CHRIST COLLEGE OF ENGINEERING
IRINJALAKUDA (AUTONOMOUS)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

B. Tech – 2025

SEMESTER – S2

(GROUP - A)

SEMESTER - S2 CURRICULUM

SECOND SEMESTER: Computer Science and Engineering (Data Science)														
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	BS	GC	Mathematics for Information Science-2	3	0	0	0	4.5	40	60	3	3
2	B	G25PYE102	BS	GC	Physics for Information Science	3	0	2	0	5.5	40	60	4	5
3	C	G25FCT205	ES	GC	Foundations of Computing: From Hardware Essentials to Web Design	3	0	0	0	4.5	40	60	3	3
4	D	G25PCE206	ES	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	ES	UC	Engineering Entrepreneurship & IPR	3	0	0	0	4.5	60	40	3	3
PRACTICALS														
7	I	A25HWE108	HM	UC	Health and Wellness	1	0	1	0	0	50	0	1	2
8	L	G25ITP210	ES	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										**33**			**25**	**30**

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 Mmxn only, Subspaces, Examples as subspaces of R^n and $Mmxn$, 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 Rn and M2x2, 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 R2, Projection in R3, 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)

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- Analyse, 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

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	10th edition, 2016
2	Elementary Linear Algebra	Ron Larson	Cengage Learning	8th 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	1st edition, 2020
2	Linear algebra and learning from data	Gilbert Strang	Wellesley-Cambridge Press	1st edition, 2019
3	Elementary Linear Algebra	Stephen Andrilli & David Hecker	Academic Press Inc.	4th edition, 2010
4	Elementary Linear Algebra	Howard Anton, Chris Rorres	Wiley	11th 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

PHYSICS FOR INFORMATION SCIENCE

(Common to Group A)

Course Code	G25PYE102	**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**	Theory + Lab

Course Objectives:

1. To equip students with a strong foundation in the fundamentals of Physics, impart this knowledge within the context of Information Science disciplines, cultivate scientific attitudes and critical thinking skills, and enable students to integrate Physics concepts with their core Information Science programs.
2. To make the students gain practical knowledge to correlate the theoretical studies and to develop practical applications of engineering.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Electrical conductivity** Classical free electron theory, Electrical conductivity in metals, Fermi Dirac distribution, Variation of Fermi function with temperature, Fermi Energy, Energy bands, Classification of materials into conductor, semiconductor and insulator. Superconductivity, Transition temperature, Critical field, Meissner effect, Type I and Type II Super conductors. BCS Theory, Applications of superconductors.	9
2	**Quantum Mechanics** Introduction, Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Application of uncertainty principle- Absence of electron inside nucleus	9

	- Natural line broadening, Wave function – properties - physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling (Qualitative)	
3	**Semiconductor Physics** Intrinsic semiconductor, Derivation of density of electrons in conduction band and density of holes in valence band, Intrinsic carrier concentration, Variation of Intrinsic carrier concentration with temperature, Extrinsic semiconductor (qualitative) Formation of p-n junction, Fermi level in semiconductors-intrinsic and extrinsic, Energy band diagram of p-n junction - Qualitative description of charge flow across a p-n junction - Forward and reverse biased p-n junctions, Diode equation (Derivation), I-V Characteristics of p-n junction	9
4	**Semiconductor Devices** Semiconductor devices- Rectifiers- Full wave and Half wave. Zener diode- VI characteristics, Tunnel diode-VI characteristics, SemiconductorLaser (Construction and working), Applications Photonic devices (Qualitative treatment only) - Photo detectors (Junction and PIN photodiodes), Solar cells- IV Characteristics, Efficiency, Stringing of Solar cells to solar panel, Light Emitting Diode, Applications	9

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

Continuous Internal Evaluation Marks (CIE):

Activity based Assessment	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Internal Examination- 3 (Written)	Internal Examination- 3 (Lab Examination)	Total
10	30	30	30	10	40

	Total of 90 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 **(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	Analyze the behaviour of matter in atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices.	K4
CO2	Apply the basic theory of electrical conductivity and superconductivity to evaluate conductive materials in engineering for sustainable applications.	K3
CO3	Apply the fundamentals of semiconductor physics to analyze material properties.	K3
CO4	Analyze the basic concepts of semiconductor physics to design different semiconductor devices for producing clean energy.	K4

CO5	Apply scientific principles in experiments to investigate core concepts, gaining hands-on experience and skills relevant to engineering practice.	K3
CO6	Apply fundamental principles of physics to analyze and interpret experimental results using software tools and simple electronic assemblies.	K3

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	2									
CO2	3	2									
CO3	3	2									
CO4	2	2									
CO5	2	2			3	3		3	3		2
CO6	2	2			3	3		3	3		2

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Physics	H K Malik and A K Singh	McGraw Hill	2nd Ed., 2017
2	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	6th Ed., 2003
3	A Textbook of Engineering Physics	MN Avadhanulu, P G Kshirsagar, TVS Arun murthy	S. Chand	11^{th} Ed., 2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Semiconductor Devices Fundamentals	Robert F Pierret	Pearson Education	1995
2	Advanced Semiconductor Fundamental	Robert F Pierret	Pearson Education	2nd Edition, 2002

3	Solid State Electronic Devices	Ben G Streetman and Sanjay Kumar Banerjee	Pearson Education 6/e	2010
4	Solid State Physics	S.O. Pillai	New age international publishers	10th Edition, 2022
5	Introduction to Solid State Physics	Charles Kittel	Wiley India Edition	2019
6	Advanced Engineering Physics	Premlet B	Phasor Books	10th Edition, 2017
7	A Text Book of Engineering Physics	I. Dominic and. A. Nahari,	Owl Books Publishers	Revised Edition, 2016

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/115103108
2	https://nptel.ac.in/courses/115101107 https://nptel.ac.in/courses/115102023
3	https://nptel.ac.in/courses/108106181
4	https://nptel.ac.in/courses/108108112

Continuous Assessment (10 Marks)

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 (5 Marks)

I. **Procedure/Preliminary Work/Conduct of Experiments (2 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

II. **Result (2 Marks)**
    - Accuracy of Results: Precision and correctness of the obtained results.

III. Viva Voce (1 Marks)
    - Proficiency in answering questions related to theoretical and practical aspects of the subject.

Experiment List

(Minimum 10 Experiments)

Experiment No.	Experiment
1	Diode characteristics
2	Zener diode- V-I characteristics
3	Tunnel diode –V-I characteristics
4	Half wave rectifier
5	Full wave rectifier
6	Hall effect in semiconductors
7	Determination of band gap energy of a semiconductor
8	Characteristics of LED
9	Solar Cell- V-I and Intensity Characteristics
10	Laser – Determination of wavelength using diffraction grating
11	Laser- To measure the wavelength using a millimeter scale as a grating
12	Compare the variation of current with potential difference, for a metal, filament bulb and semiconductor diode.
13	Determination of dielectric constant
14	CRO -Measurement of frequency and amplitude of wave forms
15	Photo diode - V-I Characteristics
16	Numerical aperture of optical fiber

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**	ES

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,	9

	Topologies. Basics of IP addresses, DHCP, NAT, Network Security (Desktop & Perimeter), DNS, VPN, Routers, Client-Server, Internet, WWW, Web servers.	
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 full question 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, 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

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 TeachYourself	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 Shimon 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

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 learners 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 strings, String related library functions – Programs for string matching.	9

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):

<table>
<tr><th>Continuous Assessment</th><th>Internal Examination-I (Written)</th><th>Internal Examination-II (Written)</th><th>Internal Examination-III (Written)</th><th>Lab Examination</th><th>Total</th></tr>
<tr><td rowspan="2">10</td><td>30</td><td>30</td><td>30</td><td rowspan="2">10</td><td rowspan="2">40</td></tr>
<tr><td colspan="3">A total of 90 marks will be scaled to 20.</td></tr>
</table>

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	Blooms Level
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.	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						
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

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

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 Relation, 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 Orderings, Hasse Diagrams, Maximal and Minimal Elements, Lattices	11

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 bycounter 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)
CO 1	Apply the principles of discrete mathematics, including counting techniques and binary relations, to solve problems related to data structures and algorithms.	K3
CO 2	Analyze the validity of arguments by applying the rules of propositional and predicate logic.	K4
CO 3	Apply the principles of generating functions and mathematical induction to solve recurrence relations and prove the validity of mathematical statements.	K3
CO 4	Analyze computational structures by applying the principles of set theory and algebraic systems.	K4
CO 5	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	

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.
5. Gain foundational knowledge of Intellectual Property Rights (IPR) and their importance for start-ups.
6. 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**	9

	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	
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):

<table>
<tr><th>Micro Project</th><th>Internal Examination-I (Written)</th><th>Internal Examination-II (Written)</th><th>Internal Examination-III (Written)</th><th>Total</th></tr>
<tr><td rowspan="2">40</td><td>30</td><td>30</td><td>30</td><td rowspan="2">60</td></tr>
<tr><td colspan="3">Average of best two and then convert to 20</td></tr>
</table>

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.	4
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.	3
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.	3
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.	4
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.	3

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

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	2nd Edition, 2004
2	The Innovator's DNA	Clayton M. Christensenand Jeffrey H. Dyer	Harward Business Review Press	Revised Edition (June 4, 2019)
3	Start with Why	Simon Sinek	Portgolio	Reprint Edition (December 27, 2011)
4	Business Model Generation	Alexander Osterwalder & Yves Pingneur	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	2nd Edition 2020
8	The Law of Copyright and Designs	B.L. Wadehra	Universal Law	5th 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

HEALTH AND WELLNESS

(Common)

Course Code	A25HWE108	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	1:0:1:0	**ESE Marks**	0
Credits	1	**Exam Hours**	Nil
Prerequisites (if any)	None	**Course Type**	Theory and Practical

Course Objectives:

1. To provide essential knowledge on physical activity, health, and wellness.
2. To ensure students understand body systems, exercise principles, nutrition, mental health, and disease management.
3. To educate students on the benefits of yoga, the risks of substance abuse and basic first aid skills.
4. To equip students with the ability to lead healthier lifestyles.
5. To enable students to design effective and personalized exercise programs.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Human Body Systems related to Physical activity and its functions: Respiratory System - Cardiovascular System. Musculoskeletal System and the Major Muscle groups of the HumanBody. Quantifying Physical Activity Energy Expenditure and Metabolic equivalent of task (MET) Exercise Continuum: Light-intensity physical activity, Moderate -intensity physical activity, Vigorous -intensity physical activity.	4

	Defining Physical Activity, Aerobic Physical Activity, Anaerobic Physical Activity, Exercise and Health-Related Physical Fitness. FITT principle to design an Exercise programme Components of Health-related Physical Fitness: - Cardiorespiratory Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	
2	Concept of Health and Wellness: Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health. Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet Carbohydrate & the Glycemic Index Animal & Plant - based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals	2
3	Lifestyle management strategies to prevent / manage common hypokinetic diseases and disorders - Obesity - Cardiovascular diseases (e.g., coronary artery disease, hypertension) - Diabetes – Osteoporosis -Musculoskeletal disorders (e.g., osteoarthritis, Low back pain, Kyphosis, lordosis , flat foot, Knock knee) Meaning, Aims and objectives of yoga - Classification andimportance of of Yogic Asanas (Sitting, Standing, lying) Pranayama and Its Types. Active Lifestyle and Stress Management Through Yoga Understanding on substance abuse and addiction - Psychoactive substances & its ill effects- Alcohol- Opioids- Cannabis -Sedative - Cocaine -Other stimulants, including caffeine -Hallucinogens - Tobacco -Volatile solvents.	4

4	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider First aid measures for: - Cuts and scrapes - Bruises - Sprains - Strains - Fractures - Burns - Nosebleeds. First Aid Procedures: Cardiopulmonary Resuscitation (CPR) - Heimlich Maneuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain)	2

Additional Topics

- Need and Importance of Physical Education and its relevance in interdisciplinary context. Understanding of the Endocrine System.
- Developing a fitness profile
- Healthy foods habits for prevention and progression of Lifestyle Diseases. Processed foods and unhealthy eating habits.
- Depression - Anxiety – Stress
- Different ways of carrying an injured person. Usage of Automated external defibrillator

Course Assessment Method (CIE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Case Study/Micro project/ Presentation	Activity evaluation	Total
25	25	50

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand and explain the various human body systems, identify different types of physical activities, and describe appropriate methods to measure and quantify these activities effectively	K2
CO2	Understand the role of psychological practices, dietary habits, and sports activities in maintaining and improving health and wellness	K2
CO3	Understand common hypokinetic and musculoskeletal disorders, and explain the importance of adopting a healthy lifestyle through yoga practice and avoiding addictive substances.	K2
CO4	Understand the basic principles of first aid and recognize common sports injuries	K2
CO5	Exhibit effective teamwork and communication by engaging in physical activities aimed at enhancing health, fitness, and wellness	K2

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	1										
CO2	1						1				
CO3	1		3								
CO4	1						1				
CO5	1		3					3	3		

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Foundations of Nutrition	Bhavana Sabarwal	Common wealth Publishers	1999
2	Anatomy and physiology in health and illness.	Ross and Wilson	Waugh, A., & Grant, A.	2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Fit to be Well Essential Concept	Thygerson, A. L., Thygerson, S. M., & Thygerson, J. S.	Jones & Bartlett Learning.	2018
2	Introduction to physical education, fitness, and sport.	Siedentop, D., & Van der Mars, H.	Human kinetics.	2022
3	Substance Use Disorders. Manual for Physicians.	Lal, R., &Ambekar,A	National Drug Dependence Treatment Centre, New Delhi	2005
4	The exercise health connection-how to reduce your risk of disease and other illnesses by making exercise your medicine.	Nieman, D. C., & White, J. A	Public Health	1998
5	ACSM's resource manual for guidelines for	Lippincott Williams& Wilkins.	American College ofSports Medicine.	2012

	exercise testing and prescription.			
6	Exercise Physiology: energy, nutrition and human performance.	Katch, F. I., Katch, V. L., & McArdle, W. D.	Lippincott Williams & Wilkins	2010

Continuous Internal Evaluation Marks (CIE): for the Health and wellness course

Students will be evaluated as follows.

Title	Method of Evaluation
Case Study/Micro project/ Presentation	Case studies will be given to students to assess their understanding of the subjects taught. Students will be required to make presentations on the subjects taught in class, and their understanding of the subjects will be assessed. Based on the case studies, micro projects, and Presentations the students will be awarded marks out of 25.
Activity Evaluation	The Assignment / Presentation faculty handling the class will use the tests from the Fitness Protocols and Guidelines for ages 18+ to 65 years, as set forth by FIT India. Measurements will be taken for all the tests of the FIT India Fitness Protocol and the evaluation will be based on the benchmark score received for the following tests: 1. V Sit Reach Test 2. Partial Curl Up - 30 seconds 3. Push Ups (Male) and Modified Push Up (Female) 4. Two (2) Km Run/Walk Students who achieve a total benchmark score of 8 across the aforementioned 4 tests will be awarded pass marks for activity evaluation. Students who score better will be awarded a maximum mark of 20.
Activity Evaluation - Special Circumstances	Physically challenged and medically unfit students can opt for an objective test to demonstrate their knowledge of the subjects taught. Based on their performance in the objective test, they will be awarded marks out of 20.
Activity Evaluation - Special Considerations NCC	Students who enrolled themselves in the NCC during the course period (between the start and end dates of the program) and attended 5 college level parades will be awarded pass marks for activity evaluation. Students who attend more parades will be eligible for a maximum mark of 20 based on their parade attendance.

Tests to evaluate as per Criterion - 2 and Benchmark Scores V Sit Reach Test

How to Perform:

1. The subject removes their shoes and sits on the floor with the measuring line between their legs and the soles of their feet placed immediately behind the baseline, heels 8-12" apart.
2. The thumbs are clasped so that hands are together, palms facing down and placed on the measuring line.
3. With the legs held flat by a partner, the subject slowly reaches forward as far as possible keeping the fingers on baseline and feet flexed.
4. After three tries, the student holds the fourth reach for three seconds while that distance is recorded.
5. Make sure there are no jerky movements, and that the fingertips remain level and the legs flat.

Infrastructure/Equipment Required:

1. A tape for marking the ground, marker pen, and ruler.
2. With the tape mark a straight line two feet long on the floor as the baseline, and a measurement line perpendicular to the midpoint of the baseline extending two feet on each side.
3. Use the marker pen to indicate every centimetre and millimetre along the measurement line. The point where the baseline and the measuring line intersect is the zero point.

Scoring: The score is recorded in centimetres and millimetres as the distance reached by the hand, which is the difference between the zero point (where the baseline and measuring line intersect) and the final position.

Scoring for V Sit Reach Test for Males

Level	Benchmark Score	Measurement (cm)
1	2	<11
2	4	12-13
3	6	14-17

4	7	18-19
5	8	20-21
6	9	22
7	10	>22

Scoring for V Sit Reach Test for Females

Level	Benchmark Score	Measurement (cm)
1	2	<14
2	4	15-16
3	6	17-19
4	7	20-21
5	8	22
6	9	23
7	10	>23

Partial Curl Up - 30 seconds How to Perform:

1. The subject lies on a cushioned, flat, clean surface with knees flexed, usually at 90 degrees, with hands straight on the sides (palms facing downwards) closer to the ground, parallel to the body.
2. The subject raises the trunk in a smooth motion, keeping the arms in position, curling up the desired amount (at least 6 inches above/along the ground towards the parallel strip).
3. The trunk is lowered back to the floor so that the shoulder blades or upper back touch the floor.

Infrastructure/Equipment Required:

1. Flat clean cushioned surface with two parallel strips (6 inches apart), Stopwatch Scoring: Record the maximum number of Curl ups in a certain time period 30 seconds.

Scoring for Partial Curl Up - 30 seconds Test for Males

Level	**Benchmark Score**	**Numbers**
1	2	<25
2	4	25-30

3	6	31-34
4	7	35-38
5	8	39-43
6	9	44-49
7	10	>49

Scoring for Partial Curl Up - 30 seconds Test for Females

Level	Benchmark Score	Numbers
1	2	<18
2	4	18-24
3	6	25-28
4	7	29-32
5	8	33-36
6	9	37-43
7	10	>43

Push Ups for Male/Modified Push Ups for Female How to Perform:

1. A standard push up begins with the hands and toes touching the floor, the body and legs in a straight line, feet slightly apart, the arms at shoulder width apart, extended and at a right angle to the body.
2. Keeping the back and knees straight, the subject lowers the body to a predetermined point, to touch some other object, or until there is a 90-degree angle at the elbows, then returns back to the starting position with the arms extended.
3. This action is repeated, and the test continues until exhaustion, or until they can do no more in rhythm or have reached the target number of push-ups.
4. For Female: push-up technique is with the knees resting on the ground.

Infrastructure/Equipment Required:

- Flat clean cushioned surface/Gym mat

Scoring: Record number of correctly completed pushups.

Scoring for Push Ups for Male

Level	Benchmark Score	Numbers
1	2	<4

2	4	04- 10
3	6	11 -18
4	7	19-34
5	8	35-46
6	9	47-56
7	10	>56

2 Km Run/Walk How to Perform:

1. Participants are instructed to run or walk 2 kms in the fastest possible pace.
2. The participants begin on signal (Starting point)- “ready, start”. As they cross the finish line elapsed time should be announced to the participants.
3. Walking is permitted but the objective is to cover the distance in the shortest possible time.

Infrastructure/Equipment Required:

- Stopwatch, whistle, marker cone, lime powder, measuring tape, 200 or 400 m with 1.22 m (minimum 1 m) width preferably on a flat and even playground with a marking of starting and finish line. You can also use any application on your mobile phone that tells you the distance.

Scoring: Time taken for completion (Run or Walk) in min, sec.

Scoring for 2Km Run/walk for Male

Level	Benchmark Score	Minutes: Seconds
1	2	> 11:50
2	4	10:42
3	6	09:44
4	7	08:59
5	8	08:33
6	9	07:37
7	10	>07:37

Scoring for 2Km Run/walk for Female

Level	**Benchmark Score**	**Minutes: Seconds**
1	2	>13:47

2	4	12:51
3	6	12:00
4	7	11:34
5	8	10:42
6	9	09:45
7	10	>09:45

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**	ESC

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

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	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

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 Workand 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)	1:0:2:0	**ESE Marks**	-
Credits	1	**Exam Hours**	-
Prerequisites (if any)	None	**Course Type**	Theory + Lab

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 I- (6 Hrs) Introduction to Idea Lab & Design Thinking** **Introduction to Idea Lab & Design Thinking** **IDEA Lab:** Objectives, structure, interdisciplinary innovation culture. **Design Thinking Basics:** Empathize → Define → Ideate → Prototype → Test. **Problem Identification:** Observation, need analysis, pain–gain chart.	2L+4P= 6

	Lab Activity: Students (3 per team) identify one problem statement and generate two solution ideas. Familiarization with IDEA Lab Equipment (3D printer, laser cutter, basic electronics bench, IoT kit).	
2	**MODULE II (6 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. Assignment 1: 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+4P= 6
3	**MODULE 3 (6 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, Any Logic, Node-RED, Unity, Blender, Autodesk Fusion 360 (Any two tools) **Assignment II- 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+4P= 6
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.	2L+4P= 6

Course Assessment Method

(CIE: 40 Marks, ESE: 60 Marks)

Continuous Internal Evaluation Marks (CIE):

Assignment I (Practical)	Assignment II (Practical)	Internal Lab Examination	Micro Project	Total
10	10	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 role of Idea Lab in promoting creativity, design thinking, and interdisciplinary innovation.	2
CO2	Apply structured problem identification, ideation, and concept development methods.	3
CO3	Demonstrate basic prototyping skills using common Idea Lab tool	4
CO4	Understand the architecture, components, and applications of Digital Twin systems.	2
CO5	Develop simple digital models and analyse them through simulations using suitable software.	4
CO6	Create a micro-project combining Idea Lab and Digital Twin concepts.	6

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	3	3	2								2
CO2	3	3	2								2
CO3	3	3	2								2
CO4	3	3	2			2		2	3		2

CO5	3	3	2			2		2	2		2
CO6	3	3	2			2		2	2		2

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 Organizations and Inspires Innovation,	Tim Brown	Harper Collins,	2nd Edition, 2019
2	Digital Twin: A Complete Guide	John Stark	Springer	1st Edition, 2019
3	Digital Twin for Industry 4.0 Applications	Arun Solanki, Parag Kulkarni & Debasis Samanta	CRC Press, 2023.	1st Edition, 2023

Reference Books

Sl. No.	Title of the Book	Name of the Author(s)	Name of the Publisher	Edition and Year
1	Digital Twin Driven Smart Design	Jorge L. Hurtado	Elsevier	1st Edition, 2021
2	Product Design and Development	Karl T. Ulrich & Steven D. Eppinger	McGraw-Hill	7/e, 2020
3	Digital Twin Technologies: A Primer for Engineers and Researchers	Saad Albahlal	Wiley	1st Edition, 2022
4	AICTE IDEALAB Handbook		AICTE, New Delhi	2022

Video Links (NPTEL, SWAYAM, etc.)

Module No.	Link
1	Design thinking (https://nptel.ac.in/courses/110106124?utm)

2	Lec 31:- Digital Twin (https://www.youtube.com/watch?v=3cCOB_W1CH0&t=7s) Dr. Debabrata Sikdar Dept. of Electronics and Electrical Engineering IIT Guwahati