope of problem.
2. Identify functional requirements and prepare a list of Actor and Use cases.
3. Prepare Use Case Specification document or write use case scenarios.
4. Create user stories with acceptance criteria.
5. Prepare prototype for the project using wireframe tools.
6. Draw activity diagram.
7. Identify analytical classes and prepare class diagram.
8. Prepare analytical sequence diagram.

Text books :	<ol style="list-style-type: none"> 1. Roger S Pressman “Software Engineering: A Practitioner’s Approach “ 7th Edition Mcgraw- Hill ISBN:0073375977 2. Ian Sommerville “ Software Engineering” 9th edition Pearson Education SBN-13: 978-0- 13-703515-1, ISBN-10: 0-13-703515-2 , pdf downloadable 3. Hong Zhu “Software Design Methodology”, Elsevier ISBN: 978-81-312-0356-9
Reference Books :	<ol style="list-style-type: none"> 1 Rajib Mall, “Fundamentals of Software Engineering”, Prentice Hall India, ISBN-13: 978-8120348981 2. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Springer, ISBN 13: 9788173192715. 3. Joseph Phillips, IT Project Management –On Track From Start to Finish, Tata Mc Graw-Hill, ISBN13: 978-0-07106727-0, ISBN-10: 0-07-106727-2.C. Michael Pilato, Ben Collins-Sussman and Brian Fitzpatrick, Version Control with subversion, O’Reilly, Shroff publishers, ISBN: 978-81-8404-728-8.

Universal Human Values 2 (ES20205)

Teaching Scheme:	Examination Scheme					
Credits : 3	CIE	ISE	SCE	ESE	TW	Total
Lectures / Week : 2Hrs/week	20	30	20	30	25	125
Tutorials/ week : 1Hrs/week						

Pre-requisites: Universal Human Values 1

Course objectives :

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding of the harmony in the human being, family, society and nature/existence.
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Course Outcomes:

Upon completion of the course, students will be able to

1. Become more aware of themselves, and their surroundings family, society, nature.
2. Become more responsible in life.
3. To handle problems with sustainable solutions.
4. Have better critical ability.
5. Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
6. To apply what they have learnt to their own self in different day-to-day settings in real life.

Unit I–Introduction - Need, Basic Guidelines, Content and Process for Value Education

Purpose and motivation for the course,Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation- as the process for self-exploration,Continuous Happiness and Prosperity- A look at basic Human Aspirations,Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Unit II - Understanding Harmony in the Human Being - Harmony in Myself!

Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’,
Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility,
Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer),
Understanding the characteristics and activities of ‘I’ and harmony in ‘I’,
Understanding the harmony of I with the Body, correct appraisal of Physical needs, meaning of Prosperity in detail.

Unit III - Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness, Trust and Respect as the foundational values of relationship

Understanding the meaning of Trust; Difference between intention and Competence,

Understanding the meaning of Respect, Difference between respect and Differentiation; the other salient values in relationship,

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals,

Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit IV- Understanding Harmony in the Nature and Existence - Whole existence as Coexistence with Implications of the Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values ,

Definitiveness of Ethical Human conduct,

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal order,

Competence in professional ethics:

- a. Ability to utilize the professional competence for augmenting universal human order
- b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
- c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Discussion on the conduct as an engineer or scientist.

List of Tutorial: (Any 7 tutorials can be taken)

1. Practice session to discuss natural acceptance in human being.
2. Practice session to discuss the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.
3. Practice session to discuss the role others have played in making material goods available to me. Identifying from one's own life.
4. Practice session to differentiate between prosperity and accumulation.
5. Practice session to discuss program for ensuring health vs dealing with disease.
6. Practice session to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc.
7. Practice session to reflect on Gratitude as a universal value in relationships. Discuss with scenarios.
8. Practice session to reflect on Gratitude Elicit examples from students' lives.
9. Practice session to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
10. Case Study session e.g. to discuss the conduct as an engineer or scientist etc.

Text books :

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, ExcelsBooks, New Delhi, 2010

Reference Books :

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

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| | <ol style="list-style-type: none">11. India Wins Freedom - Maulana Abdul Kalam Azad12. Vivekananda - Romain Rolland (English)13. University of Delhi, The Individual & Society, Pearson Education. |
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IT Workshop-II (ITUA22206)

Teaching Scheme:	Examination Scheme					
Credits : 3	CIE	ISE	SCE	ESE	TW	Total
Lectures / Week : 1Hrs/week Practicals/ week : 4 Hrs/ week	--	--	--	--	50	50

Prerequisites : Data Structure and Files, Object Oriented Programming, Basic knowledge of database management system

Course Objectives:

- To learn and understand fundamentals of core and advanced Python.
- To learn and understand applications of Python programming using Python libraries.

Course Outcomes:

After studying this course, students will be able to:

1. Interpret the basic principles of Python programming language.
2. Understand and use functions.
3. Implement applications using different libraries.

UNIT I- Python Fundamentals

Installing Python, Program structure, User Interface or IDE, Working with Interactive mode, Working with Script mode, Python Character Set, Python Tokens, Keywords, Identifiers, Literals, Operators, Variables and Assignments, Input and Output in Python,

DATA TYPES: Numbers, Strings, Lists, Tuples, Dictionary, Set, Frozenset, Bool, Mutable and Immutable. **STRING MANIPULATION:** Introduction to Python String, Accessing Individual Elements, String Operators, String Slices, String Functions and Methods. **LIST MANIPULATION:** Introduction to Python List, Creating List, Accessing List, Joining List, Replicating List, List Slicing. **TUPLES:** Introduction to Tuple, Creating Tuples, Accessing Tuples, Joining Tuples, Replicating Tuples, Tuple Slicing. **DICTIONARIES:** Introduction to Dictionary, Accessing values in dictionaries, Working with dictionaries, Properties. **SET AND FROZENSET:** Introduction to Set and Frozenset, Creating Set and Frozenset, Accessing and Joining, Replicating and Slicing. **OPERATORS:** Arithmetic Operators, Relational Operators, Logical Operators, Membership Operators, Identity Operators, Bitwise Operators, Assignment Operators, Operators Precedence, Evaluating Expression, Type Casting. **PROGRAM CONTROL FLOW:** Conditional Statements, The if Statement, The if-else Statement, The if-elif Statement, Nested if Statements, Python Indentation, Looping and Iteration, The For Loop, The While Loop, Loop else Statement, Nested Loops, Break and Continue, The Range Function, Introduction to range(), Types of range() function, Use of range() function.

UNIT II –Functions and Libraries for Data Analytics

Built-In Functions, Introduction to Functions, Using a Functions, Python Function Types, Structure of Python Functions, E.g. - map, zip, reduce, filter, any, chr, ord, sorted, globals, locals, all, etc., User Defined Functions, Structure of a Python Program, w.r.t. UDF, Types of Functions, Invoking UDF, Flow of Execution, Arguments and Parameters, Default Arguments, Named, Arguments, Scope of Variables, Lambda function, Recursion Function, Use of recursion function,

MODULES AND PACKAGES: Built-in Modules, Importing Modules in Python, Programs, Working with random Modules, E.g. - builtins, os, time, datetime, calendar, sys, etc., User Defined Functions, Structure of Python Modules. **LIBRARIES FOR DATA ANALYTICS:** Anaconda, Numpy, Scipy, Pandas, Matplotlib, Seaborn, Scikit- learn. **NUMPY:** Creating NumPy arrays, Indexing and slicing in NumPy, Downloading and parsing data, Creating multidimensional arrays, NumPy Data types, Array tributes, Indexing and Slicing, Creating array views copies, Manipulating array shapes I/O. **SCIPY:** Introduction to SciPy, Create function, modules of SciPy. **MATPLOTLIB:** Scatter plot, Bar charts, histogram, Stack charts, Legend title Style, Figures and subplots, Plotting function in pandas, Labelling and arranging figures, Save plots.

Textbooks:

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010

Reference Books:

1. Guido van Rossum, and Fred L. Drake, Jr., The Python Language Reference Manual (version 3.2), ISBN: 1906966141, Network Theory Ltd, 120 pages (Revised November 2006).
2. David Beazley, **Python Essential Reference**, ISBN: 0672329786, Addison-Wesley Professional; 717 pages (July, 2009).
3. Mark Lutz, Python Pocket Reference, 5th Edition, ISBN: 1449357016, O'Reilly Media, February 2014, 264 pages.
4. Doug Hellman, Python 3 Standard Library by Example, ISBN: 9780134291055, Addison-Wesley Professional; June 11, 2017; 1456 pages
5. <https://pynative.com/python-exercises-with-solutions/>

	IT Workshop - II Laboratory Assignments
1	Write a program to demonstrate basic data type in python. (Numbers, Strings, Lists, Tuples, Dictionary, Set, Frozenset, Bool, Mutable and Immutable.)
2	Write a program to demonstrate String Manipulation in python and perform: Accessing Individual Elements, String Operators, String Slices, String Functions and Methods. Write a program to count the numbers of characters in the string and store them in a dictionary data structure.
3	Write a program to demonstrate use of List in python and perform: Creating List, Accessing List, Joining List, Replicating List, List Slicing.
4	Write a program to demonstrate use of Tuples in python and perform: Creating Tuples, Accessing Tuples, Joining Tuples, Replicating Tuples, Tuple Slicing.
5	Write a program to demonstrate use of Dictionaries in python and perform: Accessing values in dictionaries, Working with dictionaries- Create, Merge, Delete set of keys, Rename.
6	Write a program to demonstrate use of Set and Frozenset in python and perform: Creating Set and Frozenset, Accessing and Joining, Replicating and Slicing.
7	Functions in Python: function creation, function calls, function arguments, inner functions, built-in functions. Create a function showEmployee() in such a way that it should accept the employee name, and its salary and display both. If the salary is missing in the function call assign default value 9000 to salary.
8	Numpy: NumPy is a Numerical Python library to create and manipulate multidimensional arrays useful in data science. a. Create a result array by adding the following two NumPy arrays. Next, modify the result array by calculating the square of each element b. Sort following NumPy array c. Split the array into four equal-sized sub-array
9	Matplotlib is a Python 2D plotting library that produces high-quality charts and figures, which helps us visualize extensive data to understand better. Use the following CSV file for this exercise. Read this file using Pandas or NumPy or using in-built matplotlib function. https://pynative.com/wp-content/uploads/2019/01/company_sales_data.csv

	<ul style="list-style-type: none"> a. Read Total profit of all months and show it using a line plot b. Read all product sales data and show it using a multiline plot. Display the number of units sold per month for each product using multiline plots. (i.e., Separate Plotline for each product). c. Read toothpaste sales data of each month and show it using a scatter plot d. Read face cream and facewash product sales data and show it using the bar chart e. Calculate total sale data for last year for each product and show it using a Pie chart.
10	<p>Pandas: Pandas is a handy and useful data-structure tool for analyzing large and complex data. Practice DataFrame, Data Selection, Group-By, Series, Sorting, Searching, statistics.</p> <p>In this exercise, we are using Automobile Dataset (https://pynative.com/wp-content/uploads/2019/01/Automobile_data.csv) for data analysis. This Dataset has different characteristics of an auto such as body-style, wheel-base, engine-type, price, mileage, horsepower, etc.</p> <ul style="list-style-type: none"> a. From the given dataset print the first and last five rows b. Find the most expensive car company name c. Print All Toyota Cars details d. Count total cars per company e. Find the average mileage of each car making company
	<p>Ref: https://pynative.com/python-exercises-with-solutions/</p>

Soft Skills (ES22207IT)

Teaching Scheme:	Examination Scheme					
Credits : 2	CIE	ISE	SCE	ESE	TW	Total
Lectures / Week : 1Hrs/week						
Practical/ week : 2	--	--	--	--	50	50
Hrs/Week						

Pre-requisites: Basic knowledge in communication and a good understanding of English

Course objectives :

- To encourage the all round development of students by focusing on soft skills.
- To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Course Outcomes:

After studying this course, students will be able to:

1. Effectively communicate through verbal/oral communication and improve the listening skills
2. Write precise briefs or reports and technical documents.
3. Actively participate in group discussion / meetings / interviews and prepare & deliver presentations.
4. Become a more effective individual through goal/target setting, self-motivation and practicing creative thinking.
5. Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

UNIT I: Self Awareness & Self Development

Self-Assessment, Self-Appraisal, SWOT, Goal setting - Personal & career - Self-Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self-appraisal, Personal Goal setting,

b) Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

c) Other Skills:

- Time management- The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to priorities using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions, to maximize your personal effectiveness, how to say “no” to time wasters, develop your own individualized plan of action
- Stress management- understanding the stress & its impact, techniques of handling stress

- Problem solving skill, Confidence building Problem solving skill, Confidence building
- Corporate / Business Etiquettes - Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting Understand the importance of professional behaviour at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment) Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.

UNIT II: Communication Skill

- a) Importance of communication, types, barriers of communication, effective communication
- b) Speaking Skills – Public Speaking, Presentation skills, Group discussion- Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.
- c) Listening Skills: Law of nature- you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, Avoid selective listening
- d) Group Discussion - characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.
- e) Presentation skills - planning, preparation, organization, delivery.
- f) Written Skills – Formal & Informal letter writing, Report writing, Resume writing – Sentence structure, sentence coherence, emphasis. Paragraph writing. letter writing skills - form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.

Soft Skills Laboratory

1. SWOT analysis
2. Personal & Career Goal setting – Short term & Long term
- 3 Presentation Skill
4. Letter/Application writing
5. Report writing
6. Listening skills
7. Group discussion
8. Resume writing
9. Public Speaking

10. Stress management

11. Team Activity-- Use of Language laboratory