VIT | Vidyalankar Institute of Technology
Accredited A+ by NAAC

Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Computer Engineering

Second Year Scheme & Syllabus

(As per AICTE guidelines, with effect from the Academic Year 2023-24)

Preamble

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated, and taken forward in a systematic manner. Therefore, autonomy for Vidyalankar Institute of Technology is not merely a transition from pre-cooked syllabi to self-designed curriculum. Autonomy curriculum of the Institute offers required academic flexibility with emphasis on industry requirements and market trends, employability and problem-solving approach which leads to improving competency level of learners with diverse strengths. In line with this, the curriculum framework designed is **Choice Based Credit and Grading System (CBCGS)**. Number of credits for each category of courses learnt by learners, internships and projects is finalized considering the scope of study and the ability that a learner should gain through the programme. The overall credits and approach of curriculum proposed is in line with AICTE model curriculum.

The curriculum comprises courses from various categories like basic sciences, humanities and social sciences, engineering sciences, general education and branch specific courses including professional electives and open electives. The curriculum has core courses of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. These courses are completed by third year of the engineering programme that enables learners to prepare for higher education during their final year. Professional elective courses, that begin from third year of programme, offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique professional elective courses based on industrial requirements and organizing them into tracks is a salient feature of this curricula ensuring employability. Open Elective courses cover multi-disciplinary, special skill development, project management and similar knowledge that make learner capable to work in industrial environment.
For holistic development of learners, apart from technical courses, Humanities and Social Science courses develop the required soft-skills and attitude amongst learners. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking, Yoga and Meditation, Indian Traditional Knowledge System under General Education category. These general education courses aim to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses. In addition to this, the curriculum is augmented with Life Enrichment audit courses for knowledge inspiring experience.

Additionally, curriculum provides add-on Honours/Minor degree that involves field/ domain study. Learner can avail this degree by completing requirement of additional 15 credits.

Thus, the academic plan of VIT envisages a shift from summative to formative and competency-based learning system which will enhance learner's ability towards higher education, employability and entrepreneurship.

Chairman, Board of Studies
Department of Computer Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

Second Year B. Tech. Computer Engineering **Semester: III**

Course Structure and Assessment Guidelines

Course		Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
HS03	Technical and Business Writing	Practical	2	75	-	-	075
BS05	Engineering Mathematics-III	Theory	3	20	30	50	100
BSXX	Basic Science Elective	Theory	2	15	20	40	075
CE01T	Data Structure	Theory	2	15	20	40	075
CE01P	Data Structure Lab	Practical	1	25	-	25	050
CE02T	Microprocessor	Theory	2	15	20	40	075
CE02P	Microprocessor Lab	Practical	1	25	-	25	050
CE03T	Digital Logic and Computer Organization	Theory	2	15	20	40	075
CE03P	Digital Logic and Computer Organization Lab	Practical	1	25	-	25	050
GEXXX*	Any two GE courses	As per course	As per course				
GEXXX*		As per course	As per course				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESE= End Semester Examination

***Refer to Appendix A for the list of General Education (GE) courses. A subset of courses shall be offered against GEXX*. However, the subset will depend on the GE courses made available by the institute for that semester.**

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Basic Science Elective Courses (BSXX)

Course Code	Course Name
BS17	Biology
BS19	Chemistry

Second Year B. Tech. Computer Engineering **Semester: IV**

Course Structure and Assessment Guidelines

Course		Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
HS06	Principles of Economics and Management	Theory+ Tutorial	3	40	20	40	100
BS07	Engineering Mathematics-IV	Theory	3	20	30	50	100
CE04T	Analysis of Algorithms	Theory	2	15	20	40	075
CE04P	Analysis of Algorithms Lab	Practical	1	25	-	25	050
CE05T	Database Management Systems	Theory	2	15	20	40	075
CE05P	Database Management Systems Lab	Practical	1	25	-	25	050
CE06T	Computer Graphics	Theory	2	15	20	40	075
CE06P	Computer Graphics Lab	Practical	1	25	-	25	050
CE07T	Operating Systems	Theory	2	15	20	40	075
CE07P	Operating Systems Lab	Practical	1	25	-	25	050
CE08	Software Lab	Practical	2	25	-	50	075

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESE= End Semester Examination

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Note: Refer Appendix B for the list of Advance Learning Courses along with their detailed syllabus. These courses will be offered next semester as recommended.

Detailed syllabus of Second Year Semester-III

Course Name: Technical and Business Writing

Course Code: HS03

Category: Humanities and Social Sciences (HSS)

Preamble:

The course, Technical and Business Writing, introduces students to the basics of effective writing. Writing being one of the core pillars of Communication Skills, is a significant aspect of the engineering curriculum. Engineers will encounter a plethora of technical writing tasks in their careers, and their writing needs to be professional. Technical and Business Writing will enable students to draft effective emails and letters, technical proposals and reports, maintain meeting documentation, and also to creatively express themselves through contemporary digital content creation tools.

Pre-requisites:

HS01P (Effective Communication Lab)
HS02P (Professional Skills Lab)

Course Objectives:

- To enable learners to gain understanding of writing effective letters, proposals and reports.
- To facilitate learners in developing the skills of participating in meetings.
- To create awareness of strengthening research orientation by reading and paraphrasing technical papers.
- To introduce strategies for drafting documentation required for higher studies.

Course Outcomes:

Learner will be able to:
CO 1: Draft effective letters and emails for various professional and business requirements.
CO 2: Collect and compile data in the form of a technical report, and present findings in front of an audience.
CO 3: Write technical reviews and instructions and differentiate between various hazard notations.
CO 4: Draft persuasive proposals to achieve the desired outcomes.
CO 5: Participate in meetings and draft meeting-related documentation like notice, agenda and minutes.
CO 6: Write a Statement of Purpose and create content using contemporary digital tools.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical

-	4*	-	2

*2 hours practical class wise and 2 hours practical batch wise

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	75	-	-	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Business Correspondence	Principles of Correspondence (7 Cs), Parts of a letter and Formats, Request for information/permission, Enquiry and Reply to Enquiry letters Complaints, Claims, Adjustment Letters, Email writing and etiquette	8
2	Report Writing	Significance, Objectives of Report Writing, Language and Style of Reports, Formats of Reports, Types of Reports, Synopsis writing	4
3	Technical Writing	Introduction to Technical Writing, Writing Definitions, Instructions, Safety Notations, Descriptions, Technical Reviews of gadgets, software and technologies, Paraphrasing Technical Paper (IEEE Format)	4
4	Proposal Writing	Parts of a Proposal and Formats, Drafting persuasive proposals	2
5	Meetings and Documentation	Strategies for conducting effective meetings (in person/virtual), Note Taking Notice, Agenda, and Minutes of Meeting, Business Meeting Etiquettes	2
6	Creative Writing	Statement of Purpose, Infographics, Blogging Digital Content Creation using modern tools	4
Total			**30**

Suggested List of Practicals:

1. Ice Breakers/Elevator Speech
2. Letter Writing
3. Email Writing
4. Synopsis Writing
5. Technical Instructions writing
6. Paraphrase a published IEEE Technical Paper – Reading and Drafting
7. Technical Proposal – Discussion and Drafting
8. Mock Meeting (Oral + Documentation)
9. Digital Content Creation
10. Drafting Statement of Purpose
11. Mini Project Presentation
12. Mini Project Presentation

Suggested List of Assignments:

1. Draft an Information/Enquiry/Reply to Enquiry letter in given format (Individual)
2. Draft an email on Permission/Complaint/Claim/Adjustment (Individual)
3. Draft a synopsis of the mini-project report (Group)
4. Write a set of technical instructions (Group)
5. Paraphrase a published IEEE Technical Paper (Individual)
6. Draft a technical proposal (Group)
7. Participate in a mock meeting and prepare notice, agenda, and minutes (Group)
8. Draft a Statement of Purpose (for admission to Higher Studies) (Individual)

Suggested List of Value-Added Home Assignments:

1. https://www.ted.com/talks/eric_berridge_why_tech_needs_the_humanities
2. https://www.ted.com/talks/melissa_marshall_talk_nerdy_to_me

Suggested Online Courses:

1. Courses on Communication offered by Udemy, Coursera, EdX, NPTEL Swayam, TCS iON
2. Writing Skills for Engineering Leaders https://www.coursera.org/programs/vidyalankar-institute-of-technology-coursera-response-program-tysb7/browse?productId=6sk543Q6EeaRqAobOpNSMQ&productType=course&query=technical+and+busin ess+writing&showMiniModal=true
3. Technical Writing https://www.coursera.org/programs/vidyalankar-institute-of-technology-coursera-response-program-tysb7/browse?productId=4ESRQQpFEea5dwol2CF9Kw&productType=course&query=technical+writing&sho wMiniModal=true

Reference Books:

1. Raman Meenakshi and Sangeeta Raman. Communication Skills. OUP.2016
2. Murphy Herta. Effective Business Communication. McGraw Hill. 2017
3. Kitty O Locker Business Communication- Building Critical Skills McGraw Hill. 2013

4. Lehman, Dufrene, Sinha. BCOM. Cengage Learning. 2020
5. Stanton Nicky. Mastering Communication. Palgrave Master Series. 2009
6. A.Kaul. Effective Business Communication. Prentice Hall of India.2015
7. Monippally. Business Communication Strategies .Tata McGraw Hill.2001
8. Monipally, The Craft of Business Letter Writing. Tata McGraw Hill.
9. Lesiker and Petit, Report Writing for business. Mc Graw Hill
10. Huckin and Olsen, Technical Writing for Professional Communication. Mc Graw Hill
11. R.C. Sharma and Krishna Mohan, Business Correspondence and Report Writing. Mc Graw Hill

Course Name: Engineering Mathematics-III

Course Code: BS05

Category: Basic Science (BS)

Preamble:

This course introduces students to various discrete structures concepts that is helpful for understanding many fundamental topics in computer science.

Pre-requisites:

Nil

Course Objectives:

- To enable learners to Develop a strong foundation in set theory and proofing techniques, enabling students to apply logical reasoning and rigorous proofs to analyze and solve problems in mathematics.
- To enable learners to Develop logical reasoning skills, critical thinking abilities, and understanding of formal logic systems to effectively analyze and evaluate arguments in various contexts.
- To enable learners a Comprehensive understanding of relations and functions, including their definitions, properties, classifications, and various operations, to analyze, model and solve problems in mathematics and related disciplines.
- To enable learners to Understand the fundamental concepts and techniques of graph theory, enabling them to analyze and solve problems related to graphs, networks, and their applications in diverse fields.
- To enable learners to understand algebraic structures, such as groups, rings, and fields, and their applications in coding theory, enabling them to analyze and design error-correcting codes for efficient and reliable data transmission.
- To enable learners to understand and explore the fundamental concepts and properties of number theory, including prime numbers, divisibility, modular arithmetic, and Diophantine equations, to develop problem-solving skills of the underlying structures of integers.

Course Outcome:

Students will be able to: -

CO1: Understand the concepts of set theory, notion of mathematical thinking, mathematical proofs and to apply them in problem solving.
CO2: Make use of propositional and predicate logic to construct valid arguments, evaluate propositions, and avoid common fallacies in reasoning.
CO3: Define, analyse, and apply concepts of relations and functions, including their properties, representations, and applications in various areas of mathematics and computer science.
CO4: Apply Graph theory as a powerful and flexible mathematical framework for studying the structure and connectivity of complex networks across various fields of science, engineering, and technology.

CO5: Understand and apply the concepts of algebraic structures and coding theory for encoding and decoding information in a way that can be transmitted reliably over noisy communication channels, with applications ranging from telecommunications and cryptography to data storage and error correction.

CO6: Understand and study the properties and relationships of numbers, including divisibility, prime numbers, modular arithmetic, Diophantine equations, and applications in cryptography and computer science.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No	Module name	Content	No of Hours
1	Set Theory and Logic	Definition and representation of Sets, Types of sets, operations on sets, Laws of set, Principle of Inclusion & Exclusion (3 sets), Partition of set. Counting principle, Pigeonhole Principle, Mathematical Induction.	6
2	Logic	Propositional Logic- logical connectives, Laws of logic, Logical Equivalences, Normal Forms. Predicate Logic- Predicates and Quantifiers.	4
3	Relations and Functions	Relation: Definition, Representation of relation, Properties of relation, Closure properties of relation (Reflexive, Symmetric and Transitive), partial order and equivalence relation. Composite and circular relation. Function: Definition, Types of function, Inverse function, composite functions.	10

Module No	Module name	Content	No of Hours
4	Graph Theory	Definition of graph, Types of graphs, Graph Representation, Sub graphs, Operations on Graphs, Walk, Path, Circuit, Connected Graphs, Disconnected Graph, Homomorphism and Isomorphism of Graphs, Euler and Hamiltonian Graphs, Planar Graph, Cut Set, Cut Vertex, Applications.	8
5	Algebraic Structures and Coding Theory	Algebraic structures with one binary operation: Groupoid, Semigroup, Monoid and Group, Abelian group, Cyclic groups, order and subgroup, Group Homomorphism, Isomorphism and Automorphism. Coding theory: encoding function, group codes, Minimum distance, error detection and correction, Parity check matrix, Decoding.	10
6	Number Theory	Modular Arithmetic, Divisibility and Euclid Algorithm, Primes and the Sieve of Eratosthenes, Testing for primes, Prime Number Theorem, Euler's, Fermat's Little theorems, Congruences, Computing Inverse in Congruences, Chinese Remainder Theorem.	7
Total			**45**

Text Books:

1. C. L. Liu, "Elements of Discrete Mathematics", TMH, ISBN 10:0-07-066913-9.
2. N. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8.
3. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, ISBN 978- 0-07-288008-3
4. Cryptograph and Network Security by B. A. Forouzan & D. Mukhopadhyay, 11th edition, McGraw Hill Publication.
5. Network Security and Cryptograph by Bernard Menezes, Cengage Learning Publication

Reference Books:

1. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures",Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.
2. Narsingh Deo, "Graph with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 – 87692 – 145 – 4.
3. Eric Gossett, "Discrete Mathematical Structures with Proofs", Wiley India Ltd, ISBN:978-81-265-2758-8.
4. Sriram P. and Steven S., "Computational Discrete Mathematics", Cambridge University Press, ISBN 13: 978-0-521-73311-3.
5. Elementary Number Theory and its applications by Kenneth H. Rosen, 5th edition, Addison Wesley Publication

Course Name: Chemistry

Course Code: BS19

Category: Basic Science (BS)

Preamble:

This course of Chemistry imparts the students sound knowledge on the principles of chemistry involving different application-oriented topics required in technology & engineering.

Pre-requisites:

Nil

Course Objectives:

- The contents of this course will aid in quantification and understand the applications of several concepts in Chemistry.
- To appreciate the need for and importance of engineering chemistry for industrial and domestic use.
- To gain knowledge on existing and future upcoming materials used in device fabrication.
- To impart knowledge of green chemical technology and its applications.
- To enhance the thinking capabilities in line with the modern trends in engineering and technology.

Course Outcomes:

Learner will be able:
CO1: Interpret properties, synthesis, and uses of important materials in various engineering applications.
CO2: Apply the fundamentals of electrochemistry in prevention & control measures related to corrosion of structures and devices.
CO3: Associate Green Chemistry principles in product development knowledge.
CO4: Students will be able to perform standard computational chemistry tasks.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Engineering Materials- Nanomaterials & Composite Materials	Advanced polymeric materials: Advanced polymeric materials: Conducting polymers- Polypyrrole, Polyaniline, polythiophene, (properties & applications), Light Emitting polymers (LEPs), Liquid crystal properties. In computers- electronics engineering materials used in computers Nanomaterials: Introduction, Fullerenes, Carbon nanotubes, Nanowires, Electronic and mechanical properties, Applications of nanomaterials - Catalysis, Electronics & Telecommunication, Medicines, Energy sciences. Composite Materials: Basics of composites, Types of Composites: Particle, Fibre, Reinforced, Structural, Real-life applications Smart materials: Shape Memory Alloys, piezo-electric, chromo-active, photo active materials, etc. required in computer field Packaging materials, Package substrates, Board fabrication Solder material- lead-free fabrication, Cooling- best liquid coolant, Magnets in the laptop speakers-neodymium magnets, rare earth alloys	10
2	Electrochemistry, Corrosion and Corrosion Control	Electrochemistry- types of electrochemical cells, Electrochemical series and Galvanic series, Numerical problems on Nernst equation Definition of corrosion, Direct chemical corrosion- Oxidation corrosion, Electrochemical corrosion and its mechanisms, Types of electrochemical corrosion- differential aeration, galvanic, stress, Intergranular, Microbial (soil) corrosion. Factors affecting corrosion (general factors), Protection of corrosion- anodic & cathodic protection, Coatings- Organic & Metallic, Applications with few practical problems of corrosion. Numerical problems based on Faraday's law Case studies like- Corrosion in electronic gadgets	8

Module No.	Module Name	Content	No of Hours
3	Chemistry of Semiconductors	Silicon & Germanium - Physical and atomic properties, Isotopes, Chemistry and compounds, applications in industry. Study of compounds- GaAs, GaP, InP. Problems in Semiconductor industry- Shortage of semiconductors, the degradation due to corrosion, the alternative materials, reusability of the semiconductors Strengthening of semiconductors using chemical methods	5
4	Green Chemistry	Introduction to Green Chemistry, 12 Principles of Green Chemistry	3
5	Introduction to Computational chemistry	The students are expected to write and execute at least six of the following computer programs in BASIC/Fortran/C 1. Linear regression. 2. Quadratic equation.	4
Total			**30**

Textbooks:

1. Shashi Chawla, "A Textbook of Engineering Chemistry", Dhanpat Rai & Co. (PVT.) LTD., New Delhi (2004).
2. S. S. Dara, "Engineering Chemistry", Chand & Co, New Delhi (2006)
3. Jain and Jain, "Engineering Chemistry", Dhanpat Rai & Co (PVT.) LTD, New Delhi (2006).

Reference Books:

1. B.R. Puri and L.R. Sharma, "Principles of Physical Chemistry", 45th Edition, Vishal Publishing Co. 2012.
2. Peter Atkins, "Physical Chemistry", XI th ed, Oxford, United Kingdom, Oxford University Press, 2017
3. V. K. Ahluwalia, "Green Chemistry: A textbook", Alpha Science International
4. J. D. Lee, "Concise Inorganic Chemistry"
5. V.R.Gowariker, "Polymer Science", New Age International Publication
6. S.K.Kulkarni, "Introduction to Nanotechnology"
7. C. N. Banwell, Elaine M. McCash, "Fundamentals of Molecular Spectroscopy", (4th edition), Tata McGraw Hill.
8. Y.R. Sharma, "Elementary Organic Spectroscopy", S. Chand and Co.
9. William D. Callister, "Materials Science and Engineering: An Introduction", Wiley
10. Mel Schwartz, "Smart Materials", CRC Press New York, 2009
11. Dimitris C. Lagoudas, "Shape Memory Alloys", Springer, New York, 2008
12. Micky Rakotondrabe, "Smart Materials- Based Actuators at Micro/Nano-Scale", Springer Science + Business Media, New York, 2013
13. Computer and Chemistry: introduction to programming and numerical methods T. R. Dickson, Freeman (1968)
14. 14. Computer programs for chemistry D. F. Detar W. A. Benjamin Inc, New York Vol. 1-3 (1968-69)

Course Name: Biology

Course Code: BS17

Category: Basic Science (BS)

Preamble:

This course introduces students to virology and its related terms and concepts. It also introduces basic concepts of the nervous system, biological immune system, and computational neuroscience. This course will help the learners understand the mathematical models that are inspired from the corresponding biological models/processes and are extensively used in machine learning, deep learning, artificial immune system, computer security, artificial intelligence, etc.

Pre-requisites:

Nil

Course Objectives:

- Enable the learner to understand the concepts of virology.
- Enable the learner to understand the structure and functioning of the nervous system.
- Enable the learner to understand basics of natural immune systems.
- Enable the learner to understand basics of computational neuroscience.
- Enable the learner to understand the derivation of mathematical models from their biological counterparts.

Course Outcomes:

Learner will be able:

CO1: To develop an understanding of virology.

CO2: To understand the structure and functioning of biological nervous system.

CO3: To understand Principles of natural immune system.

CO4: To understand working principles of biological neural system.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Virology	Virus structure and morphology. Viruses of veterinary importance. Important virus families, their replication strategies, pathogenicity and transmission of viruses. Plant viruses, plant virus propagation. Bacteriophages, bacteriophage propagation viroids	5
2	Nervous System	Neuron structure, anatomy in vertebrates: central & peripheral Nervous systems, Functions of the Nervous system: Neurons & Synapses, Neural circuits and systems, Reflexes & other stimulus response circuits, Intrinsic pattern generation	5
3	Immunology	Introduction and history; Components of Immune system: Innate & Adaptive. Primary and secondary organs of the immune system, Cells of the immune system	5
4	Computational Neuroscience-I Single Neuron Modeling	Ion flux in membranes, Nernst Planck Equation, Ion-Channels, Excitable membranes, Spiking, Hodgkin Huxley models, Integrate and Fire Neurons	5
5	Computational Neuroscience-II Neural Encoding and Decoding	Spike train statistics, Receptive fields, Linear and Nonlinear models of Receptive fields, Applications of Information Theory in neural coding and decoding	5
6	Computational Neuroscience-III Plasticity: Adaptation and Learning	Synapses: structure and function, plasticity, Spike Timing Dependent Plasticity (STDP), Learning rules, Supervised and Unsupervised Learning, Classical conditioning, Reinforcement Learning.	5
Total			**30**

Textbooks:

1. Fields Virology Vol 1 and 2. B.N. Fields, D.M. Knipe, P.M. Howley, R.M. Chanock, J.L. Melnick, T.P. Monath, B. Roizman, and S.E. Straus, eds.), 3rd Edition. Lippincott-Raven, Philadelphia, PA.

2. Principles of anatomy & physiology, Tortora & G.J.Derricson, J. Willey publication (15th edition)
3. Dayan, Peter, and L. F. Abbott.Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems. Cambridge, MA: MIT Press, 2001. ISBN: 9780262041997.

Reference Books:

1. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses. S. J. Flint, V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka. Latest edition / Pub. Date: December 2003 Publisher: American Society Microbiology--- Chapters 3-13.
2. Nervous system, Columbia Encyclopedia. Columbia University Press

Course Name: Data Structure

Course Code: CE01T

Category: Core

Preamble:

Data Structures deals with the organization, management, and manipulation of data. This course covers basic data structures and their algorithms, design and analysis principles, and real-world applications. By the end, students will be able to apply their knowledge to solve complex problems.

Pre-requisites:

1. ES04T (Structured Programming)
2. ES05T (Object Oriented Programming)

Course Objectives:

- To understand the need and significance of Data structures as a computer Professional.
- To teach concept and implementation of linear and Nonlinear data structures.
- To analyze various data structures and select the appropriate one to solve a specific real-world problem.
- To introduce various techniques for representation of the data in the real world.
- To teach various hashing techniques.

Course Outcomes:

Learner will be able to:
CO1: Define different types of data structures and operations.
CO2: Implement linear data structure like stack or queue with operations.
CO3: Analyze the different types of linked lists like singly, doubly, and circular with operations.
CO4: Create and manipulate different types of trees with their properties and operations.
CO5: Create and represent graphs, including vertices, edges, adjacency matrix/ list, and traversal algorithms.
CO6: Apply different hashing techniques to efficiently retrieve and manipulate data.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Data Structures	Introduction to Data Structures, Concept of ADT, Types of Data Structures-Linear and Nonlinear, Operations on Data Structures.	2
2	Stack and Queue	Introduction, ADT of Stack, Operations on Stack, Array Implementation of Stack, Applications of Stack-Correctness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation, Recursion. Introduction, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Double Ended Queue	7
3	Linked List	Introduction, Representation of Linked List, Linked List v/s Array, Types of Linked List - Singly Linked List, Circular Linked List, Doubly Linked List, Operations on Singly Linked List and Doubly Linked List, Stack and Queue using Singly Linked List	7
4	Trees	Introduction, Tree Terminologies, Binary Tree, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree, Applications of Binary Tree-Expression Tree, Huffman Encoding, Search Trees-AVL, rotations in AVL Tree, Introduction of B Tree, B+ Tree.	7
5	Graphs	Introduction, Graph Terminologies, Representation of Graph, Graph Traversals-Depth First Search (DFS) and Breadth First Search (BFS), MST using Kruskals and Prims Algorithm	5
6	Hashing	Hashing, Hash Functions, Collision resolution Techniques	2
Total			**30**

Text Books:

1. Reema Thereja," Data Structures using C", 2nd edition, Oxford Press, 2014
2. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", First Edition, Pearson Publication, 2019

Reference Books:

1. Richard F. Gilberg and Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, 2ndEdition, CENGAGE Learning, 2004.
2. P.S. Deshpande, O.G. Kakde, “C and Data Structures”, First Edition, Dreamtech Press, 2003
3. E. Balagurusamy, “Data Structure Using C”, First Edition, Tata McGraw-Hill Education India, 2013

Course Name: Data Structure Lab

Course Code: CE01P

Category: Core

Preamble:

The subject explores the fundamental concepts and practical applications of organizing and manipulating data efficiently. Through hands-on experiments and problem-solving, it aims to develop students' skills in implementing and analyzing various data structures.

Pre-requisites:

1. ES04P (Structured Programming Lab) / ES05P (Object Oriented Programming Lab)

Course Objectives:

- To implement basic data structures such as arrays, linked lists, stacks and queues
- Solve problem involving graphs, and trees.
- To develop application using data structure algorithms

Course Outcomes:

Learner will be able to:
CO1: Implement Stack and be able to handle operations like insertion, deletion and traversing on them.
CO2: Implement different types of queues and be able to handle operations like insertion, deletion and traversing on them
CO3: Implement different types of linked list like Singly linked list, Circular linked list and Doubly linked list
CO4: Create and manipulate binary search tree with their properties and operations.
CO5: Implement graph traversal techniques such as DFS and BFS

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	**ISA**	**MSE**	**ESE**	**Total**
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Learners are expected to perform minimum 12 practical based on the following suggested topics.

Sr. No.	Suggested Topic(s)	Number of Practicals
1	Implementation of stack using array	1
2	Stack Applications (Correctness of parenthesis, Infix to postfix conversion and Evaluation of postfix expression)	3
3	Implementation of different types of queues using array (Linear queue, Circular queue, Priority queue, Double Ended queue)	4
4	Implementation of different types of linked list (Singly linked list, Doubly linked list and Circular linked list)	3
5	Implementation of stack and queue using linked list	2
6	Implementation of binary search tree	1
7	Implementation of graph traversal techniques (DFS and BFS)	2

Textbooks:

1. Reema Thereja," Data Structures using C", 2nd edition, Oxford Press, 2014
2. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", First Edition, Pearson Publication, 2019

Reference Books:

1. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", 2ndEdition, CENGAGE Learning, 2004.
2. P.S. Deshpande, O.G. Kakde, "C and Data Structures", First Edition, Dreamtech Press, 2003
3. E. Balagurusamy, "Data Structure Using C", First Edition, Tata McGraw-Hill Education India, 2013

Course Name: Microprocessor

Course Code: CE02T

Category: Core

Preamble:

This course is an introductory course to understand the working of the microprocessor. To introduce students to assembly language programming and to explain how the peripherals are connected to the processor. This will serve as a foundation for advanced studies in Hardware design and Embedded System Design.

Course Pre-requisite:

1. ES06T (Fundamentals of Computer Hardware and Networking)
2. ES07T (Fundamentals of Logic Circuits)

Course Objectives:

- To develop background knowledge and core expertise in Microprocessor
- To study the concepts and basic architecture of 8086 microprocessor
- To know the importance of different peripheral devices and their interfacing with 8086
- To appreciate the architecture of advanced microprocessors

Course Outcomes:

After successful completion of the course students will be able to:

CO1: Understand the basics of RISC & CISC architecture and 8086 microprocessor.

CO2: Apply concept of assembly language programming to develop simple application programs.

CO3: Analyze and understand the necessity of the peripheral chips.

CO4: Design simple microprocessor-based system with memory & I/O devices.

CO5: Appreciate and understand the advantages of advanced microprocessors.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

Detailed Syllabus:

Module No.	Module Name	Contents	Hours
1	Introduction to Microprocessor	Fundamental Units of a Computer	04
		Introduction to Buses	
		Compare RISC & CISC architecture	
		Basic concept of – Clock cycle, Machine cycle, Instruction cycle	
2	8086 Architecture and PIN configuration	8086 - Bus Interface Unit, Control unit, Programmers Model	06
		Concept of Segmentation, Physical Address, Logical Address	
		8086 – Pin description, Power on and manual Reset ckt., Minimum and Maximum Modes,	
3	8086 Addressing Modes & Instruction set	8086- Addressing Modes	06
		8086 - Instruction set	
		Assembler directives and assembly language programming with 8086	
4	Peripheral Chips	Concept of parrel peripheral interface and study of 8255 (PPI)	06
		Interrupt structure of 8086 and study of 8259 (PIC)	
		Concept of DMA and study of 8237 (DMAC)	
5	8086 Based System Design	Address decoders for memory interfacing	04
		Interfacing of RAM, EPROM, and I/O chips with 8086	
6	Advanced Microprocessors	Introduction to the architecture of Pentium Processor and concept of Superscalar Architecture	04
		Comparative study of salient features of 8086, 80186, 80286, 80386, 80486 and Pentium processor.	
		Total	**30**

Text Books:

1. Douglas Hall, 'Microprocessors and Interfacing', TMH 2005
2. John Uffenbeck, '8086 Family: Design, programming and interfacing', PH, 2001
3. Barry Brey, 'The intel microprocessor 8086/8088,80186/8088,80286,80386,80486, Pentium and Pentium Pro Processor architecture, programming and interfacing', PHI1997

Course Name: Microprocessor Lab

Course Code: CE02P

Category: Core

Preamble:

A professional in any field of computing should not regard the computer as just a black box that executes programs by magic. All students of computing should acquire some understanding and appreciation of a computer system's functional components, their characteristics, their performance, and their interactions. Students need to understand the addressing modes, instruction set of a microprocessor and should be able to develop simple application programs.

Course Pre-requisite:

1. ES06P (Fundamentals of Computer Hardware and Networking Lab)
2. ES07P (Fundamentals of Logic Circuits Lab)

Course Objectives:

- To introduce learners with instruction set of a microprocessor.
- To introduce learners with enough assembly language to enhance their knowledge on today's most widely used microcomputer family.
- To Improving learners systems programming skills through programming exercises carried out by students.
- Learners are expected to implement solutions to problems using the concepts they will take through the course.

Course Outcomes:

After successful completion of the course students will be able to:
CO1: Understand instruction set/format of a microprocessor.
CO2: Understand concept of assembly language programming.
CO3: Develop assembly language program for simple applications.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	**ISA**	**MSE**	**ESE**	**Total**
Practical	25	-	25	050

Suggested list of Practicals:

Sr. No.	Practicals
1	Introduction to assembler directives
2	Introduction to assembler like TASM, MASM etc.
3	ALP using ADD, SUB, MUL, DIV instructions
4	ALP using AND, OR, XOR instructions
5	ALP for BCD to ASCII & ASCII to BCD conversion
6	ALP for HEX to ASCII & ASCII to HEX conversion
7	ALP to find out smallest & largest of the array
8	ALP to sort the array in ascending & descending order
9	ALP using BIOS routine for keyboard interface
10	ALP using BIOS routine for display interface

Reference Books:

1. Douglas Hall, 'Microprocessors and Interfacing', TMH 2005

2. John Uffenbeck, '8086 Family: Design, programming and interfacing', PH, 2001

3. Barry Brey, 'The intel microprocessor 8086/8088,80186/8088,80286,80386,80486, Pentium and Pentium Pro Processor architecture , programming and interfacing', PHI1997

Course Name: Digital Logic and Computer Organization

Course Code: CE03T

Category: Core

Preamble:

The study of digital logic and computer organization is crucial to understanding how computers work at the most fundamental level. This subject involves the design and analysis of digital circuits and computer architecture, including topics such as Boolean algebra, logic gates, flip-flops, registers, counters, arithmetic circuits, memory systems, and instruction set architecture. In this subject, we will explore the principles of digital logic and computer organization and their applications in the design and development of computer systems. We will cover the basic building blocks of digital circuits and how they can be combined to create complex systems. We will also examine the various components of computer architecture and how they interact to execute instructions and perform computations.

Pre-requisites:

1. ES07T (Fundamentals of Logic Circuits)

Course Objectives:

- To have the rough understanding of the basic structure and operation of basic digital circuits and digital computer.
- To discuss in detail arithmetic operations in digital system.
- To discuss generation of control signals and different ways of communication with I/O devices.
- To study the hierarchical memory and principles of advanced computing.

Course Outcomes:

Learner will be able to:
CO1: To learn different number systems and basic structure of computer system.
CO2: To demonstrate the arithmetic algorithms.
CO3: To understand the basic concepts of digital components and processor organization.
CO4: To understand the generation of control signals of computer.
CO5: To demonstrate the memory organization.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	**ISA**	**MSE**	**ESE**	**Total**
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Logic Circuit and computer fundamentals	• Introduction to Number System and Codes • Number Systems: Binary, Octal, Decimal, Hexadecimal, • Codes: Grey, BCD, Excess-3, ASCII, Boolean Algebra. • Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR • Introduction to Flip Flop: SR, JK, D, T (Truth table). • Overview of computer organization and architecture. • Basic Organization of Computer and Block Level functional Units, Von- Neumann Model.	6
2	Data Representation and Arithmetic algorithms	• Binary Arithmetic: Addition, Subtraction, Multiplication, Division using Sign Magnitude, 1's and 2's compliment, BCD and Hex Arithmetic Operation. • Booths Multiplication Algorithm, Restoring and Non-restoring Division Algorithm. • IEEE-754 Floating point Representation.	4
3	Processor Organization and Architecture - Control Unit Design	• Register Organization, • Instruction Formats, • Addressing modes, • Instruction Cycle, Interpretation and sequencing	4
4	Control Unit Design	• Hardwired Control Unit: State Table Method, Delay Element Methods. • Microprogrammed Control Unit: Micro Instruction-Format, Sequencing and execution, Micro operations, Examples of microprograms	6
5	Memory Organization	• Introduction and characteristics of memory, Types of RAM and ROM, Memory Hierarchy, 2-level Memory Characteristic, • Cache Memory: Concept, locality of reference, Design problems based on mapping techniques, Cache coherence and write policies	6
6	Principles of Advanced Processor and Buses	• Basic Pipelined Data path and control, data dependencies, data hazards, branch hazards, delayed branch, and branch prediction, • Flynn's Classification, • Introduction to multicore architecture.	4
Total			**30**

Text Books:

1. R. P. Jain, "Modern Digital Electronic", McGraw-Hill Publication, 4thEdition.
2. William Stalling, "Computer Organization and Architecture: Designing and Performance", Pearson Publication 10TH Edition.
3. John P Hayes, "Computer Architecture and Organization", McGraw-Hill Publication, 3RD Edition.
4. Dr. M. Usha and T. S. Shrikanth, "Computer system Architecture and Organization", Wiley publication.

Reference Books:

1. Andrew S. Tanenbaum, "Structured Computer Organization", Pearson Publication.
2. B. Govindarajalu, "Computer Architecture and Organization", McGraw-Hill Publication.
3. Malvino, "Digital computer Electronics", McGraw-Hill Publication, 3rdEdition.
4. Smruti Ranjan Sarangi, "Computer Organization and Architecture", McGraw-Hill Publication.

Course Name: Digital Logic and Computer Organization Lab

Course Code: CE03P

Category: Core

Preamble:

The study of digital logic and computer organization is crucial to understanding how computers work at the most fundamental level. This subject involves the design and analysis of digital circuits and computer architecture, including topics such as Boolean algebra, logic gates, flip-flops, registers, counters, arithmetic circuits, memory systems, and instruction set architecture. In this subject, we will explore the principles of digital logic and computer organization and their applications in the design and development of computer systems. We will cover the basic building blocks of digital circuits and how they can be combined to create complex systems. We will also examine the various components of computer architecture and how they interact to execute instructions and perform computations.

Pre-requisites:

1. ES07P (Fundamentals of Logic Circuits Lab)

Course Objectives:

- To implement operations of the arithmetic unit using algorithms.
- Design and simulate different digital circuits.
- To design memory subsystem including cache memory.
- To demonstrate CPU and ALU design.

Course Outcomes:

Learner will be able to:
CO1: To understand the basics of digital components.
CO2: Design the basic building blocks of a computer: ALU, registers, CPU and memory.
CO3: To recognize the importance of digital systems in computer architecture.
CO4: To implement various algorithms for arithmetic operations.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a

panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Learners are expected to perform minimum 12 practical based on the following suggested topics.

Sr. No.	Suggested Topic(s)	Number of Practicals
1	Logic gates using	2
2	Combinational circuits	2
3	Flip-flops	1
4	Types of Adders	2
5	Multiplication and division algorithms	3
6	ALU/CPU design	1
7	Memory design	2

References :

1.Manual to use Virtual Lab simulator for Computer Organization and Architecture developed by the Department of CSE, IIT Kharagpur.
2.Link http://cse10-iitkgp.virtual-labs.ac.in/

Detailed syllabus of Second Year Semester-IV

Course Name: Principles of Economics and Management

Course Code: HS06

Category: Humanities, Social Sciences and Management

Preamble:

The course, Principles of economics and management, introduces students to the basics of microeconomics and macroeconomics. Engineers will encounter a plethora of concepts related to firm and market structure, economic growth. It will enable students to apply the knowledge related to policy planning and managerial decision making.

Pre-requisites:
NIL

Course Objectives:

- To have a basic understanding of micro-economic and macroeconomic concepts.
- To enable the students to understand both the theory and practice of managerial economics.
- To introduce theories and concepts in micro-economics for managerial decision making,
- To help the students in applying the knowledge so acquired in policy planning and managerial decision making.

Course Outcomes:

Learner will be able to:
CO1: Critically assess and describe the environment and the main determinants of demand and competition facing the firm.
CO2: Distinguish between the different market structures and pricing practices available to and used by firms.
CO3: Use the tools of economic theory to explain optimal production and pricing decisions by the firm in each market structure.
CO4: Understand Business Cycles, GDP measures, Inflation and Deflation, and Unemployment measure
CO5: Understand Monetary System – Basics of Monetary and Fiscal Policy, Economic Growth and Development
CO6: Understand International Trade and Capital Flows Currency Exchange Rates, describe various exchange rate regimes.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Tutorial	Theory	Tutorial
02	01	02	01

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory & Tutorial	40	20	40	100

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module name	Content	No. of Hours
1	Topics in Demand and Supply Analysis	Calculate and interpret price, income, and cross-price Elasticities of demand, compare substitution and income effects, distinguish between normal goods and inferior goods, phenomenon of diminishing marginal returns, economies of scale and diseconomies of scale	4
2	The Firm and Market Structures	Characteristics of perfect competition, monopolistic competition, oligopoly, and pure monopoly, relationships between price, marginal revenue, marginal cost, economic profit, and the elasticity of demand under each market structure, optimal price and output for firms, factors affecting long-run equilibrium, pricing strategy, type of market structure within which a firm operates	5
3	Aggregate Output, Prices, and Economic Growth	Gross domestic product (GDP) using expenditure and income approaches, compare nominal and real GDP and calculate GDP deflator, compare GDP, national income, personal income, and personal disposable income, fundamental relationship among saving, investment, the fiscal balance, and the trade balance. IS and LM curves and how they combine to generate the aggregate demand curve, causes of movements along and shifts in aggregate demand and supply curves, distinguish between the following types of macroeconomic equilibria	

4	Understanding Business Cycles	Business cycle and its phases, theories of the business cycle, unemployment and compare measures of unemployment, explain inflation, hyperinflation, disinflation, and deflation, inflation measures, including their uses and limitations, distinguish between cost-push and demand-pull inflation	4
5	Monetary and Fiscal Policy	Compare monetary and fiscal policy, functions and definitions of money, theories of the demand for and supply of money, the Fisher effect, roles and objectives of central banks, qualities of effective central banks, monetary transmission mechanism, relationships between monetary policy and economic growth, inflation, interest, and exchange rates, roles and objectives of fiscal policy, tools of fiscal policy, including their advantages and disadvantages	4
6	International Trade and Capital Flows	Compare gross domestic product and gross national product, distinguish between comparative advantage and absolute advantage, compare types of trade and capital restrictions and their economic implications, describe the balance of payments accounts including their components; explain how decisions by consumers, firms, and governments affect the balance of payments; describe functions of World Bank, the International Monetary Fund, and the World Trade Organization	4
7	Currency Exchange Rates	Exchange rate and distinguish between nominal and real exchange rates and spot and forward exchange rates, calculate and interpret the percentage change in a currency relative to another currency, explain the arbitrage relationship between spot rates, forward rates, and interest rates, calculate and interpret a forward discount or premium, describe exchange rate regimes	4
Total			**30**

Suggested List of Tutorials:

1. Understand how prices get determined in markets, how market participants benefit in the form of consumer surplus and producer surplus, and the consequences of government intervention.
2. Derive the equilibrium conditions for cost minimization and profit maximization for 2 companies.
3. List the different goals and constraints that firms face.
4. Calculate Indian gross domestic product (GDP) using expenditure and income approaches
5. Compare GDP, national income, personal income, and personal disposable income for India
6. Explain the relationships between monetary policy, currency conversion, and exchange rates

Textbook:

1. Mankiw, N Gregory. (2011). Economics: Principles and Applications. Cengage Lrng.
2. Lipsey, Richard; Christal, Alec. (2007). Economics (2nd Edition) Oxford Univ Press.
3. Prof. Sahuraja, R.R. (December 2015). Managerial Economics (2ndEdition)

Reference Books:

1. Hirschey, Mark. Economics for Managers
2. Salvatore, Dominik; Rastogi, Siddharth. Managerial
3. Mankiw, N G. Ten Principles of Economics (PPT)
4. Banerjee and Warrier. (2018). "Macroeconomics – Theories and Applications". Sage Publications

Course Name: Engineering Mathematics-IV

Course Code: BS07

Category: Basic Science

Preamble:

This course introduces Linear Algebra, Fourier Series, Fourier Transform, Linear & Non-linear Programming Problems. It also gives an introduction to Operation Research and basic Statistical Techniques which will be useful to the learner in Data Science domain.

Pre-requisites:

Nil

Course Objective:

- To provide students with sound foundation in applied mathematics to solve real life problems in industry.
- To provide hands on experience in using Open Source Software like SAGE/ R/PYTHON to handle real life problems.

Course Outcomes:

Learner will be able to:
CO1: Compute the rank of quadratic form and interpret its significance.
CO2: Compute Fourier series of periodic functions.
CO3: Compute the Fourier transform and inverse Fourier transform of elementary functions
CO4: Apply LPP and NLPP technique to optimize the functions.
CO5: Apply various techniques of Operation research to solve transportation and assignment problems.
Co6: Interpret the correlation and regression between two variables.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	20	30	50	100

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module	Detailed Contents	Hrs.
01	**Module-1: Linear Algebra: Quadratic Forms** Quadratic forms over real field, Rank Index and Signature of Quadratic forms. Class of Quadratic forms, reduction of quadratic forms to a Canonical form using congruent and orthogonal transformation.	6
02	**Module-2: Fourier Series:** Dirichlet's conditions, Definition of Fourier series and Parseval's Identity (without proof). Fourier series of periodic function with period.Fourier series of even and odd functions. Half range Sine and Cosine Series.	8
03	**Module-3: Fourier Transform** Fourier Integral Theorem (statement only). Fourier transform of a function, Fourier Sine and Cosine Integral Theorem (statement only). Fourier Cosine and Sine transform of elementary functions. Properties of Fourier Transform. Convolution Theorem and Inverse Fourier Transform.	8
04	**Module-4: Linear and Non-Linear Programming Problems** Simplex method. Artificial variables, Big-M method (Method of penalty) Duality, Dual of LPP, NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers, NLPP with two equality constraints, NLPP with inequality constraint: Kuhn-Tucker conditions	10
05	**Module-5: Operation research** Transportation problem, Assignment Problems, Game Theory zero sum problems only	5
06	**Module-6: Statistical Techniques** Karl Pearson's coefficient of correlation (r), Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks), Lines of regression	8
Total		**45**

Reference Books:

1. A text book of Applied Mathematics, P.N.Wartikar and J.N.Wartikar, Vol – I and –II by Pune VidyarthiGraha.
2. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
3. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited, 9thEd.
4. Matrices, Shanti Narayan.S. Chand publication
5. Operation Research ,T. Madhavan, Willey

Course Name: Analysis of Algorithms

Course Code: CE04T

Category: Core

Preamble:
The course covers the fundamental principles and techniques used in designing and analyzing algorithms. Students will learn how to analyze the performance of algorithms, measure their efficiency, and compare different algorithms based on their time and space complexity. The course is designed for students with a solid understanding of programming and data structures. By the end of the course, students will have a deep understanding of the principles of algorithm design and analysis and will be equipped with the tools and techniques necessary to develop efficient algorithms for a wide range of computational problems.

Pre-requisites:

1. BS05 (Engineering Mathematics-III)
2. CE01T (Data Structures)

Course Objectives:

- To provide a deep understanding of algorithmic design and analysis techniques that enable the development of efficient and effective algorithms for solving computational problems.
- To develop a strong foundation in the theory of algorithms, including concepts such as time and space complexity, algorithmic paradigms, data structures, graph algorithms, sorting and searching, and dynamic programming.
- To equip students with the tools and techniques necessary to compare and evaluate the performance of different algorithms and choose the best algorithm for a given problem.
- To provide students with the knowledge and skills required for a successful career in software development, data analysis, and other fields that require strong analytical and problem-solving abilities.

Course Outcomes:

Learner will be able to:
CO1: Analyze the time and space complexity of algorithms.
CO2: Apply and Analyze Divide and Conquer strategy to solve given problems.
CO3: Apply and Analyze Greedy strategy to solve given problems.
CO3: Apply and Analyze Dynamic Programming strategy to solve given problems.
CO4: Apply and Analyze Backtracking, Branch and Bound strategy to find solution for the given problems.
CO5: Classify a problem as computationally tractable or intractable and discuss strategies to address intractability.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Algorithm Analysis	Performance analysis: Space, and Time complexity, Growth of function. Asymptotic Notations: Big-Oh, Omega Theta notation. Analysis of selection sort, insertion sort and Naïve String-Matching Algorithm. Recurrences: The substitution method, Recursion tree method, Master method.	8
2	Divide and Conquer Approach	General method, Analysis of Merge sort and Quick sort, Finding minimum and maximum algorithms and their Analysis, Analysis of Binary search.	4
3	Greedy Method Approach	General Method, Analysis of Minimum cost spanning trees: Kruskal and Prim's algorithm, Single source shortest path: Analysis of Dijkstra's Algorithm, Fractional Knapsack Problem and Job Sequencing with Deadlines	6
4	Dynamic Programming Approach	General Method, Finding nth term in Fibonacci series, Single Source Shortest Path: Bellman Ford Algorithm All Pair Shortest Path: Floyd Warshall's Algorithm, Longest Common Subsequence,0/1 Knapsack Problem, Matrix Chain Multiplication and Sum of Subset Problem.	7
5	Backtracking and Branch and Bound	General Method, Backtracking: N-queen problem, Graph Coloring. Branch and Bound: 15 Puzzle problem, Travelling Salesperson Problem	3
6	Introduction to Complexity Theory	The class P and NP. Polynomial reduction. NP-Complete Problems. NP-Hard Problems	2
Total			**30**

Text Books:

1. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", 2nd Edition, PHI Publication 2005.
2. Jon Kleinberg, Eva Tardos "Algorithm Design", Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw-Hill Edition.
2. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI.

Course Name: Analysis of Algorithms Lab

Course Code: CE04P

Category: Core

Preamble:
The course covers the fundamental principles and techniques used in designing and analyzing algorithms. Students will learn how to analyze the performance of algorithms, measure their efficiency, and compare different algorithms based on their time and space complexity. The course is designed for students with a solid understanding of programming and data structures. By the end of the course, students will have a deep understanding of the principles of algorithm design and analysis and will be equipped with the tools and techniques necessary to develop efficient algorithms for a wide range of computational problems.

Pre-requisites:

- BS05 (Engineering Mathematics-III)
- CE01P (Data Structures Lab)

Course Objectives:

- To introduce the methods of designing and analyzing algorithms.
- Design and implement efficient algorithms for a specified application.
- Strengthen the ability to identify and apply suitable algorithms for the given real-world problem.
- Analyze worst-case running time of algorithms and understand fundamental algorithmic problems.

Course Outcomes:

At the end of the course, the students will be able to
CO1: Implement the algorithms using different approaches.
CO2: Analyze the complexities of various algorithms.
CO3: Apply and Analyze Greedy strategy to solve given problems.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	**ISA**	**MSE**	**ESE**	**Total**
Theory	25	--	25	50

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical's:

Sr No.	Suggested Topic(s)
1.	Introduction: Selection sort, Insertion sort
2.	Divide and Conquer Approach: Finding Minimum and Maximum, Merge sort, Quick sort, Binary search
3.	Greedy Method Approach: Single source shortest path- Dijkstra Fractional Knapsack problem Job sequencing with deadlines Minimum cost spanning trees-Kruskal and Prim's algorithm
4.	Dynamic Programming Approach: Single source shortest path- Bellman Ford All pair shortest path- Floyd Warshall 0/1 knapsack Longest common subsequence
5.	Backtracking: N-queen problem Graph coloring

Text Books:

1. T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", 2nd Edition, PHI Publication 2005.
2. Jon Kleinberg, Eva Tardos "Algorithm Design", Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw-Hill Edition.
2. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI.

Course Name: Database Management System

Course Code: CE05T

Category: Core

Preamble:

The goal of the course is to introduce the students to relational database design. This course covers the design and implementation of databases using SQL commands.

Pre-requisites:

CE01T (Data Structure)

Course Objectives:

- Develop entity relationship data model and its mapping to relational model.
- Learn relational algebra and Formulate SQL queries.
- Apply normalization techniques to normalize the database.
- Understand concept of transaction, concurrency control and recovery techniques.

Course Outcomes:

Learner will be able to:
CO1: Recognize the need of database management system.
CO2: Design ER and EER diagram for real life applications.
CO3: Construct relational model and write relational algebra queries.
CO4: Formulate SQL queries.
CO5: Apply the concept of normalization to relational database design.
CO6: Describe the concept of transaction, concurrency and recovery.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction Database Concepts	Introduction, Characteristics of databases, File system v/s Database system, Data abstraction and data Independence, DBMS system architecture, Database Administrator	2
2	Entity–Relationship Data Model	The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation, Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation	4
3	Relational Model and relational Algebra	Introduction to the Relational Model, relational schema and concept of keys. Mapping the ER and EER Model to the Relational Model, Relational Algebra-operators, Relational Algebra Queries.	6
4	Structured Query Language (SQL)	Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity, check constraints, Data Manipulation commands, Data Control commands, Set and string operations, aggregate function-group by, having, Views in SQL, joins, Nested and complex queries, Triggers	6
5	Relational-Database Design	Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Armstrong Axioms of functional dependency, Closure set of attributes, Equivalence of Functional dependency, First Normal Form, 2NF, 3NF, BCNF	6
6	Transactions Management and Concurrency and Recovery	Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Recovery System: Log based recovery, Deadlock handling	6
Total			**30**

Text Books:

1. Korth, Slberchatz, Sudarshan, Database System Concepts, 6thEdition, McGraw Hill
2. Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, Pearson Education
3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH

Reference Books:

1. Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management Thomson Learning, 5thEdition.
2. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dream Tech Press.
3. G. K. Gupta, Database Management Systems, McGraw Hill, 2012

Course Name: Database Management System Lab

Course Code: CE05P

Category: Core

Preamble:

The goal of the course is to introduce the students to relational database design. This course covers the design and implementation of databases using SQL commands.

Pre-requisites:

CE01P (Data Structure Lab)

Course Objectives:

- To explore design and develop of relational model.
- To present SQL and procedural interfaces to SQL comprehensively
- To introduce the concepts of transactions and transaction processing

Course Outcomes:

Learner will be able to:

CO1: Design ER /EER diagram and convert it to relational model for the real world application.
CO2: Apply DDL, DML, DCL and TCL commands.
CO3: Write simple and complex queries.
CO4: Use PL / SQL Constructs.
CO5: Demonstrate the concept of concurrent transactions execution and frontend-backend connectivity.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of practicals

Sr. No.	Suggested Topic(s)
1	Identify the case study and detail statement of problem. Design an Entity-Relationship (ER) / Extended Entity-Relationship (EER) Model.
2	Mapping ER/EER to Relational schema model
3	Create a database using Data Definition Language (DDL) and apply integrity constraints for the specified System
4	Apply DML Commands for the specified system
5	Perform Simple queries, string manipulation operations and aggregate functions.
6	Implement various Join operations.
7	Perform Nested and Complex queries
8	Perform DCL and TCL commands
9	Implementation of Views and Triggers.
10	Demonstrate Database connectivity

Text Books:

1. Korth, Slberchatz, Sudarshan, Database System Concepts, 6thEdition, McGraw Hill
2. Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, Pearson Education
3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH

Reference Books:

1. Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management Thomson Learning, 5thEdition.
2. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dream Tech Press.
3. G. K. Gupta, Database Management Systems, McGraw Hill, 2012

Course Name: Computer Graphics

Course Code: CE06T

Category: Core

Preamble:
The goal of the course is to introduce students to the technical concepts behind creating synthetic computer-generated images, focusing on underlying mathematical concepts covering geometrical and attribute related features. This course attempts to uncover various 2D and 3D rendering techniques.

Pre-requisites:
Data Structure- CE01T
Structured Programming Approach- ES04T

Course Objectives:

- To enable learners to understand the basics of computer graphics, including the principles of image representation, display technology, and color models.
- To enable learner to understand 2D and 3D geometric transformations, including translation, scaling, rotation, orthographic and perspective projection.
- To enable learners to design and implement graphical user interfaces (GUIs) for software applications.

Course Outcomes:

Learner will be able to:
CO1: Understand the basic concepts of Computer Graphics.
CO2: Demonstrate various algorithms for scan conversion, for filling of basic geometrical objects and their comparative analysis.
CO3: Apply geometric transformations, viewing and clipping on graphical objects.
CO4: Explore 3-D geometric transformations, curve representation techniques and projections methods.
CO5: Understand visible surface detection techniques and illumination models.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by

a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction and Overview of Graphics System.	Definition and Representative uses of Computer Graphics, Classification of application areas, Overview of Coordinate Systems, Definition of Scan Conversion, Rasterization and Rendering. Raster Scan & Random Scan Displays, Architecture of Raster Graphics System with display processor, Architecture of Random Scan Systems.	2
2	Raster Algorithms.	Scan Conversions of Point, Line, and Circle: DDA Algorithm and Bresenham Algorithm for Line Drawing, Midpoint Algorithm for Circle. Aliasing, Antialiasing Techniques like Pre and Post Filtering, Super Sampling, and Pixel Phasing. Filled Area Primitives: Scanline Polygon Fill Algorithm, Inside Outside Tests, Boundary Fill and Flood fill Algorithm.	8
3	Two Dimensional Geometric Transformations, Viewing and Clipping.	• Basic transformations: Translation, Scaling, Rotation. Matrix Representation and Homogeneous Coordinates, Composite Transformation. • Viewing Transformation Pipeline and Window to Viewport Coordinate Transformation. Clipping Operations: Point Clipping, Line Clipping Algorithms: Cohen–Sutherland, Midpoint Subdivision, Liang–Barsky, Polygon Clipping Algorithms: Sutherland–Hodgeman and Weiler – Atherton Algorithm.	8
4	Three-Dimensional Object Representations, Geometric Transformations and 3D Viewing.	Boundary Representation and Space Partitioning Representation: Polygon Surfaces, Bezier Curve B-Spline Curve, Fractal-Geometry: Fractal Dimension, Koch Curve. 3D-Transformations: Translation, Rotation, Scaling and Reflection. Composite Transformations: Rotation about an Arbitrary Axis. 3D-Transformation Pipeline Projections– Parallel and Perspective Projection. (Matrix Representation).	6
5	Visible Surface Detection.	Classification of Visible Surface Detection Algorithm, Back Surface Detection Method: Depth Buffer Method, Scan Line Method, Area Subdivision Method.	4
6	Illumination Models and Surface Rendering	Basic Illumination Models: Diffused reflection, Phong Specular Reflection Model, Halftone and Dithering Techniques, Polygon Rendering:	2

		Constant shading, Gouraud Shading, Phong Shading.	
Total			**30**

Textbooks:

1. "Computer Graphics C version" by Hearn & Baker, 2nd Edition, Pearson Publication, ISBN-13: 978-8177587654.
2. "Computer Graphics Principles and Practice in C", by James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, 2nd Edition, Pearson Publication, ISBN-0201121107, ISBN-9780201121100.
3. "Computer Graphics", by Samit Bhattacharya, Oxford Publication. ISBN: 9780198096191.
4. "Computer Graphics", by Rajesh K. Maurya, Wiley India Publication, ISBN-13:978-81-265-3100, ISBN:81-265-3100-2

Reference Books:

1. "Procedural Elements for Computer Graphics " by D. Rogers , Tata McGraw-Hill Publications.
2. "Computer Graphics", by Zhigang Xiang , Roy Plastock , Schaum's Outlines McGraw-Hill Education.
3. "Computer Graphics using OpenGL , by F.S.Hill , Jr. ,Third edition, Pearson Publications.

Course Name: Computer Graphics Lab

Course Code: CE06P

Category: Core

Preamble:

The goal of the course is to introduce students to the technical concepts behind creating synthetic computer-generated images, focusing on underlying mathematical concepts covering geometrical and attribute related features. This course attempts to uncover various 2D and 3D rendering techniques.

Pre-requisites:

Data Structure Lab-CE01P
SPA Lab-ES04P

Course Objectives:

- To enable learner to develop practical experience with raster algorithms for line, circle drawing and creating/ manipulating images.
- To enable learners to apply 2D & 3D geometric transformations to create visual effects and animations.
- To enable learners to use viewing transformations to define a camera position and orientation. Also implement clipping algorithms to remove parts of an image that are outside the view.

Course Outcomes:

Learner will be able to:
CO1: Understand various algorithms to draw lines in computer graphics applications, display lines with varying thickness and styles.
CO2: Understand and implement various area fill algorithms to efficiently fill areas with colors or patterns in computer graphics applications.
CO3: Apply 2D & 3D geometric transformations and clipping operations on an object to create visual effects and animations.
CO4: Understand Open GL library functions to generate graphical objects and create animated sequences in graphics applications.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Sr No.	Suggested Topic(s)
1.	Implement DDA Line Drawing algorithms and Bresenham algorithm.
2.	Program to display thick line, dotted line, and dashed line.
3.	Line generation using parallelism approach.
4.	Implement midpoint Circle algorithm.
5.	Implement Area Filling Algorithm: Boundary Fill, Flood Fill, Scan line Polygon Fill
6.	Implement Curve: Bezier for n control points, B Spline (Uniform)
7.	Implement Fractal (Koch Curve).
8.	Character Generation: Bit Map method and Stroke Method
9.	Implement 2D Transformations: Translation, Scaling, Rotation, Reflection, Shear.
10.	Implement Line Clipping Algorithm: Cohen Sutherland / Liang Barsky.
11.	Implement polygon clipping algorithm.
12.	Program to represent a 3D object using polygon surfaces and then perform 3D transformation.
13.	Program to perform projection of a 3D object on Projection Plane: Parallel and Perspective.
14.	Study of Open GL library functions and using it to generate graphical objects.
15.	Program to perform surface rendering using Open GL functions.
16.	Program to generate an animated sequence.

Textbooks:

1. "Computer Graphics C version" by Hearn & Baker, 2nd Edition, Pearson Publication, ISBN-13: 978-8177587654.
2. "Computer Graphics Principles and Practice in C", by James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, 2nd Edition, Pearson Publication, ISBN-0201121107, ISBN-9780201121100.
3. "Computer Graphics", by Samit Bhattacharya, Oxford Publication. ISBN: 9780198096191.
4. "Computer Graphics", by Rajesh K. Maurya, Wiley India Publication, ISBN-13:978-81-265-3100, ISBN:81-265-3100-2

Reference Books:

1. "Procedural Elements for Computer Graphics " by D. Rogers , Tata McGraw-Hill Publications.
2. "Computer Graphics", by Zhigang Xiang , Roy Plastock , Schaum's Outlines McGraw-Hill Education.
3. "Computer Graphics using OpenGL , by F.S.Hill , Jr. ,Third edition, Pearson Publications.

Course Name: Operating System

Course Code: CE07T

Category: Core

Preamble:

The goal of the course is to introduce the students to modern operating systems design. This course covers the design and implementation of operating systems with a focus on modern, concurrent kernels.

Pre-requisites:

CE01T (Data Structure)

Course Objectives:

- To enable learner to understand how operating system manages allocation and deallocation of different resources needed by user/ application.
- To enable learner to understand how operating system controls access to various resources and provides security.
- To enable learner to evaluate performance of different approaches used by operating systems, for effective resource utilization.

Course Outcomes:

Learner will be able to:
CO1: Understand the benefits of software modularity and how it applies to OS design.
CO2: Compare various OS scheduling policies based on performance parameters.
CO3: Analyze methods to achieve synchronization and handle deadlocks.
CO4: Evaluate performance of Memory allocation and replacement policies.
CO5: Compare various files and I/O management techniques.
CO6: Understand how principles of general OS are applied in Linux OS.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by

a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to Operating System	Operating System definitions, Processes and Interrupts, Functions of Operating System, Operating System Structures, User mode and kernel mode of a process, Types of Operating System, System Calls, Booting	4
2	Process Management and Synchronization	Process Management: Definition of Process, Process Control Block, Process Scheduling: Types and scheduling algorithms (FCFS, SJF, SRTN, Priority, RR), Threads: Definition and Concept of Multithreading. Process Synchronization: Principles of Concurrency, Inter-process communication, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Producer and Consumer problem,	6
3	Deadlock	Principles of Deadlock: Conditions and Resource, Allocation Graphs, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm, Deadlock Detection and Recovery, Dining Philosophers Problem.	6
4	Memory Management	Memory Management Requirements, Memory Partitioning: Fixed, Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Paging and Segmentation, TLB, Page table design Virtual Memory: Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU, Thrashing, Kernel Memory Allocation	6
5	File Systems and I/O Management	Files and File Systems, Directory Systems, File allocation methods: Contiguous allocation, Linked allocation, Indexed allocation, Kernel I/O subsystem, Communication and Data Transfer with I/O Devices, Disk Organization, I/O Management and Disk Scheduling: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK, RAID Structure	5
6	The Linux System	Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Network Structure, Security	3
Total			**30**

Textbooks:

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8thEdition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley &Sons, Inc., 9thEdition, 2016, ISBN 978-81-265-5427-0
3. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rdEdition.

Reference Books:

1. Sumitabha Das, “UNIX: Concepts and Applications”, McGraw Hill, 4thEdition
2. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rdEdition

Course Name: Operating System Lab

Course Code: CE07P

Category: Core

Preamble:

The course introduces learners to Linux shell commands and simulate various algorithms used by general OS for managing resources. This courses project will explore the key operating system facilities in the relative isolation of an OS development framework with the goal of maximizing experiential learning.

Pre-requisites:

CE01P (Data Structure Lab)

Course Objectives:

- To enable learner to visualize the working of operating system by simulating techniques used by it to manage resources.
- To enable learner to apply techniques of process synchronization in multithreaded programs and hence develop concurrent applications.

Course Outcomes:

Learner will be able to:
CO1: Understand various shell commands of Linux OS.
CO2: Compare performance of different process scheduling policies.
CO3: Perform process/ thread synchronization for consistency and concurrency.
CO4: Simulate OS techniques for memory and virtual memory management.
CO5: Develop project to explore key OS facilities.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Suggested List of Practicals:

Sr No.	Suggested Topic(s)
1.	Linux commands
2.	Non-Preemptive process Scheduling
3.	Preemptive process Scheduling
4.	Process synchronization using mutex locks.
5.	Deadlock Handling
6.	Dynamic memory allocation techniques
7.	Adddress translation in virtual memory
8.	Page replacement policies
9.	Disk scheduling techniques

Textbooks:

2. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8thEdition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley &Sons, Inc., 9thEdition, 2016, ISBN 978-81-265-5427-0
4. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rdEdition.

Reference Books:

2. Sumitabha Das, "UNIX: Concepts and Applications", McGraw Hill, 4thEdition
2. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rdEdition

Course Name: Software Lab

Course Code: CE08

Category: Core

Preamble:

This course is designed to take students from beginner to advanced Python programming. It covers the fundamentals of Python programming, as well as advanced topics such as object-oriented programming, multithreading, web development and data analysis. Students will gain practical experience through hands-on programming assignments and projects.

Pre-requisites:

- Basic knowledge of Python programming
- Understanding of basic concepts in databases
- Familiarity with HTML, CSS, and JavaScript for web development

Course Objectives:

- To enable learner to understand variables, data types, control structure, functions, file handling in python.
- To enable learners to write programs using object-oriented programming concepts in Python.
- To enable learners to understand the use of different python libraries in data analysis.
- To enable learners to create web applications using python web framework.

Course Outcomes:

Learner will be able to:
CO1: Understand the variables, data types, control structure, functions and modules in Python.
CO2: Understand and implement the data structure of python such as List, Tuple, String, Dictionary Set.
CO3: Understand and apply object-oriented programming concepts in Python to write programs.
CO4: Perform CRUD operations on databases and understand File handling in Python.
CO5: Perform data analysis and visualization using Python libraries such as NumPy, Pandas, and Matplotlib.
CO6: Understand Multithreading and Explore python web framework for developing python-based web application.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	4	-	2

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	50	-	25	075

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to Python Programming	Overview of Python programming. Basic syntax, data types, and control structures in Python. Function and Modules in Python. Date and Time modules.	8
2	Data Structures in Python	Lists, Tuples, String, Dictionaries, Sets Implementing Stack & Queue using Python data structures. List comprehension in python.	12
3	Object-Oriented Programming (OOP) in Python	Class and object creation. inheritance, and polymorphism, absract class. Exception handling in python.	12
4	File Handling, GUI Programming and database connectivity.	Reading and writing files in Python. Desing GUI using Tkinter library. Connecting to databases using Python. Performing CRUD operations on databases using Python.	10
5	Data Analysis and Visualization using Python	Introduction to Python libraries for data analysis and visualization Using NumPy, Pandas, and Matplotlib for data analysis and visualization	8
6	Multi-Threading & Web Development in Python	Introduction to multi-threading in Python. Creating threads and managing threads. Introduction to Python Webframework.	10
Total			**60**

Textbooks:

1. Core Python Programming, Dr. R. Nageswara Rao, Dreamtech Press.
2. Beginning Python: Using Python 2.6 and Python 3.1, James Payne Wrox Publication.
3. Introduction to computing and problem solving using python , E Balagurusamy,McGraw Hill Education.

Reference Books:

1. Learn Python the Hard Way, Zed A. Shaw, Pearson Education.
2. Learn Python the Hard Way: (3rd Edition) (Zed Shaw's Hard Way Series).
3. Eric Matthes, “Python Crash Course, A Hands – on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
4. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

Suggested List of Practical’s:

Sr No.	Suggested Topic(s)
1.	Programs to explore basics of python likes input output statements, conditional & control statements.
2.	Programs to understand function, module in python.

3.	Programs to use python data structure- List, Tuple, String, Dictionary & Set.
4.	Programs to implement stack & Queue data structure.
5.	Programs to use list comprehension in python.
6.	Programs to create classes and object in python.
7.	Programs to implements inheritance, and polymorphism, absract class concepts in python.
8.	Programs to demonstrate exception handling.
9.	Programs to understand file handling in python.
10	Creating GUI with python containing widgets such as labels, textbox,radio,checkboxes and custom dialog boxes.
11	Program to demonstrate CRUD(create, read, update and delete) operations on database (SQLite/MySQL) using python.
12	Program to demonstrate use of NumPy: Array objects.
13	Program to demonstrate Data Series and Data Frames using Pandas.
14	Programs on Threading using python.
15	Program on simple socket for basic information exchange between server and client.
16	Program on Web application using python framework.

Appendix A

General Education (GE) Sub-Categories

GE Sub-Category	GE Sub-Category Code
Arts	A
Social and Behavioral Science	SB
Creativity and Innovation	CI
Political Science	PS
Physical Education and Wellness	PEW
Finance	F
Natural Science	NS
Wonders of Infrastructure	WI

Courses under General Education (GE) Category

Course Code	Course Name	Credits
GEA01	Voice Culture for Professional Speaking	2
GEA02	Various Dance Forms	2
GEA03	Exploring Indian Art	2
GESB01#	Social Service Internship/ Project	3
GESB02	Universal Human Values	2
GESB03	Indian Traditional Knowledge System	2
GESB04	Corporate and Social Etiquettes	2
GESB05	Global Citizenship Education	2
GESB06	Responsibility towards sustainable environment	2
GESB07	Psychology	2
GECI01	Design Thinking	2
GECI02	Innovation and Entrepreneurship	1
GEPS01	Indian Constitution	2
GEPS02	Four Pillars of Democratic Nation	2
GEPEW01	Wellness – Body, Mind & Spirit	2
GEPEW02	IQ vs EQ	2
GEPEW03	Nutrition and Physical Wellness	2
GEF01	Basics of Finance & Legal aspects for Business	2
GEF02	Financial Management for beginners	2
GENS01	Facets of Astronomy	2
GENS02	Modern Farming	2
GEWI01	Railways - Wonders of Infrastructure	2
GE01$	Internship with other Institutes (Credit Transfer)	4

 # For GESB01- Social Service Internship/ Project: 2 hours / week slot will be provided during the semester (in regular timetable). Additional work of 60 hours needs to be completed during the semester (besides regular timetable) or after the semester (during inter semester break).
$ For GE01- Internship with other Institutes (Credit Transfer): Internship with other reputed institutes equivalent to 4 credits is recommended to be done by learner during second year inter semester break (i.e. summer break between semester 4 and semester 5).

Note: 07 credits, of required 14 credits, under GE category are exempted for Direct Second Year (DSY) students who will secure admission through lateral entry from the AY 2023-24 onwards. Such students can opt for any courses from the above list to fulfil the required credits for the award of degree.

Appendix B

List of Advance Learning Courses for Semester 4

Course		Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
CE09	Theory of Computer Science	Theory + Tutorial	3	40	20	40	100
CE12T	Software Engineering	Theory	2	15	20	40	075
CE12P	Web Design Lab	Practical	1	25	-	25	050
CE45	Mini-Project	Practical	2	25	-	50	075

Detailed syllabus of Advance Learning courses

Course Name: Theory of Computer Science

Course Code: CE09

Category: Core

Preamble:

This course introduces students to formal language and automata theory. It covers different types of grammars and automata of different powers that are required to recognize languages defined by the grammars.

Pre-requisites:

BS05 (Engineering Mathematics 3)

Course Objectives:

- Acquire conceptual understanding of fundamentals of grammars and languages.
- Build concepts of theoretical design of deterministic and non-deterministic finite automata and push down automata.
- Develop understanding of different types of Turing machines and applications.

Course Outcomes:

Learner will be able to:
CO1: Express rules in mathematical form (grammar).
CO2: Classify the problem into appropriate type of grammar.
CO3: Apply equivalence theory to recognize power of different automata.
CO4: Design Automata to meet the required specifications.
CO5: Create a tool that designs automata for a given grammar.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
2	1	2	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory + Tutorial	40	20	40	100

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Language and Automata	Concepts: Symbol, Alphabet, Language and Grammar. Types of Grammar and Automata.	2
2	Finite Automata	Deterministic: 5-tuple representation of DFA. Designing DFA for Regular Language. Minimization of DFA. Non-Deterministic: 5-tuple representation of NFA with epsilon moves and NFA without epsilon moves. Equivalence of language recognized by NFA and DFA	6
3	Regular Language and grammar	Regular Expression and Regular Grammar. Equivalence of FA and Regular Expression. Properties of Regular Sets/ Languages. Classifying language as Regular and Non-regular.	6
4	Context Free and Sensitive Languages.	Concepts: CFG, CFL, Derivations and Ambiguity. CFL as a superset of Regular. Normal Forms (CNF and GNF). Properties of CFL.	6
5	Push-down Automata	7-tuple Deterministic PDA. Deterministic and Non-Deterministic PDA. Equivalence of NPDA and CFL.	4
6	Turing Machine	Basic 7-tuple Turing Machine (TM). Variants of TM. TM as acceptor of Recursively Enumerable (RE) Languages. Halting Problem. Recursive and RE Languages. Undecidability	6
Total			**30**

Suggestion for list of Tutorials:

1. At-least one tutorial on each module. Recommended to add additional tutorials for module 3, 5 and 7.
2. Questions should be short and conceptual only. Each tutorial should be designed worth 2 Marks. Required to be solvable in 5 to 10 mins.
3. Tutorial to have major questions mapping to level 1 of Blooms Taxonomy (Understanding) and few questions mapping to level 2 of Blooms Taxonomy (Applying)

Reference Books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman. Introduction to Automata Theory, Languages and Computation. Pearson Education. 2008.
2. Michael Sipser. Introduction to the Theory of Computation. Thomson Course Technology. 2012.
3. Peter Linz. An Introduction to Formal Languages and Automata. Jones and Bartlett Student Edition. 2016.

Course Name: Software Engineering

Course Code: CE12T

Category: Core

Preamble:

To apply role of SDLC in Software Project Development with the concepts and features of Web Technology. Explore the agile methodologies that drive modern development, emphasizing collaboration and adaptability. The art and science of crafting dynamic, user-friendly websites and applications journey from foundational concepts to advanced techniques, gaining proficiency in HTML, CSS, JavaScript, and more. Through hands-on projects, you'll hone your skills, cultivating a portfolio showcasing your evolving expertise.

Pre-requisites:
NIL

Course Objectives:
- To provide knowledge of Software Engineering Discipline
- To Apply knowledge of Software Engineering Discipline for Web based applications
- To understand Requirement gathering process and design engineering
- To apply analysis and develop software solutions
- To demonstrate and evaluate real time projects with respect to web based software projects
- To apply and analyze testing and quality assurance in web based software solutions

Course Outcomes:
Learner will be able to:
CO1: Define various software application domains and remember different process model used in software development.
CO2: Explain needs for software specifications also they can classify different types of software requirements and their gathering techniques.
CO3: Justify role of SDLC in Software Project Development and they can evaluate importance of Software Engineering in PLC.
CO4: Apply testing to assure quality in software solution and Identify risks, manage the change to assure quality in software projects.
CO5: Understand the core concepts and features of Web Technology
CO6: Design static web pages using HTML5 and CSS3

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Introduction to Web Programming and Concepts	Introduction to HTML, HTML Document Structure Text Elements, Images and Attributes, Hyperlinks, Semantic HTML, complex image maps, tables and nested tables, Inserting web page, Setting & modifying field properties, Validating HTML CSS: Internal and External CSS, CSS Grid Overview, Sizing Grid Columns and Rows, Building a Simple CSS Grid Layout Javascript & Document Object Model: Introduction to JavaScript, Variables and Objects, Decision Making Statement, Loops, Arrays, Functions & Prototypes, Core JavaScript Objects, DOM Introduction, Event Model, Function	8
2	The Software Process	Generic view of Process, Prescriptive Models: Waterfall Model, Incremental-RAD Model, Evolutionary Process Model-Prototyping, Spiral Agile Methodology, Scrum and Extreme Programming	4
3	Requirements Engineering and Analysis	Requirement, Types of Requirements, Requirement Gathering , Requirement Engineering Task, SRS (Software Requirement Specification)	4
4	Software Estimation and Scheduling	Management Spectrum, 4Ps (people, product and process) ,Process and Project metrics, Software Project Estimation: LOC, FP, Empirical Estimation Models - COCOMO Model, Project scheduling: WBS, Defining a Task Set for the Software Project, Timeline charts, Tracking the Schedule	5
5	Design Engineering	Software Design Concepts, Interaction Design , Design Golden Rules and Heuristics.	3
6	Software Testing and Risk Management	Testing: Software Quality, Testing: Strategic Approach, Strategic Issues- Testing: Strategies for Conventional Software. Risk Management: Risk Identification, Risk Assessment, Risk Projection, RMMM, Software Configuration management, SCM process- Version Control , Change	6

		Control	
Total			**30**

Textbooks:

1. Software Engineering: A Practitioner's Approach Roger Pressman McGraw-Hill Publications
2. Software Engineering Ian Sommerville, Pearson Education (9th edition)
3. Software Engineering FundamentalsAli Behfrooz and Fredeick J.Hudson Oxford University Press
4. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed., DT Editorial Services

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Reference Books:

1. Software Engineering – Concepts and Practices Ugrasen Suman Cengage Learning
2. An integrated approach to Software Engineering Pankaj Jalote, Springer/ Narosa
3. Web Development with Node and Express, Ethan Brown, O'Reilly

Course Name: Web Design Lab

Course Code: CE12P

Category: Core

Preamble:

Integrate the principles of Software Development Life Cycle (SDLC) into the realm of Software Project Development, specifically aligning them with the dynamic landscape of Web Technology. Investigate contemporary agile methodologies that propel modern development practices, with a focus on fostering collaboration and adaptability. Embark on the captivating journey of mastering the craft of designing dynamic and user-friendly websites and applications, progressing from fundamental concepts to advanced techniques. Develop proficiency in essential technologies such as HTML, CSS, JavaScript, and beyond through practical, hands-on projects.

Pre-requisites:
NIL

Course Objectives:

- To Apply knowledge of Software Engineering Discipline for Web based applications
- To understand Requirement gathering process and design engineering
- To apply analysis and develop software solutions
- To demonstrate and evaluate real time projects with respect to web based software projects
- To apply and analyze testing and quality assurance in web based software solutions

Course Outcomes:

Learner will be able to:
CO1: Characterize diverse domains of software applications and recall various process models employed in software development.
CO2: Elaborate on the necessity of software specifications, categorize different types of software requirements, and articulate techniques for gathering them.
CO3: Validate the significance of the Software Development Life Cycle (SDLC) in Software Project Development.
CO4: Implement testing methodologies to ensure quality in software solutions. Identify and manage risks and changes to guarantee quality in software projects.
CO5: Comprehend the fundamental concepts and features of Web Technology.
CO6: Formulate static web pages using HTML5 and CSS3.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

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Suggested List of Practicals:

Sr No.	Title of Practicals
1	Project Selection and Conceptualization
2	Design the static web pages required for Project : Registration , Login, Home page , Feature1, 2 (based on project)
3	Write JavaScript to validate the following fields of the Registration page. 1. First Name (Name should contains alphabets and the length should not be less than 6 characters). 2. Password (Password should not be less than 6 characters length). 3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) 4. Mobile Number (Phone number should contain 10 digits only). 5. Last Name and Address (should not be Empty).
4	Design a web page using CSS (Cascading Style Sheets) which includes the following: Use different font, styles: In the style definition you define how each selector should work (font, color etc.). Then, in the body of your pages, you refer to these selectors to activate the styles.
5	Prepare SRS for Project topic
6	Prepare DFD-Data flow diagram for Project topic
7	Prepare Use case diagram for Project topic
8	Prepare Sequence Activity diagram for Project topic
9	Prepare Component and Deployment diagram for Project topic
10	Prepare WBS and Gantt Chart for Project topic
11	Prepare Test Case plan for Project topic
12	Prepare RMMM Document for Project topic

Textbooks:

1. Software Engineering: A Practitioner's Approach Roger Pressman McGraw-Hill Publications
2. Software Engineering Ian Sommerville, Pearson Education (9th edition)
3. Software Engineering FundamentalsAli Behfrooz and Fredeick J.Hudson Oxford University Press
4. HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery) 2Ed., DT Editorial Services

Reference Books:

1. Software Engineering – Concepts and Practices Ugrasen Suman Cengage Learning
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3. Web Development with Node and Express, Ethan Brown, O'Reilly

(Draft Copy of Second Year Syllabus (R-2022), Subject to approval of Academic Council, Vidyalankar Institute of Technology.)