



**CHRIST COLLEGE OF ENGINEERING
IRINJALAKUDA (AUTONOMOUS)**

**DEPARTMENT OF COMPUTER SCIENCE AND
BUSINESS SYSTEMS**

B. Tech – 2025

**SEMESTER – S2
(GROUP - A)**

SEMESTER - S2 CURRICULUM

SECOND SEMESTER: Computer Science and Business Systems														
Sl. No:	Slot	Course Code	Course Type	Course Category	Course Title (Course Name)	Credit Structure				SS	Total Marks		Credits	Hrs./Week
						L	T	P	R		CIE	ESE		
THEORY														
1	A	G25MAT201	BSC	GC	Mathematics for Information Science-2	3	0	0	0	4.5	40	60	3	3
2	B	G25CYE203	BSC	GC	Chemistry for Information Science and Electrical Science	3	0	2	0	5.5	40	60	4	5
3	C	G25FCT205	ESC	GC	Foundations of Computing: From Hardware Essentials to Web Design	3	0	0	0	4.5	40	60	3	3
4	D	G25PCE206	ESC	GC	Programming in C	3	0	2	0	5.5	40	60	4	5
5	E	X25DMT207	PC	PC	Discrete Mathematics	3	1	0	0	5	40	60	4	4
6	F	A25IPT207	ESC	UC	Engineering Entrepreneurship And IPR	3	0	0	0	4.5	60	40	3	3
PRACTICALS														
7	I	A25LSE109	HM	CC	Life Skills and Professional Communication	2	0	1	0	3.5	100	0	1	3
8	L	G25ITP210	ESC	GC	IT Workshop	0	0	2	0	1	50	50*	1	2
MANDATORY COURSES														
9	I	A25ILE211	SE	CC	Introduction to Idea Lab and Digital Twin Technology	1	0	2	0	2.5	50	-	2	3
10	-		MC	MC	Activity Point Programme								-	-
Total										36.5			25	31

SEMESTER S2
MATHEMATICS FOR INFORMATION SCIENCE – 2
(Group A)

Course Code	G25MAT201	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	Elementary matrix operations	Course Type	Theory

Course Objectives:

1. To provide a comprehensive understanding of linear algebra focusing on fundamental concepts and applications, and to develop necessary skills to effectively utilize linear algebra in advanced studies and professional practice.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Linear systems of equations, Solution by Gauss elimination, Row echelon form and rank of a matrix, Fundamental theorem for linear systems - homogeneous and non-homogeneous (without proof), Eigen values and Eigen vectors of matrices, Diagonalization of matrices. [Text 1: Relevant topics from sections 7.3, 7.4, 7.5, 8.1, 8.4]	9
2	Vector Spaces, Examples of vector space – R^n and $M_{m \times n}$ only, Subspaces, Examples as subspaces of R^n and $M_{m \times n}$, Linear combinations of vectors in a vector space, Spanning sets, Linear dependence and independence, Basis for a vector space, The dimension of vector space, Coordinate representation in R^n , Change of basis in R^n : Transition Matrix (without proof). [Text 2: Relevant topics from sections 4.2, 4.3, 4.4, 4.5, 4.7]	9

3	Vector length and unit vector, Dot product and angle between two vectors, The Cauchy- Schwarz Inequality, Inner product, Examples as R^n and $M_{2 \times 2}$, Properties of inner products, Definitions of length, distance and angle, Orthogonal projections in inner product spaces, Orthogonal and orthonormal sets, Orthogonal and orthonormal basis, Gram-Schmidt orthonormalization process (without proof), The least squares problem, Projection onto a Subspace, Solving the least square problems. [Text 2: Relevant topics from sections 5.1, 5.2, 5.3, 5.4]	9
4	Linear Transformations, Properties of linear transformations, Linear Transformation given by a matrix, Rotation in R^2, Projection in R^3, Kernel of a Linear Transformation and its basis, Range of a Linear Transformation and its basis, Rank and Nullity of a Linear Transformation, Sum of Rank and Nullity (without proof), Matrices for Linear Transformations. [Text 2: Relevant topics from sections 6.1, 6.2, 6.3]	9

Course Assessment Method (CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Assignment (Activity based)	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
15*	30	30	30	
	A total of 90 marks will be scaled to 25.			40

*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply the concepts of linear systems, eigenvalues, and eigenvectors to solve real-world problems in various fields.	K3
CO2	Analyze vector spaces and subspaces to determine their properties, including linear independence, span, basis, and dimension.	K4
CO3	Apply the concepts of inner product spaces to solve ortho normalization and least-squares problems.	K3
CO4	Analyze linear transformations to determine their key properties, including their rank and nullity, and to derive their corresponding matrices.	K4
CO5	Able to develop, analyze and make use of theoretical concepts to solve complex problems and visualize the output	K4

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyze, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3									
CO2	2	3									
CO3	2	3									
CO4	2	3									
CO5	2	3			2			2	3		2

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10 th edition, 2016
2	Elementary Linear Algebra	Ron Larson	Cengage Learning	8 th edition, 2017

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Mathematics for Machine Learning	Marc Peter Deisenroth, A. Aldo Faisal & Cheng SoonOng	Cambridge University Press	1 st edition, 2020
2	Linear algebra and learning from data	Gilbert Strang	Wellesley-Cambridge Press	1 st edition, 2019
3	Elementary Linear Algebra	Stephen Andrilli & David Hecker	Academic Press Inc.	4 th edition, 2010
4	Elementary Linear Algebra	Howard Anton, Chris Rorres	Wiley	11 th edition, 2019

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://archive.nptel.ac.in/courses/111/107/111107164/
2	https://archive.nptel.ac.in/courses/111/107/111107164/
3	https://archive.nptel.ac.in/courses/111/107/111107164/
4	https://archive.nptel.ac.in/courses/111/107/111107164/

SEMESTER S2

CHEMISTRY FOR INFORMATION SCIENCE AND ELECTRICAL SCIENCE

Course Code	G25CYE203	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:2:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Lab Embedded Theory

Course Objectives:

1. To equip students with a comprehensive understanding of chemistry concepts that are relevant to engineering applications.
2. To familiarize students with applied topics such as spectroscopy, electrochemistry, and instrumental methods.
3. To raise awareness among students about environmental issues, including climate change, pollution, and waste management, and their impact on the quality of life.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Electrochemistry and Corrosion Science (9 Hours) Electrochemical Cell - Electrode potential- Nernst equation for single electrode and cell (Numerical problems)- Reference electrodes – SHE & Calomel electrode –Construction and Working - Electrochemical series - Applications – Glass Electrode & pH Measurement-Conductivity- Measurement using Digital conductivity meter. Li-ion battery & H ₂ -O ₂ fuel cell (acid electrolyte only) construction and working. Corrosion –Electrochemical corrosion mechanism (acidic & alkaline medium) - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection –Electroplating of copper - Electroless plating of copper.	9

2	Materials for Electronic Applications (9 Hrs) Nanomaterials - Classification based on Dimension & Materials-Synthesis – Sol gel & Chemical Reduction - Applications of nanomaterials Carbon Nanotubes, Fullerenes, Graphene & Carbon Quantum Dots – structure, properties & application. Polymers - Fire Retardant Polymers- Halogenated & Non-halogenated polymers (Examples only)- Conducting Polymers-Classification- Polyaniline & Polypyrrole-synthesis, properties and applications. Organic electronic materials and devices- construction, working and applications of Organic Light Emitting Diode (OLED) & Dye-Sensitized Solar Cells (DSSC) Materials used in Quantum computing Technology, Super capacitors, Spintronics	9
3	Molecular Spectroscopy and Analytical Techniques (9 Hours) Spectroscopy-Types of spectra- Molecular energy levels - Beer Lambert's law – Numerical problems - Electronic Spectroscopy – Principle, Types of electronic transitions –Role of conjugation in absorption maxima- Instrumentation-Applications – Vibrational spectroscopy – Principle- Number of vibrational modes - Vibrational modes of CO₂ and H₂O – Applications Thermal Analysis: Dielectric Thermal Analysis (DETA) of Polymers- Working and Application. Electron Microscopic Techniques: SEM - Principle, instrumentation and Applications.	9
4	Environmental Chemistry (9Hrs) Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Degree of hardness (Numericals) Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. – Water disinfection methods – chlorination-Break point chlorination, ozone and UV irradiation. Dissolved oxygen (DO), BOD and COD- Definition & Significance. Waste Management: Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. E Waste, Methods of disposal – recycle, recovery and reuse. Chemistry of climate change- Greenhouse Gases- Ozone Depletion-Sustainable Development- an introduction to Sustainable Development Goals.	9

Course Assessment Method (CIE: 40 Marks, ESE: 60 Marks)**Continuous Internal Evaluation Marks (CIE):**

Continuous Assessment	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Lab Examination	Total
10	30	30	30	10	40
	A total of 90 marks will be scaled to 20.				

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

CO No.	CO Statement	Module Mapping	Blooms Level
CO1	Apply the basic concepts of Electrochemistry and corrosion to examine their possible applications in various engineering fields for creating clean energy.	2	K3
CO2	Illustrate the use of analytical techniques for the synthesis and characterisation of different engineering materials for sustainable consumption and production.	3	K2
CO3	Interpret the use of various engineering materials for the production of affordable and clean energy in different industries.	1	K4

CO4	Analyse water treatment techniques and waste management methods to ensure the availability of water, a good climate and to maintain a sustainable life below water and on land.	4	K4
CO5	Apply basic knowledge of principles and theories in Chemistry to conduct experiments.	Lab Practical-based	K3
CO6	Apply basic chemistry principles in material design and innovation to synthesis new materials through hands-on experiments and perform software-based studies to construct simple models or interpret experimental results.	Out of syllabus	K3

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping Table:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	2			3					
CO2	2	2	2			3					
CO3	2	2				3					
CO4	2	2	2			3					
CO5	2	2	2	2		2		3	3	3	3
CO6					2	3	3	3	3	3	3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Chemistry	B. L. Tembe, Kamaluddin, M. S. Krishnan	NPTEL Web-book	2018
2	Physical Chemistry	P. W. Atkins	Oxford University Press	International Edition-2018
3	Instrumental Methods of Analysis	H. H. Willard, L. L. Merritt	CBS Publishers	7th Edition-2005
4	Engineering Chemistry	Jain & Jain	Dhanpath Rai Publishing Company	17 th Edition - 2015

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill	4 th edn., 1995
2	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma, M. S. Pathania	Vishal Publishing Co	47th Edition, 2017
3	Introduction to Spectroscopy	Donald L. Pavia	Cengage Learning India Pvt. Ltd	2015
4	Polymer Chemistry: An Introduction	Raymond B. Seymour, Charles E. Carraher	Marcel Dekker Inc	4th Revised Edition, 1996
5	The Chemistry of Nanomaterials: Synthesis, Properties and Applications	Prof. Dr. C. N. R. Rao, Prof. Dr. h.c. mult. Achim Müller, Prof. Dr. A. K. Cheetham	Wiley-VCH Verlag GmbH & Co. KGaA	2014
6	Organic Electronics Materials and Devices	Shuichiro Ogawa	Springer Tokyo	2024
7	Principles and Applications of Thermal Analysis	Gabbot, P	Oxford: Blackwell Publishing	2008

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://archive.nptel.ac.in/courses/104/106/104106137/
	https://archive.nptel.ac.in/courses/113/105/113105102/
	https://archive.nptel.ac.in/courses/113/104/113104082/
	https://www.youtube.com/watch?v=BeSxFLvk1h0
2	https://archive.nptel.ac.in/courses/113/104/113104102/
	https://archive.nptel.ac.in/courses/104/105/104105124/
	https://archive.nptel.ac.in/courses/105/104/105104157/

Continuous Assessment (10 Marks)

Continuous assessment evaluations are conducted based on laboratory associated with the theory.

Mark distribution

1. Preparation and Pre-Lab Work (2 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (2 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (3 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (3 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for Lab Examination (10 Marks)**1. Procedure/Principle/Conduct of Experiments (4 Marks)**

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

2. Result (4 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.

3. Viva Voce (2 Marks)

- Proficiency in answering questions related to theoretical and practical aspects of the subject.

List of Experiments**Any 10 Experiments Mandatory**

Nos.	Experiment
1	Estimation of iron in iron ore
2	Estimation of copper in brass
3	Determination of cell constant and conductance of solutions
4	Calibration of pH meter and determination of pH of a solution
5	Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
6	Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution
7	Determination of molar absorptivity of a compound (KMnO_4 or any water-soluble food colorant)
8	Analysis of IR spectra
9	Identification of drugs using TLC
10	Estimation of total hardness of water-EDTA method
11	Estimation of dissolved oxygen by Winkler's method
12	Determination of calorific value using Bomb calorimeter
13	Determination of saponification value of a given vegetable oil
14	Determination of acid value of a given vegetable oil
15	Verification of Nernst equation for electrochemical cell.

SEMESTER S2

FOUNDATIONS OF COMPUTING: FROM HARDWARE ESSENTIALS TO WEB DESIGN

Course Code	G25FCT205	CIE Marks	40
Teaching Hours/Week(L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To introduce the students to the fundamental building blocks of an IT infrastructure including the computing systems, its peripherals, Operating Systems and Networking.
2. To make the learners capable of developing and deploying simple and dynamic websites.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Computer Hardware – CPU, Memory - Memory hierarchy: registers, cache, RAM, virtual memory, Motherboard - Computer Peripherals - I/O devices, Storage devices- HDDs, SSDs, optical drives, I/O communication and device management, Interface cards – Buses – Firmware - Boot process	9
2	Binary representation of data and numbers, Integer Representation, Data storage units - bits, bytes, kilobytes, etc., ASCII and Unicode, CPU Architecture and Instruction Set: Basic CPU architecture - ALU, registers, control unit, Instruction format and assembly language (basics only) Fetch-execute cycle and instruction execution.	9

3	Computer System Software - Operating Systems, Basic commands in Linux / Windows, Shell scripting (bash). Computer Communications – LAN, MAN, WAN, Client/Server networks, Peer-to-Peer networks, Topologies. Basics of IP addresses, DHCP, NAT, Network Security (Desktop & Perimeter), DNS, VPN, Routers, Client-Server, Internet, WWW, Web servers.	9
4	Web Design (Basics of HTML, CSS, and JavaScript) – Understanding the web content delivery, Understanding HTML and XHTML Connections, Understanding Cascading Style Sheets, Understanding JavaScript	9

Course Assessment Method (CIE: 40 marks, ESE:60)

Continuous Internal Evaluation Marks (CIE):

Assignment	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Internal Examination-3 (Written)	Total
15*	30	30	30	40
	A total of 90 marks will be scaled to 25.			

*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per the revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one fullquestion out of two questions

Part A	Part B	Total
2 Questions from each module. - Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Identify the fundamental components and the working of an IT environment	K2
CO2	Outline the data representations, CPU architectures, and the basic functioning of a computer	K2
CO3	Illustrate the operating systems, computer network architecture, and necessary protocols used	K2
CO4	Develop simple interactive web pages and validate the inputs.	K3
CO5	Develop a micro-project using computing concepts to address challenges related to sustainability	K6

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2									2
CO2	3	2									2
CO3	3	2			3						2
CO4	3	2			3				3		2
CO5	3	2			3	2	2	3	3	2	2

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Invitation to Computer Science	G.Michael Schneider, Judith Gersting	Cengage	2/e, 2020
2	The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach	Irv Englander	Wiley	5/e, 2014
3	HTML, CSS, and JavaScript All in One, Sams Teach Yourself	Julie C. MeloniJennifer Kyrnin	Pearson	1/e, 2020

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	The Elements of Computing Systems, second edition: Building a Modern Computer from First Principles	Noam Nisan and Shim Schocken	The MIT Press	2/e, 2021
2	Peter Norton's Introduction to Computers	Peter Notron	McGrawHill	6/e, 2010
3	Web Design with HTML, CSS, JavaScript and JQuery	Jon Duckett	Wiley	1/e, 2014

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://www.nand2tetris.org/
2	https://onlinecourses.swayam2.ac.in/nou20_cs05/preview

SEMESTER S2

PROGRAMMING IN C

(Common to Group A & B)

Course Code	G25PCE206	CIE Marks	40
Teaching Hours/Week(L: T:P: R)	3:0:2:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Lab Embedded Theory

Course Objectives:

1. To prepare learner to write versatile C programs for solving computational problems that they come across in their professional life.
2. To equip the learner to write efficient C programs using suitable language constructs to solve real world computational problems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	C Fundamentals - Character Set, Constants, Identifiers, Keywords, Basic Data types, Variables, Operators and its precedence, Bit-wise operators, Expressions; Statements - Input and Output statements; Structure of a C program; Simple programs. Control Statements - if, if-else, nested if, switch, while, do-while, for, break & continue, nested loops.	9
2	Arrays - Single dimensional arrays, Defining an array, Array initialization, Accessing array elements; Enumerated data type; Type Definition; Two- dimensional arrays – Defining a two-dimensional array; Programs for matrix processing; Programs for sequential search; Bubble sort; Strings - Declaring a string variable, Reading and displaying	9

	strings, String related library functions – Programs for string matching.	
3	Functions - Function definition, Function call, Function prototype, Parameter passing; Recursion; Passing array to function; Macros - Defining and calling macros; Command line Arguments. Structures - Defining a Structure variable, Accessing members, Array of structures, Passing structure to function; Union. Storage Class - Storage Classes associated with variables: automatic, static, external and register.	9
4	Pointers - Declaration, Operations on pointers, Passing pointer to a function, Accessing array elements using pointers, Processing strings using pointers, Pointer to pointer, Array of pointers, Pointer to function, Pointer to structure, Dynamic Memory Allocation. Files- Different types of files in C, Opening & Closing a file, Writing to and Reading from a file, Processing files, Library functions related to file – fseek(), ftell(), fread(), fwrite().	9

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Continuous Assessment	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Lab Examination	Total
10	30	30	30	10	40
	A total of 90 marks will be scaled to 20.				

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
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2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60
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Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Interpret a given computational problem and construct C programs using basic constructs, including control statements, to demonstrate understanding of fundamental programming concepts	K2
CO2	Implement C programs that utilize arrays, matrices, and strings to solve computational problems and manipulate data effectively	K3
CO3	Apply functions to solve computational problems by modularizing them into multiple components and utilizing abstract data types	K3
CO4	Implement C programs using pointers and file handling for efficient data management.	K3
CO5	Analyze, document, and communicate debugging processes and solutions in C programs effectively, producing clear reports and presentations that enhance program reliability and efficiency.	K4

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2			2						
CO2	2	2			2						
CO3	2	3			2						2
CO4	2	2		2	2						2

CO5	2	3	2	3	3	2	2	3	2	2	2
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1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Programming with C	Byron S Gottfried	Mc Graw Hill	4/e, 2018
2	Problem Solving and Program Design in C	Jeri R. Hanly, Elliot B. Koffman	Pearson	8/e, 2016

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	The C Programming Language	Brian W. Kernighan and Dennis Ritchie	Pearson	2/e, 2015
2	C The Complete Reference	Herbert Schildt	Mc Graw Hill	4/e, 2017
3	Let us C	Yashavant Kanetkar	BPB Publishers	19/e, 2022
4	Programming in ANSI C	E Balagurusamy	Mc Graw Hill	9/e, 2024

SEMESTER S2**DISCRETE MATHEMATICS***(Common to all Computer Science and its allied branches)*

Course Code	X25DMT207	CIE Marks	40
Teaching Hours/Week(L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To equip students with the ability to analyze and solve problems using discrete mathematical techniques.
2. To give a deeper understanding of mathematical logic, set theory, and proof techniques such as direct proofs, proof by contradiction, and mathematical induction.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Sets, Functions, and Relations Sets and Subsets, Venn Diagrams, Set Operations, Set Identities, Generalized Unions and Intersections, The Principle of Inclusion-Exclusion (Basic and Generalized versions), and applications. Function definition, Injections, Surjections and Bijections, Inverse Functions, and Compositions of Functions, Cardinality of Sets, Cantor diagonalization argument Relations and Their Properties, Composition of relations, n-ary Relations, Representing Relations Using Matrices, Equivalence Relations, Equivalence Classes, Partial	11

	Orderings, Hasse Diagrams, Maximal and Minimal Elements, Lattices	
2	Mathematical logic and proofs Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs, Methods of Proving Theorems - Direct proof, Indirect proof (Proof by Contraposition), Proof by Contradiction, Proof by counter examples, The Pigeonhole Principle.	11
3	Induction and Recurrences Mathematical Induction, Weak and Strong induction Recursive (Inductive) definitions and recurrence relations, Modeling with Recurrence Relations, Solving Linear Recurrence Relations (homogeneous and nonhomogeneous), Generating Functions, Using Generating Functions to Solve Recurrence Relations.	11
4	Group theory Groups - Definition, Examples, and Elementary Properties, Abelian group, Permutation group, Subgroup, Homomorphisms, Isomorphisms, and Cyclic Groups, Cosets and Lagrange's Theorem	11

Course Assessment Method (CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Assignment (Activity based)	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
15*	30	30	30	
	A total of 90 marks will be scaled to 25.			40

*One or more assignments should be given, and the total marks should be consolidated and converted to 15 as per revised evaluation guidelines.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
2 questions from each module. - Total of 8 questions, each carrying 3 marks (8 x 3 = 24 Marks)	- Each question carries 9 marks. - Two questions will be given from each module, out of which 1 question should be answered. - Each question can have a maximum of 3 sub divisions. (4 x 9 = 36 Marks)	60

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply the principles of discrete mathematics, including counting techniques and binary relations, to solve problems related to data structures and algorithms.	K3
CO2	Analyze the validity of arguments by applying the rules of propositional and predicate logic.	K4
CO3	Apply the principles of generating functions and mathematical induction to solve recurrence relations and prove the validity of mathematical statements.	K3
CO4	Analyze computational structures by applying the principles of set theory and algebraic systems.	K4
CO5	Analyze discrete mathematical concepts to solve application-oriented problems and visualize the solutions.	K4

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3				2					
CO2	3	3				2					
CO3	3	3				2					
CO4	3	3				2					
CO5	3	3			2	2		2	3	2	

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Discrete Mathematics and its Applications	Kenneth H. Rosen, Kamala Krithivasan	McGraw Hill	8/e, 2021

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Schaum's Outline of Discrete Mathematics	Marc Lipson, Seymour Lipschutz	McGraw-Hill	3/e, 2021
2	Discrete Mathematics	Kenneth A. Ross, Charles R.B. Wright	Pearson	5/e, 2012

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://nptelvideos.com/lecture.php?id=6033
2	https://nptelvideos.com/lecture.php?id=6024
3	https://nptelvideos.com/lecture.php?id=6051
4	https://nptelvideos.com/lecture.php?id=6058

SEMESTER S2
ENGINEERING ENTREPRENEURSHIP AND IPR
(Common to All Branches)

Course Code	A25IPT207	CIE Marks	40
Teaching Hours/Week (L:T:P:R)	3:0:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. and 30 Mins.
Prerequisites (if any)	None	Course Type	Theory

Course Objective:

1. Develop a framework for identifying, curating and validating engineering-based business ideas.
2. Learn essential tools for understanding product-market fit and customer needs.
3. Create a comprehensive business plan for a new venture.
4. Gain foundational knowledge of Intellectual Property Rights (IPR) and their importance for startups.
5. Develop skills for prototyping, stakeholder engagement, and team collaboration

SYLLABUS

Module No.	Description	Contact Hours
1	Introduction to Ideation, Innovation & Entrepreneurship What is Ideation? Understanding Innovation, Frameworks for Innovation, The Entrepreneurial Mindset, Starting a Business, types formation statutory compliances, Resources for Aspiring Entrepreneurs Introduction to Intellectual Property Rights (IPR) Types of IPR: Patents, trademarks, copyrights, trade secrets, Strategies for protecting intellectual property based on the type of innovation, Role of IPR in securing funding and competitive advantage Importance of building a strong team Identifying roles, Skill sets, Team dynamics Identifying Pain Points and problem statement Idea Generation Techniques, Developing and Refining Ideas, develop strategies for bringing your innovation to life	9

2	Problem and solution canvas preparation Orientation and canvas introduction, Customer needs assessment, Market segmentation, Value proposition, Competitive analysis, Market entry strategy, Market validation, Regulatory and legal considerations Customer profiling Review of market research, Customer segmentation, Customer profiling, Persona development, Validation and feedback, Prioritisation and selection, Communication and messaging Competitor analysis Identify competitors, Competitor profiling, SWOT analysis, Market positioning, Customer feedback and reviews, Pricing analysis, Differentiation strategy, Benchmarking and improvement	9
3	Business plan preparation Business plan framework, Market analysis, Product/ service description, Marketing and sales strategy, Operations plan, Financial projections, Risk management Prototype development plan preparation Prototype requirements analysis, technical specifications, Development approach, Development timeline, Resource allocation, Testing and quality assurance, Iterative development and feedback loop, Documentation and version control	9
4	Prototype development Stakeholder engagement strategies Investors, Partners, Customers, Advisors & Mentors	9

Course Assessment Method (CIE: 60 Marks, ESE: 40 Marks)

Continuous Internal Evaluation Marks (CIE):

Micro Project	Internal Examination-I (Written)	Internal Examination-II (Written)	Internal Examination-III (Written)	Total
40	30	30	30	60
	A total of 90 marks will be scaled to 20			

Micro project / Comprehensive Business Plan:

The course will be evaluated based on a comprehensive Business Plan Report submitted and prototype development evaluation at the end of the course. The report should integrate learnings and activities from each module, demonstrating a deep understanding of the concepts and your ability to apply them to a chosen engineering venture.

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions.

Part A	Part B	Total
• Minimum 1 and Maximum 2 Questions from each module • Total of 6 questions, each carrying 2 marks (6 x 2 = 12 Marks)	• Each question carries 7 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. (4 x 7 = 28 Marks)	40

Course Outcomes (COs)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Analyze problem statements and apply ideation frameworks, innovation models, intellectual property strategies, and team-building skills to develop and refine entrepreneurial ideas into sustainable and socially relevant business opportunities.	K4
CO2	Apply entrepreneurial tools such as problem–solution canvas, customer profiling, and competitor analysis to identify customer needs, segment markets, develop value propositions, and design strategies for sustainable business growth.	K3
CO3	Apply business planning frameworks and prototype development strategies, including market analysis, financial projections, risk management, resource allocation, and iterative testing, to design viable and responsible entrepreneurial ventures that address economic and societal needs .	K3
CO4	Analyze stakeholder needs and apply effective engagement strategies with investors, partners, customers, and mentors to develop prototypes and foster entrepreneurial ventures that create lasting economic and societal value.	K4

CO5	Apply concepts of ideation, business planning, prototype development, and stakeholder engagement in a micro project to design and present a practical entrepreneurial solution that balances economic feasibility, innovation, and societal well-being.	K3
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Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 – Create

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1			2			3					2
CO2			2	3		3					2
CO3			2	3		3				3	2
CO4			3							3	2
CO5			3	3	3	3		3	3	3	3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	The Engineering Handbook	Richard C Dorf	CRC Press	2 nd Edition, 2004
2	The Innovator's DNA	Clayton M. Christensen and Jeffrey H. Dyer	Harvard Business Review Press	Revised Edition (June 4, 2019)
3	Start with Why	Simon Sinek	Portfolio	Reprint Edition (December 27, 2011)
4	Business Model Generation	Alexander Osterwalder & Yves Pigneur	Wiley	2010
5	The Engineering Entrepreneur: A Practical Guide to Starting and Running a Successful Engineering Business in India	Saibal Gupta and Ashok Jhunjhunwala	Sage Publications	2011
6	Innovation and Entrepreneurship for Engineers	Bharat Bhushan and Seema Bhushan	CRS Press	2016
7	Indian Patent Law	P. Narayanan	Eastern Book Company	2 nd Edition 2020

8	The Law of Copyright and Designs	B.L. Wadehra	Universal Law	5 th Edition, 2010
9	Intellectual Property Rights (Including IPR in the Digital Age)	Prabuddha Ganguli	Tata McGraw-Hill Education	2001
10	The Startup India Manifesto: A Guide to the Indian Startup Ecosystem	Rashmi Bansal and Deepinder Goyal	Westland Publications	2020

SEMESTER S2
LIFE SKILLS AND PROFESSIONAL COMMUNICATION
(Common to All Branches)

Course Code	A25LSE109	CIE Marks	100
Teaching Hours/Week (L:T:P:R)	2:0:1:0	ESE Marks	0
Credits	1	Exam Hours	-
Prerequisites (if any)	None	Course Type	Activity-based learning

Course Objective:

1. To foster self-awareness and personal growth, enhance communication and interpersonal connection skills, promote effective participation in groups and teams, develop critical thinking, problem-solving, and decision-making skills, and cultivate the ability to exercise emotional intelligence.
2. To equip students with the necessary skills to listen, read, write & speak, to comprehend and successfully convey any idea, technical or otherwise.
3. To equip students to build their profile in line with the professional requirements and standards.

Continuous Internal Evaluation Marks (CIE):

- Continuous internal evaluation is based on the individual and group activities as detailed in the activity table given below.
- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. They should use online collaboration tools for group activities, report/presentation making and work management.
- Activities are to be distributed between 3 class hours (2L+1P) and 3.5 Self-study hours.
- Marks given against each activity should be awarded fully if the students successfully complete the activity.
- Students should maintain a portfolio file with all the reports and other textual materials generated from the activities. Students should also keep a journal related to the activities undertaken.
- Portfolio and journal are mandatory requirements for passing the course, in addition to the minimum marks required.

- The portfolio and journal should be carried forward and displayed during the 7th Semester Seminar course as a part of the experience sharing regarding the skills developed through the HMC courses and Mini project course.
- Self-reflection questionnaire shall be given at the beginning of the semester, in between and at the end of the semester based on the guidelines in the manual of the course.

Table 1: Activity Table

Sl. No.	Activity	Class room (L) / Self Study (SS)	Week of completion	Group / Individual (G/I)	Marks	Skills	CO
1.1	Group formation and self-introduction among the group members	L	1	G	-	Connecting with group members, Time management	CO1
1.2	Familiarizing the activities and preparation of the time plan	L	1	G	-	Planning, coordination	CO1
1.3	Preparation of Gantt chart based on the time plan	SS	1	G	2	Time management	CO1
2.1	Online personality development test, self-reflection and report	SS	1	I	2	Self-awareness, reflective writing	CO1
2.2	Role-storming exercise – perspectives of parent/mentor and friend	L	1	I	2	Goal setting, self-awareness	CO1
2.3	Role-storming exercise – teacher perspective on B.Tech skills	SS	1	I	2	Career awareness	CO1

2.4	Group discussion on skills identified through role-storming	L	1	G	2	Collaboration	CO1
2.5	Mind map preparation and presentation	SS	2	G	2	Visualization, presentation	CO1
3	Presentation on instances of empathy	L	2–4	I	2	Empathy, communication	CO2
4.1	Networking with professionals including LinkedIn	SS	3	I	2	Networking, communication	CO2
4.2	Interaction with professionals and documentation	SS	3	I	4	Report writing	CO2
4.3	Group discussion and preparation of minutes	SS	3	G	2	Team discussion	CO2
4.4	Report preparation based on discussions	SS	4	G	3	Technical writing	CO4
4.5	Role-play on workplace dynamics	L	5	G	4	Communication, teamwork	CO3
4.6	Personal goal identification and action plan	SS	5	I	2	Planning	CO1
5.1	Selection of real-life technical problem	L	6	G	2	Problem identification	CO5
5.2	TED talk / expert lecture	SS	6	I	2	Listening, summarizing	CO4

	review and summary						
5.3	Idea gathering using online technical forums	SS	6	G	2	Information analysis	CO5
5.4	Solution development using Six Thinking Hats	L	7	G	3	Analytical thinking	CO5
5.5	Report on problem-solving experience	SS	7	G	2	Documentation	CO5
6.1	LinkedIn profile creation	SS	8	I	2	Profile building	CO4
6.2	Resume preparation	SS	8	I	2	Professional documentation	CO4
6.3	Self-introduction video	SS	8	I	3	Verbal communication	CO3
7	Presentation on emotional intelligence	SS	9	I	2	Emotional intelligence	CO2
8	Short video on diversity aspects	SS	10	G	3	Inclusivity awareness	CO2
9	Online interview skills session and reflection	SS	10	I	2	Interview readiness	CO4
10	Online listening test and reflection	SS	11	I	2	Listening skills	CO3
11.1	Vocabulary improvement activities	L	8	I/G	4	Language proficiency	CO4
11.2	Grammar error identification activities	L	9	I/G	2	Writing accuracy	CO4
11.3	Common spelling and	L	10	I/G	2	Language clarity	CO4

	pronunciation activities						
11.4	Self-reflection on communication improvement	SS	12	I	2	Reflective writing	CO4
11.5	Group presentation on collaboration tools	L	11–12	G	2	Collaboration	CO3
12.1	Podcast video on technological interventions	SS	12	G	4	AV skills, technology awareness	CO5
12.2	Upload podcast to platform	SS	12	G	1	Digital publishing	CO5
12.3	Add podcast link to LinkedIn	SS	12	G	1	Professional networking	CO5

Table 2. Lab hour Activities (P): 24 Marks

Sl. No	Activity	Marks	Skill	CO
1	Hands-on sessions on day-to-day engineering skills and a self-reflection report on the experience gained: 1. Drilling practice using electric hand drilling machines. 2. Cutting of MS rod and flat using electric hand cutters. 3. Filing, finishing and smoothening using electrically operated hand grinders. 4. MS rod cutting using Hack saw by holding the work in bench wise. 5. Study and handling different types of measuring instruments. 6. Welding of MS, SS work pieces.	24	Basic practical engineering skills	5

	7. Pipe bending practice (PVC and GI). 8. Water tap fitting. 9. Water tap rubber seal changing practice. 10. Union and valves connection practice in pipes. 11. Foot valve fitting practice. Water pump seal and bearing changing practice.			
2	Language Lab sessions	-	Language Skills	4

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply self-awareness strategies to demonstrate confidence in one's abilities; implement goal-setting and planning techniques; and practice emotional intelligence, empathy, responsibility, and respect for diversity while working effectively in collaborative environments.	K5
CO2	Apply critical thinking, problem-solving, and decision-making techniques to address personal, academic, and professional situations effectively.	K5
CO3	Apply listening, reading, writing, and speaking skills to comprehend, interpret, and communicate ideas effectively using textual, audio, and visual modes.	K6
CO4	Apply audio-visual and digital tools to develop professional presentations and profiles aligned with industry standards, and actively engage in networking through social media platforms and professional forums.	K6
CO5	Apply basic engineering knowledge and problem analysis techniques to identify a real-life technical problem, formulate a solution approach, evaluate alternatives, and document results with consideration for feasibility and sustainability.	K4

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1							3	3		2	2
CO2						2	2	2			2
CO3								2	2		
CO4									3		
CO5	1	3		2	2				3	2	3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Life Skills & Personality Development	Maithry Shinde et.al.	Cambridge University Press	First Edition, 2022
2	Emotional Intelligence: Why it can matter more than IQ	Daniel Goleman	Bloomsbury, Publishing PLC	25th Anniversary Edition December 2020
3	Think Faster, Talk Smarter: How to speak successfully when you are put on the spot	Matt Abrahams	Macmillan Business	September 2023
4	Deep Work: Rules for focused success in a distracted world	Cal Newport	PIATKUS	January 2016
5	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2nd Edition 2017
6	Interchange	Jack C. Richards, With Jonathan Hull, Susan Proctor	Cambridge publishers	5th Edition

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Life Skills for Engineers	Remesh S., Vishnu R.G.	Ridhima Publications	First Edition, 2016
2	Soft Skills & Employability Skills	Sabina Pillai and Agna Fernandez	Cambridge University Press	First Edition, 2018
3	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2nd Edition 2017
4	English Grammar in Use	Raymond Murphy,	Cambridge University Press India PVT LTD	5th Edition 2023
5	Guide to writing as an Engineer	David F. Beer and David McMurrey	John Willey. New York	2004

SEMESTER S2**IT WORKSHOP**

Course Code	G25ITP210	CIE Marks	50
Teaching Hours/Week(L: T:P: R)	0:0:2:0	ESE Marks (Internal Only)	50
Credits	1	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Lab

Course Objectives:

1. To provide a basic understanding about computer hardware, software, and computer network.
2. To familiarize the learner with the web development process using HTML, CSS, and Javascript.

Details of Experiments

Expt. No	Experiment (Minimum 10 Experiments)
1	Practice Computer Hardware – Familiarization CPU Box, Motherboard, CPU & Chip-set, Interface cards, Card slots, Hard disk, Cables, SMPS, NIC, Various ports, etc. Computer Peripherals - I/O Devices. Storage devices, Interface cards – Buses – Firmware
2	Familiarization of Boot process
3	Familiarizing installation of Linux and Windows operating systems
4	Familiarizing basic Unix/Linux commands - ls, mkdir, cp, mv, grep, rmdir, chmod, useradd, passwd, history, dmesg, cpuinfo, uname, du, time, write, fdisk
5	Familiarizing networking hardware - RJ45, UTP, fibre, switch, NIC, router, Wireless Access Point (WAP), modem
6	Familiarizing basic networking commands - ifconfig, ping, traceroute, nslookup, ssh, scp, telnet, ftp
7	View network traffic using Wireshark/Packet tracer

8	Familiarizing the steps how to configure and establishing a network connecting
9	Shell programming in Linux(bash)
10	Create a web page and deploy on a local web server.
11	Use Javascript to validate forms.
12	Create an image slider using HTML, CSS, and JavaScript. Allow users to navigate between images using previous and next buttons.
13	Familiarisation of LaTeX - Basic only
14	Familiarisation of Development Environments - Visual studio code, Sublime Text, Atom
15	Introducing Repositories - Git / Bitbucket

Course Assessment Method (CIE: 50 Marks, ESE: 50 Marks)

Continuous Internal Evaluation Marks (CIE):

Preparation/Pre-Lab Work, experiments, Viva and Timely completion of Lab Reports/Record (Continuous Assessment)	Total
50	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of Experiment/ Execution of work/Troubleshooting/ programming	Result with valid inference/ Quality of output	Viva voce	Record	Total
10	20	5	10	5	50

Mandatory Requirement for ESE:

Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified Lab record.

Pass Criteria:

- A student must score a minimum of 50% overall, combining marks from both Continuous Internal Evaluation (CIE) and End Semester Examination (ESE).
- In addition, the student must secure at least 40% in the End Semester Examination (ESE).
- The ESE shall be conducted internally, with evaluation carried out by a panel of faculty members.
- This panel must include at least one faculty member who was not involved in the Continuous Internal Evaluation (CIE) of the lab course.

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Experiment with the fundamental hardware components of a computer and how to interface them with software systems.	K3
CO2	Make use of the command line of Linux operating system and shell programming.	K3
CO3	Experiment with the data network communication scenarios using Wireshark.	K3
CO4	Develop basic websites using HTML, CSS & JavaScript and manage the versions.	K6
CO5	Design and develop a mini-project, such as a dynamic web page or an interactive web application, integrating front-end and back-end technologies	K6

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2			2	2					3
CO2	2	3			2	2					3
CO3	2	3			3	2		2			3

CO4	2	2	3	3	3			3			3
CO5	2	3		3	3	3	3	3	3	3	3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), : No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Invitation to Computer Science	G. Michael Schneider, Judith Gersting	Cengage	2/e, 2020
2	LINUX for Developers: Jumpstart Your Linux Programming Skills	William Rothwell	Pearson	1/e, 2018
3	HTML, CSS, and JavaScript -All in One, Sams Teach Yourself	Julie C. Meloni Jennifer Kyrnin	Pearson	1/e, 2018

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	The Architecture of Computer Hardware, Systems Software, & Networking: An Information Technology Approach	Irv Englander	Wiley	5/e, 2014
2	Mastering Git : Attain expert level proficiency with Git for enhanced productivity and efficient collaboration	Jakub Narębski	Packt	1/e, 2016
3	Web Design with HTML, CSS, JavaScript, and JQuery.	Jon Duckett	Wiley	1/e, 2014

Video Links (NPTEL, SWAYAM...)	
Sl. No.	Link ID
1	https://overthewire.org/wargames/bandit/
2	https://www.w3schools.com/

Continuous Assessment (50 Marks)

1. Preparation and Pre-Lab Work (10 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. Conduct of Experiments (10 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

3. Lab Reports and Record Keeping (10 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. Viva Voce (20 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

ESE

Procedure/ Preparatory work/Design/ Algorithm	Conduct of Experiment/ Execution of work/Troubleshooting/ programming	Result with valid inference/ Quality of output	Viva voce	Record	Total
10	20	5	10	5	50

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. Procedure/Preliminary Work/Design/Algorithm (10 Marks)

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.

- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. Conduct of Experiment/Execution of Work/Programming (20 Marks)

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. Result with Valid Inference/Quality of Output (5 Marks)

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. Viva Voce (10 Marks)

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. Record (5 Marks)

- Completeness, clarity, and accuracy of the lab record submitted

SEMESTER S2
INTRODUCTION TO IDEA LAB AND DIGITAL TWIN
TECHNOLOGY
(Common to All Groups)

Course Code	A25ILE211	CIE Marks	50
Teaching Hours/Week (L:T:P:R)	1:0:2	ESE Marks	-
Credits	2	Exam Hours	-
Prerequisites (if any)	NIL	Course Type	Project-Based/Skill Enhancement

Course Objective:

1. To introduce the fundamentals of innovation, Design Thinking, and the Idea Lab ecosystem.
2. To enable students to translate ideas into functional prototypes using Idea Lab tools.
3. To impart basic concepts, architecture, and applications of Digital Twin Technology.
4. To provide hands-on experience in modelling, simulating, and visualizing a basic Digital Twin.
5. To Empower students to solve real-life problems through Project-Based Learning and present validated prototypes.

SYLLABUS

Module No.	Description	Contact Hours
1	MODULE- (6 Hrs) Introduction to Idea Lab & Design Thinking Design Thinking Basics: Empathize → Define → Ideate → Prototype → Test. Problem Identification: Observation, need analysis, pain–gain chart. IDEA Lab: Objectives, structure, interdisciplinary innovation culture. Lab Activity: Students (3 per team) identify one problem statement and generate three solution ideas . Familiarization with IDEA Lab Equipment (3D printer, laser cutter, basic electronics bench, IoT kit).	2L+4P=6

	Assignment I (Presentation): Team-based identification of a real-world problem and presentation of three solution concepts using structured ideation methods.	
2	MODULE II (8 Hrs): Basic Prototyping in IDEA Lab Additive Manufacturing: CAD (Computer-Aided Design) basics, 3D printing workflow (Design, Slice, Print). Lab Activity: IoT Kit based sensing and control in a physical prototype. 3D Printing based on CAD modelling software Autodesk Fusion 360 Assignment II: Build a basic functional or visual prototype using at least two different IDEA Lab tools (e.g., a 3D printed housing with simple sensor circuits).	2L+10P= 12
3	MODULE 3 (8 Hrs): Digital Twin Fundamentals: Definition, DT vs. Simulation, DT Components & Architecture. Types of DTs (Product, Operation, Process). Lab Activity: Modelling & Simulation for DT: Introduction to DT / Simulation Tools: MATLAB/Simulink Digital Twin ** (AnyLogic, Node-RED, Unity, and Blender) Assignment III- Basic DT Simulation: Develop a basic DT simulation. Task involves creating a virtual model and linking it to mock data to demonstrate state changes (e.g., Virtual object behaviour simulation, or environmental parameter twin).	2L+10P= 12
4	MODULE 4 (7 Hrs): Micro Project Project Management & Presentation: Basics of technical report writing, data visualization, and technical presentation skills for project pitching. Lab Activity: Micro Project: The team (3 Members) integrates their Idea Lab prototype with its Digital Twin model. Demonstration of the physical model and the virtual model synchronizing via data.	1L+6P=7

****Note: MATLAB/Simulink Digital Twin is compulsory. In addition, any one of the following tools—AnyLogic, Node-RED, Unity, or Blender—may be introduced based on branch relevance (Optional)**

Course Assessment Method
Continuous Internal Evaluation Marks (CIE: 50 Marks)

Assignment-I (Practical)	Assignment-II (Practical)	Assignment -III (Practical)	Internal Lab Examination	Micro Project	Total
10	10	10			
Take average of three and convert it into 20			15	15	50

Course Outcomes (COs)

At the end of the course students should be able to:

CO No.	Description	Blooms Knowledge Level (KL)
CO1	Explain the objectives, structure, and role of the IDEA Lab ecosystem and the principles of Design Thinking in fostering interdisciplinary innovation.	K2
CO2	Apply structured problem identification and ideation techniques to identify real-world problems and propose multiple solution concepts.	K3
CO3	Demonstrate basic prototyping skills by developing simple physical prototypes using IDEA Lab tools such as CAD modelling, 3D printing, and IoT kits.	K4
CO4	Analyse the fundamentals, architecture, and types of Digital Twin systems and develop basic digital models using suitable simulation software.	K4
CO5	Design and implement a mini Digital Twin-enabled micro-project by integrating a physical prototype with its virtual model to address a real-world problem.	K6

Note: K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyse, K5 – Evaluate, and K6 - Create

Text Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Change by Design: How Design Thinking Transforms	Tim Brown	HarperCollins,	2 nd Edition, 2019

	Organizations and Inspires Innovation,			
2	Product Design and Development.	Karl T. Ulrich & Steven D. Eppinger	McGraw-Hill	7/e, 2020
3	Digital Twin Technology: Fundamentals and Applications	Soheil Sabri , Kostas Alexandridis & Newton Lee	Springer	Kindle Edition, 2024

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	The Digital Twin	Noel Crespi , Adam T. Drobot & Roberto Minerva	Springer	1/e, 2023
2	AICTE IDEALAB Handbook		AICTE, New Delhi	2022

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	Design thinking https://nptel.ac.in/courses/110106124
2	Lec 30:- Digital Twin https://www.youtube.com/watch?v=3cCOB_W1CH0&t=7s