



Bachelor of Engineering in Industrial IOT

Scheme and Syllabus
(2025 Scheme)

III Semester



VISION OF THE INSTITUTE

Be an Institution of Excellence with International Standards.

MISSION OF THE INSTITUTE

- Impart quality education, along with industrial exposure
- Provide world-class facilities to undertake research activities relevant to industrial and professional needs.
- Promote Innovation, Entrepreneurship and Value-added education that is socially relevant, along with economic benefits.

VISION OF THE DEPARTMENT

To be a department of academic excellence, by imparting quality education, and carrying out Industrial research and technology development in frontier areas of Internet of Things.

MISSION OF THE DEPARTMENT

- **Professional Growth:** To shape our students into hardcore professionals who would become effective leaders and noteworthy innovators in the technological area of Internet of Things.
- **Lifelong Learning:** To motivate and encourage our students to engage in lifelong learning which would help them keep pace with contemporary developments in their fields of operation and enable them to leverage on the power of this knowledge to become outstanding performers in whatever careers they choose.
- **Teamwork:** To inculcate creative thinking in our students, through innovative group work exercises which will bring out their entrepreneur skills and Research capabilities, and increase their Employability potential.
- **Skill Development:** To enable our students to develop skills through which they can solve complex technological problems of current times, and also provide a framework for promoting collaborative and multidisciplinary activities.

PROGRAM OUTCOMES:

1. **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.
3. **Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required.
4. **Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions.
5. **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems.
6. **The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.
7. **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws.
8. **Individual and Collaborative Teamwork:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. **Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
10. **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

11. **Life-Long Learning:** Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS):

- **Professional Development:** Our Graduates will obtain the theoretical and practical acumen to excel in their careers in Internet of Things and associated industries. They will also be adequately equipped for higher education and research.
- **Attitude towards Lifelong Learning:** Our Graduates will develop the attitude and ability to continuously keep enhancing their technical capabilities so that they can face the ever-changing technological challenges.
- **Technical Innovation:** Our Graduates will emerge as creative and innovative engineers, who will use their teamwork and management skills to conceptualize and deliver products of varying complexities.

PROGRAM SPECIFIC OUTCOMES (PSOS):

- **Core Competency:** Our Graduates will gain a solid foundation in the analysis, design and implementation of IOT devices, Cloud networking, Data Analytics and Embedded systems.
- **Interpretation Skills:** Our Graduates will acquire the skills necessary to design, verify and validate IOT functional elements for a variety of applications, along with the ability to interpret and communicate results, effectively.

MVJ College of Engineering, Bengaluru (Autonomous)
B.E. in Industrial IOT - Scheme 2025
 Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)
 (Applicable for 2025-26 admitted students)

Semester - III

Sl. No	Course	Course Code	Course Title	Teaching & Learning Scheme					Examination				Credits
				CI		LI	TW & SL	# TH / S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	ASC	MVJ25EC31	Probability and Transformation Techniques	56	0	0	64	120	3	50	50	100	4
2	IPCC	MVJ25IO32	Data Structures and Algorithms	42	0	28	50	120	3	50	50	100	4
3	PCC	MVJ25IO33	Analysis and Design of Digital Systems	56	0	0	64	120	3	50	50	100	4
4	PCC	MVJ25IO34	Sensor and Instrumentation	56	0	0	64	120	3	50	50	100	4
5	PCC	MVJ25IO35	Computer Organization and Architecture	42	0	0	48	90	3	50	50	100	3
6	PCCL	MVJ25IOL36	Digital Electronics Laboratory	0	0	28	2	30	3	50	50	100	1
7	AEC	MVJ25AECK37	Sustainable Engineering and SDGs	14	0	0	16	30	2	50	50	100	1
8	SDL	MVJ25EC38SL	LabVIEW for ECE	0	0	28	2	30	3	50	50	100	1
9	NCCMC	MVJ25PE39	Physical Education (PE) (Sports and Athletics)	0	0	0	28	28	---	100	---	100	PP
		MVJ25YO39	Yoga										
10	NCCMC	MVJ25MATDIP310	Additional Mathematics – I*	28	0	0	0	28	---	100	---	100	0
TOTAL													22

*Applicable for Lateral entry students only

MVJ College of Engineering, Bengaluru (Autonomous) B.E. in Industrial IOT - Scheme 2025 Outcome-Based Education (OBE)and Choice-Based Credit System (CBCS) (Applicable for 2025-26 admitted students)													
Semester – IV													
Sl. No	Course	Course Code	Course Title	Teaching & Learning Scheme					Examination				Credits
				CI		LI	TW & SL	# TH / S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	SL						
1	PCC	MVJ25EC41	Control Systems	56	0	0	64	120	3	50	50	100	4
2	IPCC	MVJ25IO42	Industrial Internet of Things	42	0	28	50	120	3	50	50	100	4
3	PCC	MVJ25IO43	Principles of Communication Systems	56	0	0	64	120	3	50	50	100	4
4	PCC	MVJ25IO44	Machine Learning	56	0	0	64	120	3	50	50	100	4
5	PCCL	MVJ25IOL45	Machine Learning Laboratory	0	0	28	2	30	3	50	50	100	1
6	BSC	MVJ25BI46	Biology for Engineers	28	0	0	32	60	2	50	50	100	2
7	AEC	MVJ25AECK47	Scientific Foundation of Health	14	0	0	16	30	2	50	50	100	1
8	SDL	MVJ25EC48SL	Semiconductor Devices Simulation Lab	0	0	28	2	30	3	50	50	100	1
9	NCMC	MVJ25PE49	Physical Education (PE) (Sports and Athletics)	0	0	0	28	28	---	100	---	100	PP
		MVJ25YO49	Yoga										
10	NCMC	MVJ25MATDIP410	Additional Mathematics – II*	28	0	0	0	28	---	100	---	100	0
TOTAL													21

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Semester – V

Sl. No	Course	Course Code	Course Title	Teaching & Learning Scheme					Examination				Credits
				CI		LI	TW & SL	# TH / S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	HSMC	MVJ25IO51	Software Engineering and Project Management	42	0	0	48	90	3	50	50	100	3
2	IPCC	MVJ25IO52	Computer Communication Networks	42	0	28	50	120	3	50	50	100	4
3	PCC	MVJ25IO53	Embedded Systems Design using ARM and RISC Architecture	42	0	0	48	90	3	50	50	100	3
4	PCC	MVJ25IO54	IoT & Wireless Sensor Networks	42	0	0	48	90	3	50	50	100	3
5	PEC	MVJ25IO55X	Professional Elective Course-I	42	0	0	48	90	3	50	50	100	3
6	BSC	MVJ25RM56	Research Methodology and IPR (Online)	28	0	0	32	60	2	50	50	100	2
7	AEC	MVJ25AECK57	Ability Enhancement Course	14	0	0	16	30	2	50	50	100	1
8	SDL	MVJ25EC58SL	MATLAB and Simulink programming and modelling	0	0	28	2	30	3	50	50	100	1
9	PCCL	MVJ25EAL59	ARM Controller and RISC V Processor Laboratory	0	0	28	2	30	3	50	50	100	1
10	SDC	MVJ25HBP510	Hackathon-Based Project	0	0	0	60	60	---	50	50	100	2
TOTAL													23
Professional Elective Course-I													
MVJ25IO55A		Object Oriented Concepts using Java		MVJ25IO55C		Mobile Application Development							
MVJ25IO55B		Cloud Computing and IOT Analytics		MVJ25IO55D		Healthcare IoT & Wearable Technology							

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Semester – VII (Swappable VII and VIII SEMESTER) (SCHEME-A)

Sl. No	Course	Course Code	Course Title	Teaching & Learning Scheme					Examination				Credits
				CI		LI	TW & SL	# TH / S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	MVJ25IO71	Edge Computing	42	0	28	50	120	3	50	50	100	4
2	PEC	MVJ25IO72X	Professional Elective Course-III	42	0	0	48	90	3	50	50	100	3
3	PEC	MVJ25IO73X	Professional Elective Course -IV	42	0	0	48	90	3	50	50	100	3
4	OEC	MVJ25IO74X	Open Elective Course-I	42	0	0	48	90	3	50	50	100	3
5	SDC	MVJ25IO75	Capstone Project - Phase-II	0	0	0	210	210	3	100	100	200	7
6	NCMC	MVJ25IKS76	Indian Knowledge System	14	0	0	14	28	---	100	--	100	PP
7	AEC	MVJ25AECK77	Ability Enhancement Course	14	0	0	16	30	2	50	50	100	1
8	SDL	MVJ25EC78SL	Design Flow for VLSI Chips	0	0	28	2	30	3	50	50	100	1
TOTAL													22
Professional Elective Course-III													
MVJ25IO72A		Block Chain Technology			MVJ25IO72C		Smart Cities						
MVJ25IO72B		MEMS and NANO Technology			MVJ25IO72D		Industrial Robotics & Human-Machine Interaction						
Professional Elective Course-IV													
MVJ25IO73A		Real Time Operating Systems			MVJ25IO73C		Deep Learning						
MVJ25IO73B		Introduction to Agentic AI			MVJ25IO73D		Digital Twin Technologies for IOT						
Open Elective Course-I													
MVJ25IO74A		Sensor Technology			MVJ25IO74C		Medical Electronics						
MVJ25IO74B		Healthcare IoT & Wearable Technology			MVJ25XX74D		Foreign Language (NPTEL/SWAYAM/online VTU)						

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Semester – VIII (Swappable VII and VIII SEMESTER) (SCHEME-A)

Sl. No.	Course	Course Code	Course Title	Teaching & Learning Scheme					Examination				Credits
				CI		LI	TW & SL	# TH / S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PEC	MVJ25IO81X	Professional Elective-V (NPTEL/VTU Online Course)	42	0	0	48	90	3	50	50	100	3
2	OEC	MVJ25IO82X	Open Elective-II (NPTEL/VTU Online Course)	42	0	0	48	90	3	50	50	100	3
3	SDC	MVJ25INT83X	Internship (15 weeks or 90 working days)	--	--	--	--	360	3	100	100	200	9
TOTAL													15

Professional Elective-V

MVJ25IO81A	NPTEL/VTU Online Course	MVJ25IO81C	NPTEL/VTU Online Course
MVJ25IO81B	NPTEL/VTU Online Course	MVJ25IO81D	NPTEL/VTU Online Course
Open Elective-II			
MVJ25IO82A	NPTEL/VTU Online Course	MVJ25IO82C	NPTEL/VTU Online Course
MVJ25IO82B	NPTEL/VTU Online Course	MVJ25IO82D	NPTEL/VTU Online Course

Types of Internships (Course Code: MVJ25INT83X)

Students shall undertake one of the following internship types during the eighth semester, as per academic guidelines:

- MVJ25INT83A – Industry Internship:** Shall involve practical exposure and training within an industrial or corporate setting.
- MVJ25INT83B – Research Internship:** Shall focus on academic or applied research under the guidance of faculty or research institutions.
- MVJ25INT83C – Post-Placement Internship:** Shall be undertaken by students who have secured placement, aligning with their future employment domain.
- MVJ25INT83D – Societal Internship:** Shall engage students in community-based or social impact projects with NGOs, government bodies, or civic organizations.
- MVJ25INT83E – Online Internship:** Shall be conducted through recognized digital platforms offering structured internship modules.
- MVJ25INT83F – Skill Enhancement Internship:** Shall be opted by students unable to secure internships, offering credit equivalence through curated online courses available at <http://www.online.vtu.ac.in>

MVJ College of Engineering, Bengaluru (Autonomous) B.E. in Industrial IOT - Scheme 2025 Outcome-Based Education (OBE)and Choice-Based Credit System (CBCS) (Applicable for 2025-26 admitted students)													
VII and VIII semesters for the candidates who opt for a two-semester internship along with Capstone Project (Scheme B)													
Sl. No.	Course	Course Code	Course Title	Teaching & Learning Scheme					Examination				Credits
				CI		LI	TW & SL	# TH / S	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	MVJ25IO71	Edge Computing	42	0	28	50	120	3	50	50	100	4
2	PEC	MVJ25IO72X	Professional Elective Course-III (NPTEL/VTU Online Course)	42	0	0	48	90	--	50	50	100	3
3	PEC	MVJ25IO73X	Professional Elective Course-IV (NPTEL/VTU Online Course)	42	0	0	48	90	--	50	50	100	3
4	OEC	MVJ25IO74X	Open Elective Course -I (NPTEL/VTU Online course)	42	0	0	48	90	---	50	50	100	3
5	SDC	MVJ25IO75	Capstone Project - Phase-II	0	0	0	210	210	3	100	100	200	7
6	NCMC	MVJ25IKS76	Indian Knowledge System (VTU online)	14	0	0	14	28	--	100	--	100	PP
7	AEC	MVJ25AECK77	Ability Enhancement Course	14	0	0	16	30	2	50	50	100	1
8	SDL	MVJ25EC78SL	Design Flow for VLSI Chips	0	0	28	2	30	3	50	50	100	1
Total													22
1	PEC	MVJ25IO81X	Professional Elective-V (NPTEL/VTU Online Course)	42	0	0	48	90	---	50	50	100	3
2	OEC	MVJ25IO82X	Open Elective-II (NPTEL/VTU Online Course)	42	0	0	48	90	---	50	50	100	3
3	SDC	MVJ25INT83X	Internship (Two- semester internship for a minimum Period of 180 working days or -30 weeks)	--	--	--	--	360	3	50	50	100	9
Total													15
VII semester and VIII semester Credits Total													37

Professional Elective Course-III			
MVJ25IO72A	NPTEL/VTU Online Course	MVJ25IO72C	NPTEL/VTU Online Course
MVJ25IO72B	NPTEL/VTU Online Course	MVJ25IO72D	NPTEL/VTU Online Course
Professional Elective Course-IV			
MVJ25IO73A	NPTEL/VTU Online Course	MVJ25IO73C	NPTEL/VTU Online Course
MVJ25IO73B	NPTEL/VTU Online Course	MVJ25IO73D	NPTEL/VTU Online Course
Open Elective Course-I			
MVJ25IO74A	NPTEL/VTU Online Course	MVJ25IO74C	NPTEL/VTU Online Course
MVJ25IO74B	NPTEL/VTU Online Course	MVJ25IO74D	NPTEL/VTU Online Course
Professional Elective Course-V			
MVJ25IO81A	NPTEL/VTU Online Course	MVJ25IO81C	NPTEL/VTU Online Course
MVJ25IO81B	NPTEL/VTU Online Course	MVJ25IO81D	NPTEL/VTU Online Course
Open Elective Course-II			
MVJ25IO82A	NPTEL/VTU Online Course	MVJ25IO82C	NPTEL/VTU Online Course
MVJ25IO82B	NPTEL/VTU Online Course	MVJ25IO82D	NPTEL/VTU Online Course

Types of Internships (Course Code: MVJ25INT83X)

Students shall undertake one of the following internship types during the eighth semester, as per academic guidelines:

1. **MVJ25INT83A – Industry Internship:** Shall involve practical exposure and training within an industrial or corporate setting.
2. **MVJ25INT83B – Research Internship:** Shall focus on academic or applied research under the guidance of faculty or research institutions.
3. **MVJ25INT83C – Post-Placement Internship:** Shall be undertaken by students who have secured placement, aligning with their future employment domain.
4. **MVJ25INT83D – Societal Internship:** Shall engage students in community-based or social impact projects with NGOs, government bodies, or civic organizations.
5. **MVJ25INT83E – Online Internship:** Shall be conducted through recognized digital platforms offering structured internship modules.
6. **MVJ25INT83F – Skill Enhancement Courses (SEC):** Shall be opted by students unable to secure internships, offering credit equivalence through curated online courses available at [http:// www.online.vtu.ac.in](http://www.online.vtu.ac.in)

To ensure uniformity, quality, and transparency in the internship process, **VTU has launched a centralized web portal** that serves as a **single platform** for all internships opportunities. Reputed **industries, Centers of Excellence, Research Laboratories**, and other recognized bodies will be registered on this portal. **Students must choose internships exclusively through this portal. No other mode of internship selection will be permitted.**

B.E, Industrial IOT

Probability and Transformation Techniques			
Course Code	MVJ25EC31	Scheme	2025
Type of Course	ASC	Semester	III
Teaching Hours/Week (L:T:P)	4:0:0	CIE Marks	50
Total Hours of Pedagogy (L:T:P:SL&TW)	56:0:0:64	SEE Marks	50
Credits	4	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Objectives: This course will give ability to: • Apply discrete and continuous probability distributions in analysing the probability models arising in engineering field. • Understand the concepts of Complex variables and transformation for solving Engineering Problems. • Demonstrate and present data using statistical method and fit the best curve for the data.			
Syllabus			
This course equips students with the ability to apply Discrete and continuous probability distributions to analyse engineering systems, signal behaviour, and data-driven models. It strengthens their understanding of complex variables and transformations, enabling effective problem-solving in areas such as communication systems, circuit design, and embedded technologies. Additionally, it develops skills in statistical analysis, data interpretation, and curve fitting, which are essential for performance evaluation, optimization, and decision-making in modern electronic and IoT-based applications.			
Course Plan			
Module I			
Probability Theory			
S. No	Topics to be covered		Hours required
1	Random variables for discrete and continuous time functions.		12
2	probability density function.		
3	Cumulative density function.		
4	Probability Distributions: Binomial distribution.		
5	Poisson distribution. Normal distribution, Exponential distribution.		
6	Joint probability distributions.		
Module II			
Complex Variables			
S. No	Topics to be covered		Hours required
1	Functions of complex variables, Analytic function, Properties of analytic functions.		11
2	Cauchy-Riemann equations in Cartesian form and polar coordinates.		
3	Construction of analytic function by using Milne-Thomson method.		
4	Transformations: Bi-linear Transformation, Conformal Transformation.		
5	Discussion of the transformations: $w = z^2$, $w = e^z$ and $w = z + \frac{1}{z}$ ($z \neq 0$).		
Module III			
Fourier series			
S. No	Topics to be covered		Hours

		required
1	Definition of Periodic functions, Dirichlet's condition.	11
2	Fourier series of periodic functions of period 2π .	
3	Fourier series of periodic functions of arbitrary period $2c$.	
4	Half-range Fourier Sine and cosine series.	
5	Practical Harmonic Analysis and Problems.	
Module IV		
Fourier transforms and Z-transforms		
S. No	Topics to be covered	Hours required
1	Infinite Fourier transforms, Fourier sine and cosine transform.	11
2	Inverse Fourier cosine and sine transform.	
3	Definition of Z-transforms, standard z-transforms, Damping, and shifting rules.	
4	Inverse Z-transforms by the partial fraction method.	
5	Solving difference equations by using Inverse Z-transform.	
Module V		
Statistical and Sampling theory		
S. No	Topics to be covered	Hours required
1	Definition of Correlation, Regression coefficients.	11
2	Line of regression problems.	
3	Fitting of the curves in the form $y = ax + b$ by the method of least squares.	
4	Sampling, Sampling distributions, Standard error.	
5	Student's t-distribution.	
6	Chi-square distribution.	
Textbooks:		
1. B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.		
2. G.B.Gururajachar, "Engineering Mathematics-III" Academic Excellent Series Publications, 2016.		
Reference Books:		
1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.		
2. B.V. RAMANA, "Higher engineering mathematics", Tata McGraw-Hill.		
3. R.K. Jain and S.R.K. Iyengar, "advanced engineering mathematics", Narosa Publishing House, 5th Edition.		
Course Outcomes:		
At the end of the course, the student will be able to:		
CO1: Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory and Design engineering.		
CO2: Understand the analytic functions and application of Bi-linear, Conformal Transformation.		
CO3: Communications, Know the use of periodic signals and Fourier series to analyze circuits and system.		
CO4: To use and to apply Fourier Transform, Z-Transform techniques to solve difference equations in Engineering.		
CO5: Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.		

CO-PO Mapping

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

High-3: Medium-2: Low-1

The Evaluation Method

Continuous Internal Evaluation (CIE):

- Three Internal Tests will be conducted for 50 marks each and average of three will be taken. The student should score minimum 30% marks of the average of the three tests to avoid NSSR. **(A)**.
- Alternative Assessment Tools (AAT) are used to complete a project / Quiz/Seminar / Presentation/ other suitable alternate assessment method for 30 marks. Two evaluations will be conducted **(B)**.
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks **(C)**.

Final CIE Marks will be calculated as $(A+B+C)/2$ for 50 marks.

Semester End Examination (SEE):

The question paper consists of two parts, A and B.

Part A: Consists of 10 questions (2 questions from each module) of 2 marks each.

Part B: The question paper should have 10 questions. Each question carries 16 marks. There should be 2 questions from each module, with a maximum of 2 subdivisions. Students must answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

Final mark for the course is sum of the CIE and SEE Marks.

B.E, Industrial IoT

Semester: III			
Data Structures and Algorithms			
Course Code	MVJ25IO32	Scheme	2025
Type of Course	IPCC	Semester	III
Teaching Hours/Week (L:T:P)	4:0:2	CIE Marks	50
Total Hours of Pedagogy (L:T:P:SL&TW)	42:0:28:50	SEE Marks	50
Credits	4	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Objectives: This course will give ability to: • Understand the fundamentals of data structures and their applications in logic building and project assessment. • Understand the concept of linked lists and sorting techniques. • Acquire the knowledge of algorithms of queues and stacks. • Analyze the concepts of Binary trees. • To Understand Graphs and its algorithms.			
Syllabus			
This course covers the fundamentals of data structures and algorithms, including asymptotic notations, properties, complexity classes and types of algorithms. The course also includes various searching and sorting techniques. It introduces linear data structures such as Linked List, Stack and Queue and the non-linear data structures such as Binary Search trees and Graphs.			
Course Plan			
Module I - Algorithm Analysis & Searching			
Sr. No	Topics to be covered		Hours required
1	Data Structures, ADT, what is an algorithm		8 Hrs
2	How to compare algorithms, Rate growth		
3	Types of analysis, Asymptotic Notation		
4	Performance Analysis: Space complexity, Time complexity		
5	Guidelines for asymptotic analysis.		
6	Searching Techniques: Linear Search and Binary Search (Chapter 1 (1.1-1.3), Chapter 5 (5.1–5.3) and Chapter (6.1–6.3). of Textbook 1)		
Module II- Linked Lists & Sorting			
Sr. No	Topics to be covered		Hours required
1	Linked Lists: Definition, Linked list operations		8 Hrs
2	Traversing, Searching, Insertion, and Deletion		
3	Doubly Linked lists and its operations		
4	Circular linked lists and its operations.		
5	Sorting Techniques: Bubble Sort, Insertion Sort, Selection Sort, Quick Sort and Merge Sort (Chapter 6 (6.4–6.9) , 7, 10, 13 of Textbook 1)		
Module III– Stacks & Queues			
Sr. No	Topics to be covered		Hours required
1	Stacks: Definition, Stack Implementation using arrays/lists and linked lists		8 Hrs
2	Stack Operations (Insertion and Deletion), Array Representation of Stacks		
3	Stack Applications: Infix to postfix conversion, Tower of Hanoi.		
4	Queues: Definition, Array Representation, Queue Implementation using arrays/lists and linked		

	lists	
5	Circular Queues and its operations, Priority Queues and its operations. (Chapter 8 (8.1–8.6), 9, 12 of Textbook 1)	
Module IV– Trees & Heaps		
Sr. No	Topics to be covered	Hours required
1	Trees: Terminology, Binary Trees, Types of Binary trees, Properties of Binary trees,	9 Hrs
2	Array Representation of Binary Trees, Binary Tree Traversals – Inorder, Postorder, Preorder	
3	Binary Search Trees – Definition, Insertion, Deletion, Searching, Implementation of Binary tree	
4	Heaps and Heap Sort	
5	Construction of Expression Trees, AVL Trees. (Chapter 14, 15 of Textbook 1 and Chapter 6, 7 of Text 2)	
Module V– Graph Algorithms		
Sr. No	Topics to be covered	Hours required
1	Graphs: Definitions, Terminologies	9 Hrs
2	Matrix and Adjacency List Representation of Graphs and operations	
3	Traversal methods: Breadth First Search and Depth First Search	
4	DAG, Minimum Spanning Trees: Prim – Kruskal algorithm	
5	Single Source Shortest Path: Weighted graphs, Dijkstra algorithm. (Chapter 9 (9.1-9.9))	
Lab Experiments		
- Write a Python program for implementing the following searching techniques. - Linear Search - Binary Search - Write a Python program for implementing the following sorting techniques. - Bubble Sort - Selection Sort - Insertion Sort - Write a Python program for implementing the following sorting techniques. - Quick Sort - Merge Sort - Write a Python program to design and implement Linked List and its operations. - Write a Python program to design and implement Circular Linked List and its operations. - Write a Python program to i. Design and implement Stack and its operations using List. ii. Design and implement Queue and its operations using List. - Write a Python program for the following stack applications: - Infix to postfix conversion - Tower of Hanoi - Write a Python program to implement the following: - Create a Binary Search Tree - Tree Traversals: Inorder, Preorder, Postorder. - Determine the height of the tree. - Count the number of elements of tree. - Write a Python program to implement the following graph traversal algorithms: i. BFS ii. DFS		
Textbooks:		
- Rance D. Necaie “Data Structures and Algorithms Using Python”, 2nd Edition, Wiley, John Wiley and Sons. - Narasimha Karumanchi “Data Structures and Algorithms Made Easy”, 5th Edition, CareerMonk Publications.		
Reference Books:		
- Michael T. Goodrich, R. Tamassia and Michael H Goldwasser “Data structures and Algorithms in python”,Wiley student edition, John Wiley and Sons. - Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed “Fundamentals of Data Structures in C”, W. H. Freeman and Computer Science Press.		
Other References:		
https://nptel.ac.in/courses/106/106/106106127/		
https://nptel.ac.in/courses/106105085/		

Course Outcomes:

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

CO1: Explain the fundamental programming concepts of Python including variables, control flow, functions, and modules, along with basic data structures and algorithm principles.

CO2: Apply searching and sorting techniques using arrays, pointers, and linked lists to solve basic computational problems efficiently.

CO3: Analyze the performance of various data structures such as stacks, queues, and trees by examining their operations and time-space complexities..

CO4: 1). Evaluate tree and graph data structures including traversal techniques and algorithms like Dijkstra's, Prim's, and Kruskal's for different computational problems and 2). Create efficient and modular programs using advanced data structures such as trees and graphs to address complex computational tasks.

CO5: Sustainable Development Goal (SDG 3)

Design a health-focused data management system or analytics tool using data structures and algorithms to promote awareness, monitoring, or solutions that contribute to good health and well-being

CO-PO Mapping

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

High-3: Medium-2: Low-1

Stacks: Definition, Stack Implementation using arrays/lists
Stack Operations: Push, Pop, Array Representation of Stacks
Stack Applications: Infix to Postfix Conversion, Tower of Hanoi
Queues: Definition, Queue Operations, Array Representation, Queue Implementation using arrays/lists
Circular Queues and its operations, Priority Queues and its operations.

Evaluation Method

Continuous Internal Evaluation (CIE):

Three Internal Tests will be conducted for 50 marks each and average of three will be taken. The student should score minimum 30% marks of the average of the three tests to avoid NSSR. (A).

Alternative Assessment Tools (AAT) are used to complete a project / Quiz/ Seminar cum Presentation / other suitable alternate assessment methods for 30 marks. Two evaluations will be conducted (B).

Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C).

Final CIE Marks will be calculated as $(A+B+ C)/2$ for 50 marks.

Semester End Examination (SEE):

The question paper consists of two parts, A and B.

Part A: Consists of 10 questions (2 questions from each module) of 2 marks each.

Part B: The question paper should have 10 questions. Each question carries 16 marks. There should be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The Final mark for the course is sum of the CIE and SEE Marks.

Course delivery methods		Assessment methods	
1	Chalk and Talk	1	IA tests
2	PPT and Videos	2	Open Book Assignments (OBA)/ Lab Project
3	Flipped Classes	3	Lab Test
4	Practice session/Demonstrations in Labs	4	Semester End Examination
5	Virtual Labs (if present)		

B.E, Industrial IOT

Semester: III			
Analysis and Design of Digital Systems			
Course Code	MVJ25IO33	Scheme	2025
Type of Course	PCC	Semester	III
Teaching Hours/Week (L:T:P)	4:0:0	CIE Marks	50
Total Hours of Pedagogy (L:T:P:SL&TW)	56:0:0:64	SEE Marks	50
Credits	4	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Objectives:			
This course will give ability to:			
- Identify with the simplification techniques & design various combinational digital circuits using logic gates. - Develop the analysis and design procedures for synchronous and asynchronous sequential circuits. - Analyzing & designing different applications of Combinational & Sequential Circuits - Analyzing & designing sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines - Knowledge of the importance of programmable devices used for designing digital circuits.			
Syllabus			
This course covers the fundamentals of digital logic design, starting with combinational logic principles, canonical forms, K-maps, and logic minimization techniques. It progresses to the design and analysis of combinational circuits such as adders, subtractors, multiplexers, encoders, and decoders. The syllabus then introduces flip-flops, registers, and counters, followed by sequential circuit design using FSMs, counters, and timing analysis. Finally, it focuses on practical applications including sequence detectors, code converters, arithmetic circuits, and an introduction to programmable logic devices (PLA, PAL, FPGA).			
Course Plan			
Module I - Principles of combinational logic			
Sr. No	Topics to be covered		Hours required
1	Introduction to Digital Logic, Combinational Logic, Canonical Forms		11 Hrs
2	Generation of Switching Equations from Truth Tables		
3	Karnaugh Maps – 3 and 4 Variables		
4	Incompletely Specified Functions – Don't Care Terms		
5	Quine-McCluskey Minimization Technique – 3 and 4 Variables.		
Module II - Design and Analysis of combinational logic			
Sr. No	Topics to be covered		Hours required
1	Full Adder & Full Subtractor		11 Hrs
2	Parallel Adder and Parallel Subtractor		
3	Look ahead carry Adder		
4	Binary comparators, Decoders & Encoders		
5	Multiplexers as minterm / maxterm Generator.		
6	Code Converters – Binary to Gray, Gray to Binary, BCD to Excess-3 and Excess-3 to BCD		
7	Binary Multiplier.		
Module III - Flip-Flops and its Applications			
Sr. No	Topics to be covered		Hours required
1	Latches and Flip Flops (SR, JK, D and T)		
2	Master-Slave JK flip-flop		

3	Timing concerns in sequential circuits	12 Hrs
4	Shift Registers: SISO, SIPO, PISO PIPO	
5	Universal shift register	
6	Counters: Synchronous and Asynchronous (Up, Down, Up/Down).	
7	Up, Down and Up/Down Counters and their Specifications	
8	Sequential Generators – Ring and Johnson Counters	

Module IV - Sequential Circuit Design

Sr. No	Topics to be covered	Hours required
1	Characteristic equations – SR, JK, D, T Flip Flop	11 Hrs
2	Finite State Machines, Design of one flip flop using other flip flop	
3	Mealy & Moore Models	
4	Guidelines for construction of state graphs, Design Example	
5	Sequence Detector – Basic Design Concept	
6	Design of One Flip-Flop Using Another Flip-Flop.	

Module V - Applications of Digital Circuits

Sr. No	Topics to be covered	Hours required
1	Construction and Analysis of State Graphs – Design Examples	11 Hrs
2	Programmable Logic Devices – PLA and PAL	
3	Field Programmable Gate Arrays (FPGA) – Introduction and Architecture	
4	FPGA-Based Digital Logic Implementation – Basic Design Concepts.	

Textbooks:

1. John M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 2001.
2. Donald D. Givone, “Digital Principles and Design”, McGraw Hill, 2002.

Reference Books:

1. Charles H Roth Jr., Larry L. Kinney —Fundamentals of Logic Design, Cengage Learning, 7th Edition.
2. Morris Mano, —Digital Design, Prentice Hall of India, Third Edition.

Other References:

1. <https://nptel.ac.in/courses/108105113>
2. https://onlinecourses.nptel.ac.in/noc26_ee54/preview

Course Outcomes:

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

CO1: Illustrate simplification of Algebraic equations using K-map & Quine-McCluskey Technique.

CO2: Design the combinational logic circuits.

CO3: Analyse & design different applications of Combinational & Sequential Circuits to meet desired need within realistic constraints.

CO4: Design the sequential circuits using SR, JK, D, T flip-flops and Mealy & Moore machines

CO5: Understand the digital applications by conducting experiments.

CO-PO Mapping

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

High-3: Medium-2: Low-1

Evaluation Method:

Continuous Internal Evaluation (CIE):

- Three Internal Tests will be conducted for 50 marks each and average of best two will be taken. The student should score minimum 30% marks of the average test score to avoid NSSR. **(A).**
- Alternative Assessment Tools (AAT) should be a project / Quiz/ Seminar cum Presentation / other suitable alternate assessment methods for 30 marks. Two evaluations will be conducted **(B).**
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks **(C).**

Final CIE Marks will be calculated as $(A+B+ C)/2$ for 50 marks. :

Semester End Examination (SEE):

The question paper consists of two parts, A and B.

Part A: Consists of 10 questions (2 questions from each module) of 2 marks each.

Part B: The question paper should have 10 questions. Each question carries 16 marks. There should be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The Final mark for the course is sum of the CIE and SEE Marks.

Course delivery methods		Assessment methods	
1	Chalk and Talk	1	IA tests
2	PPT and Videos	2	Open Book Assignments (OBA)/ Lab Project
3	Flipped Classes	3	Lab Test
4	Practice session/Demonstrations in Labs	4	Semester End Examination
5	Virtual Labs (if present)		

B.E, Industrial IOT

Semester: III			
Sensor and Instrumentation			
Course Code	MVJ25IO34	Scheme	2025
Type of Course	ASC	Semester	III
Teaching Hours/Week (L:T:P)	4:0:0	CIE Marks	50
Total Hours of Pedagogy (L:T:P:SL&TW)	56:0:0:64	SEE Marks	50
Credits	4	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Objectives:			
This course will give ability to:			
- Understand the basic concepts of transducers. - Identify the mathematical model of transducer and its response for various inputs. - Understand the construction and working principle of resistive type transducers. - Infer knowledge on capacitive type and inductive type transducer. - Understand the construction and working principle of sensors and its real time applications.			
Syllabus			
This syllabus covers measurement systems, error analysis, and transducer principles, including static and dynamic characteristics, modelling, and response analysis. It also includes various sensors, smart sensing technologies, MEMS, environmental monitoring, and actuator systems used in automation, robotics, and real-world applications.			
Course Plan			
Module I			
Sr. No	Topics to be covered	Hours required	
1	General block diagram of measurements systems – Methods of measurements	11 Hrs	
2	Introduction to sensors and actuators		
3	Classification and selection of transducers		
4	Error analysis, Statistical methods		
5	Odds and uncertainty		
6	Classification of instruments, applications of measurement systems		
Module II			
Sr. No	Topics to be covered	Hours required	
1	Static characteristics – Accuracy, precision, resolution, sensitivity, linearity	11 Hrs	
2	Dynamic characteristics		
3	Mathematical model of transducer – Zero, first and second order transducers		
4	Response for impulse, step, ramp and sinusoidal inputs		
Module III			
Sr. No	Topics to be covered	Hours required	
1	Principle of operation – Construction details – Characteristics and application of resistance potentiometer	12 Hrs	

2	Strain gauge, Resistance thermometer	
3	Thermistor, Hot-wire anemometer	
4	Humidity sensors	
5	Induction potentiometer, Variable reluctance transducers – LVDT	
Module IV		
Sr. No	Topics to be covered	Hours required
1	Capacitive transducer and types – Capacitor microphone, Frequency response	11 Hrs
2	Piezoelectric transducer – Hall effect transducer	
3	Magnetostrictive – Digital transducers	
4	Fiber optic sensors – Thick and thin film sensors (Bio sensor and chemical sensor)	
5	Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification	
Module V		
Sr. No	Topics to be covered	Hours required
1	Environmental monitoring sensors (Water quality and air pollution)	12 Hrs
2	Photo electric transducer – Vibration sensor	
3	Ultrasonic based sensors	
4	Introduction to MEMS and Nanotechnology – Applications – Robotics – Home appliance.	
5	Actuators: Pneumatic and Hydraulic Actuation Systems, Valves, Rotary actuators, Mechanical Actuation Systems Electrical Actuation Systems.	
Textbooks:		
1. “A Course in Electrical and Electronics Measurements and Instrumentation”, Sawhney A K, Dhanpat Rai and Sons, New Delhi, 2013		
Reference Books:		
1. “Sensors and Transducers”, Patranabis D, Prentice Hall of India, Second Edition, 2010		
2. “Transducers and Instrumentation”, Murthy D V S, Prentice Hall of India, New Delhi, Second Edition, 2010.		
Course Outcomes:		
At the end of the course, the student will be able to:		
CO1: Choose appropriate sensors for the measurement of various physical parameters.		
CO2: Find the mathematical model of the transducer and its response for various inputs.		
CO3: Choose appropriate resistive type transducer for the measurement of various physical parameters.		
CO4: Select capacitive and inductive type transducers for the measurement of various physical parameters.		
CO5: Select the suitable type of sensors for real time applications.		

CO-PO Mapping

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

High-3: Medium-2: Low-1

Evaluation Method:

Continuous Internal Evaluation (CIE):

- Three Internal Tests will be conducted for 50 marks each and average of best two will be taken. The student should score minimum 30% marks of the average test score to avoid NSSR. **(A).**
- Alternative Assessment Tools (AAT) should be a project / Quiz/ Seminar cum Presentation / other suitable alternate assessment methods for 30 marks. Two evaluations will be conducted **(B).**
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks **(C).**

Final CIE Marks will be calculated as $(A+B+ C)/2$ for 50 marks. :

Semester End Examination (SEE):

The question paper consists of two parts, A and B.

Part A: Consists of 10 questions (2 questions from each module) of 2 marks each.

Part B: The question paper should have 10 questions. Each question carries 16 marks. There should be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The Final mark for the course is sum of the CIE and SEE Marks.

Course delivery methods		Assessment methods	
1	Chalk and talk	1	IA tests
2	PPT and Videos	2	Open Book Assignments (OBA) / Lab Project
3	Flipped Classes	3	Lab Test
4	Practice session/Demonstrations in Labs	4	Semester End Examination
5	Virtual Labs		

B.E, Industrial IOT

Semester: III			
Computer Organization and Architecture			
Course Code	MVJ25IO35	Scheme	2025
Type of Course	PCC	Semester	III
Teaching Hours/Week (L:T:P)	4:0:0	CIE Marks	50
Total Hours of Pedagogy (L:T:P:SL&TW)	42:0:0:48	SEE Marks	50
Credits	3	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	3
Course Objectives:			
This course will give ability to:			
• Explain the basic sub systems of a computer, their organization, structure and Operation. • Illustrate the concept of programs as sequences of machine instructions. • To understand the different ways of communicating with I/O devices and to introduce memory types including cache memories. • Describe memory hierarchy and concept of virtual memory. • To analyse concepts of Pipelining and other computing systems.			
Syllabus			
This course introduces the fundamental concepts of computer organization and architecture, covering the structure and operation of computer systems, instruction execution, and performance evaluation. It includes topics such as machine instructions, addressing modes, input/output organization, memory hierarchy including cache and virtual memory, and basic processing unit design with pipelining concepts. The course also emphasizes practical understanding through assembly language programming and analysis of system components.			
Course Plan			
Module I			
Sr. No	Topics to be covered		Hours required
1	Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts		8 Hrs
2	Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation.		
3	Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters		
4	IEEE standard for Floating point Numbers, Memory Location and Addresses		
5	Memory Operations, Instructions and Instruction Sequencing.		
Module II			
Sr. No	Topics to be covered		Hours required
1	Addressing Modes: Assembly Language		8 Hrs
2	Basic Input and Output Operations		
3	Stacks and Queues		
4	Subroutines, Additional Instructions.		
Module III			
Sr. No	Topics to be covered		Hours required
1	Input/Output Organization: Accessing I/O Devices		8 Hrs
2	Interrupts – Interrupt Hardware		
3	Enabling and Disabling Interrupts, Handling Multiple Devices		
4	Controlling Device Requests		

5	Direct Memory Access, and Buses.	
Module IV		
Sr. No	Topics to be covered	Hours required
1	Memory System: Basic Concepts	9 Hrs
2	Semiconductor RAM Memories-Internal organization of memory chips, Static memories	
3	Asynchronous DRAMS, Read Only Memories	
4	Cash Memories, Mapping Functions, Replacement Algorithm	
5	Virtual Memories, Secondary Storage-Magnetic Hard Disks.	
Module V		
Sr. No	Topics to be covered	Hours required
1	Basic Processing Unit: Some Fundamental Concepts	9 Hrs
2	Execution of a Complete Instruction, Multiple Bus Organization	
3	Hardwired Control, Micro programmed Control	
4	Pipelining, Basic concepts, Role of Cache memory	
5	Pipeline Performance	
Textbooks: 1. Carl Hamacher, ZvonkoVranesic, SafwatZaky: “Computer Organization”, 6th Edition, TataMcGraw Hill, 2011. 2. "Hamacher, Vranesic & Zaky, Computer Organization, 6th Edition (Tata McGraw Hill, 2011)."		
Reference Books: 1. David A. Patterson, John L. Hennessy: “Computer Organization and Design – The Hardware / Software Interface ARM Edition”, 4th Edition, Elsevier, 2009.		
Other References: 1. https://onlinecourses.swayam2.ac.in/e-learning/preview/nou21_ge41 2. https://elearn.nptel.ac.in/shop/completed-courses/short-term-programs-completed/introduction-to-android-app-development/?utm_source=chatgpt.com&v=13b5bfe96f3e		
Course Outcomes: At the end of the course, the student will be able to: CO1: Identify the functional units of the processor and the factors affecting the performance of a computer. CO2: Demonstrate the ability to classify the addressing modes, instructions sets and design programs. CO3: Understand the different ways of accessing an input / output device including interrupts. CO4: Illustrate the organization of different types of semiconductor and other secondary storage memories. CO5: Illustrate the simple processor organization based on hardwired control and microprogrammed control.		

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	1	-	-	1	-	-	1
CO2	3	3	2	2	-	1	-	-	1	-	-	1
CO3	3	3	2	2	-	1	-	-	1	-	-	1
CO4	3	3	2	2	-	1	-	-	1	-	-	1
CO5	3	3	2	2	-	1	-	-	1	-	-	1

High-3: Medium-2: Low-1

Evaluation Method:

Continuous Internal Evaluation (CIE):

- Three Internal Tests will be conducted for 50 marks each and average of best two will be taken. The student should score minimum 30% marks of the average test score to avoid NSSR. **(A).**
- Alternative Assessment Tools (AAT) should be a project / Quiz/ Seminar cum Presentation / other suitable alternate assessment methods for 30 marks. Two evaluations will be conducted **(B).**
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks **(C).**

Final CIE Marks will be calculated as $(A+B+ C)/2$ for 50 marks. :

Semester End Examination (SEE):

The question paper consists of two parts, A and B.

Part A: Consists of 10 questions (2 questions from each module) of 2 marks each.

Part B: The question paper should have 10 questions. Each question carries 16 marks. There should be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The Final mark for the course is sum of the CIE and SEE Marks.

Course delivery methods		Assessment methods	
1	Chalk and Talk	1	IA tests
2	PPT and Videos	2	Open Book Assignments (OBA)/ Lab Project
3	Flipped Classes	3	Lab Test
4	Practice session/Demonstrations in Labs	4	Semester End Examination
5	Virtual Labs		

B.E, Industrial IOT

Semester: III			
Digital Electronics Laboratory			
Course Code	MVJ25IOL36	Scheme	2025
Type of Course	PCCL	Semester	III
Teaching Hours/Week (L:T:P)	4:0:0	CIE Marks	50
Total Hours of Pedagogy (L:T:P:SL&TW)	0:0:28:2	SEE Marks	50
Credits	1	Total Marks	100
Examination type (SEE)	Practical	Exam Hours	3
Course Objectives: This course will give ability to: - Understand and verify the operation of basic and universal logic gates - Design and analyse combinational logic circuits - Implement code converters - Study and realize sequential logic circuits, including SR, JK, D, and T flip-flops - Design and implement counters, including MOD-N counters			
Sl. No.	Experiments List Design& simulate the Digital Circuits using NI ELVISII+ and NI Multisim		
1.	Verification of Logic Gates and Realization using K-Map for SOP & POS.		
2.	Verification of Full Adder and Full Subtractor.		
3.	Implementation of Binary to Gray Code Converter.		
4.	Realization of SR, JK, D and T flip flops.		
5.	Design of Multiplexer and Demultiplexer.		
6.	Implementation of Encoder using basic gates.		
7.	Implementation of Decoder using basic gates.		
8.	Implementation of MOD-N counter.		
9.	Design and implement 4-bitParallelAdder / Subtractor using IC 7483.		
Course Outcomes: At the end of the course, the student will be able to: CO1: Design and implement combinational arithmetic circuits such as Full Adders and Full Subtractors and analyze their performance. CO2: Implement code conversion circuits (Binary to Gray Code) using fundamental logic gates. CO3: Design, implement, and analyze sequential circuits using SR, JK, D, and T flip-flops, understanding state transitions and clocking behavior. CO4: Implement Multiplexers, Demultiplexers, Encoders and Decoders using basic logic gates and evaluate their functional correctness. CO5: Design and implement MOD-N counters, demonstrating understanding of state diagrams and counter reset logic.			

CO-PO Mapping

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

High-3: Medium-2: Low-1

Evaluation Method:

Continuous Internal Evaluation (CIE):

- Three Internal Tests will be conducted for 50 marks each and average of best two will be taken. The student should score minimum 30% marks of the average test score to avoid NSSR. **(A).**
- Alternative Assessment Tools (AAT) should be a project / Quiz/ Seminar cum Presentation / other suitable alternate assessment methods for 30 marks. Two evaluations will be conducted **(B).**
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks **(C).**

Final CIE Marks will be calculated as $(A+B+ C)/2$ for 50 marks. :

Semester End Examination (SEE):

The question paper consists of two parts, A and B.

Part A: Consists of 10 questions (2 questions from each module) of 2 marks each.

Part B: The question paper should have 10 questions. Each question carries 16 marks. There should be 2 questions from each module, with a maximum of 2 subdivisions. Students have to answer any 5 questions choosing one full question from each module.

The SEE Theory marks of 100 will be scaled down to 50.

The Final mark for the course is sum of the CIE and SEE Marks.

Course delivery methods		Assessment methods	
1	Chalk and Talk	1	IA tests
2	PPT and Videos	2	Open Book Assignments (OBA)/ Lab Project
3	Flipped Classes	3	Lab Test
4	Practice session/Demonstrations in Labs	4	Semester End Examination
5	Virtual Labs		

B.E, Industrial IOT

Sustainable Engineering and SDGs			
Course Code	MVJ25AECK37	Scheme	2025
Type of Course	AEC	Semester	III
Teaching Hours/Week (L:T:P)	1:0:0	CIE Marks	50
Total Hours of Pedagogy (L:T:P:SL&TW)	14:0:0:16	SEE Marks	50
Credits	1	Total Marks	100
Examination type (SEE)	Theory	Exam Hours	2 Hrs.
Course Objectives: This course will give ability to: • Explain the basic concepts of sustainability, sustainable development and the role of engineers. • Describe the 17 Sustainable Development Goals (SDGs) and relate selected SDGs to engineering disciplines. • Explain basic sustainable-engineering principles including resource efficiency, systems thinking, life cycle thinking and circular economy. • Identify environmental, social and economic impacts associated with engineering products, processes and services. • Apply simple sustainability thinking to propose an improved solution to a real-life engineering problem.			
Syllabus			
Objective of this course is to inculcate in students an awareness of environmental issues and the global initiatives towards attaining sustainability. The student should realize the potential of technology in bringing in sustainable practices.			
Module I			
Sr. No	Topics to be covered		Hours required
1	Foundations of Sustainability and Role of Engineers: Sustainability: Introduction, concept, evolution of the concept; Social, environmental and economic sustainability concepts; Sustainable development, Nexus between Technology and Sustainable development; Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)-Overview of the 17 SDGs, Clean Development Mechanism (CDM), Introduction to the UN 2030 Agenda.		3
Module II			
Sr. No	Topics to be covered		Hours required
1	Environmental Pollution: Air Pollution and its effects, Water pollution and its sources, Zero waste concept and 3 R concepts in solid waste management; Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading and carbon footprint, legal provisions for environmental protection.		3
Module III			
Sr. No	Topics to be covered		Hours required

1	Environmental management standards: ISO 14001:2015 framework and benefits, Scope and goal of Life Cycle Analysis (LCA), Sustainable Engineering Principles and Circular Economy, Bio-mimicking, Environment Impact Assessment (EIA), Industrial ecology and industrial symbiosis.	3
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Module IV

Sr. No	Topics to be covered	Hours required
1	Resources and its utilisation: Basic concepts of Conventional and non-conventional energy, Environmental footprints, General idea about solar energy, Fuel cells, Wind energy, Small hydro plants, biofuels, Energy derived from oceans and Geothermal energy.	3

Module V

Sr. No	Topics to be covered	Hours required
1	Sustainable design and practices/Case Studies/Student Activity: Sustainability practices: Basic concept of sustainable habitat, conventional design Vs sustainable design, Methods for increasing energy efficiency in buildings, Green Engineering, Sustainable Urbanisation, Sustainable cities, Sustainable transport.	2

Textbooks:

1. Toolseeram Ramjeawon, Introduction to Sustainability for Engineers, CRC Press, 1st Edition, 2020.
2. Rag, R. L. and Ramesh Lakshmi Dinachandran, Introduction to Sustainable Engineering, PHI Learning.
3. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
4. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
5. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.

Reference Books:

1. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications- Rating System, TERI Publications - GRIHA Rating System
2. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
3. Allenby, B. R., The Sustainability Engineering Handbook, McGraw-Hill.
4. Mihelcic, J. R. and Zimmerman, J. B., Environmental Engineering: Fundamentals, Sustainability, Design, Wiley.
5. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
6. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
7. Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

Course Outcomes:

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

CO1: Explain sustainability, sustainable development and the role of engineers

CO2: Explain different types of environmental pollution problems, SDGs, relate them to engineering applications, and their sustainable solutions

CO3: Explain life cycle thinking and environmental footprints

CO4: Apply basic principles of sustainable engineering and circular economy

CO5: Propose a basic sustainable engineering solution to a real-life problem

CO-PO Mapping

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

High-3: Medium-2: Low-1

Evaluation Method

Continuous Internal Evaluation (CIE) – 50 Marks

The CIE for the mandatory credit courses common across all disciplines comprises of two components as follows:

Internal Assessment Tests (30 Marks):

Two Internal Assessment tests will be conducted, each comprising 50 multiple choice questions for a total of 50 marks. The average of the two test scores will be scaled down to 30 marks.

Assignments (20 Marks):

Students are required to complete two assignments, each carrying 10 marks. These assignments may include projects*, poster presentations*, seminars*, or similar academic activities. The marks of the two assignments are added to get 20 marks.

*Each assignment will undergo two rounds of evaluation to assess progress and quality

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of Assignment for the course.

Together, these two components are added to get the Final CIE marks of 50.

Semester End Examination (SEE) – 50 Marks

A Semester End Examination is conducted for 50 marks comprising of multiple-choice questions (MCQ) type each of one mark.

The final score for the course out of 100 is the SumTotal of SEE and CIE.

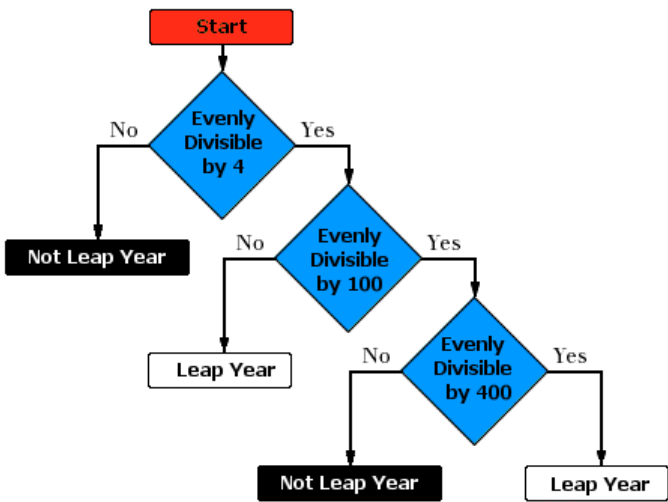
B.E, Industrial IOT

Semester: III			
LabVIEW for ECE			
Course Code	MVJ25EC38SL	Scheme	2025
Type of Course	SDL	Semester	III
Teaching Hours/Week (L:T:P)	0:0:2	CIE Marks	50
Total Hours of Pedagogy (L:T:P:SL&TW)	0:0:28:2	SEE Marks	50
Credits	1	Total Marks	100
Examination type (SEE)	Practical	Exam Hours	3

Course Objectives:

This course will enable students to,

- Introduce the basics of LabVIEW environment and the basic concept of Data Flow programming.
- Familiarize the common LabVIEW functions with the different palettes.
- Understand the graphical programming and the debugging methods.
- Understand the advanced operations of LabVIEW programming in developing stand alone applications.
- Understand the modularity in different data types and modularity in different operations of LabVIEW.

Sl. No.	Experiments List
1.	Build a VI to develop code converters like binary to gray, gray to binary, BCD to Excess 3.
2.	Build a VI to perform the operation of Half adder and Full adder.
3.	Build a VI to find whether the given input year is a leap year or not.  <pre> graph TD Start([Start]) --> D1{Evenly Divisible by 4} D1 -- No --> NLY1[Not Leap Year] D1 -- Yes --> D2{Evenly Divisible by 100} D2 -- No --> LY1[Leap Year] D2 -- Yes --> D3{Evenly Divisible by 400} D3 -- No --> NLY2[Not Leap Year] D3 -- Yes --> LY2[Leap Year] </pre>
4.	Build a VI for Tank level measurement. (Single tank level filling and then draining, Two tank with one filling and other draining after first tank filling, two tanks simultaneously One filling and other draining)
5.	Build a VI to add 'n' Natural numbers according to the input of the user.(Using feedback node and shift register)
6.	Build a VI to find the Fibonacci series according to the given input of the user.
7.	Build a VI to find the factorial of a given number.

8.	Build a VI to display only the odd numbers and even numbers separately using conditional tunnel modes.
9.	Build a VI to simulate traffic light control.

Course Outcomes:

The student will be able to:

CO1: Understand the basic tools for developing the Virtual Instruments environment.

CO2: Analyse data structures of different data types of Numeric, Boolean in LabVIEW and Identify and use various loop structures in LabVIEW environment.

CO3: Understand the different operational functions for arrays and clusters to develop different tasks.

CO4: Examine Digital waveform graphs and Charts and Implement error handling techniques in LabVIEW.

CO-PO Mapping

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

High-3: Medium-2: Low-1

Evaluation Method:

Continuous Internal Evaluation (CIE): - 50 Marks

The CIE is evaluated for 50 marks, distributed as follows: Regular Laboratory Performance & Conduct (15 Marks) + Module Project Evaluations (3 Projects) (20 Marks) + Laboratory Record / Logbook & Calculations (10 Marks) + Internal Practical Test / Quizzes (5 Marks)

Final CIE Marks of practical should be calculated for 50 marks.

Semester End Examination (SEE) – 50 Marks

A Semester End Examination is conducted for 50 marks comprising of multiple-choice questions (MCQ) type each of one mark.

The final score for the course out of 100 is the SumTotal of SEE and CIE.

The Final mark for the course is sum of the CIE and SEE Marks.

B.E, Industrial IOT

SEMESTER III			
PHYSICAL EDUCATION (SPORTS & ATHLETICS) (Common to All Branches)			
Course Code	MVJ25PE39	Scheme	2025
Type of Course	NCMC	Semester	III
Total Hours of Pedagogy (L:T:P:SL&TW)	0:0:0:30	CIE Marks	100
Credits	-	Total Marks	100
Course Objectives: the student will be able to			
1	Understand the meaning and importance of the fitness and the benefits of fitness		
2	Types of fitness and fitness tips.		
3	Importance of Sports, and Yoga in a day-to-day life.		
4	Understand the importance of aerobics and other activities for healthy lifestyle.		
5	Know about the different roles of organization and administration in sports events.		
Topics / Activities to be Covered (100Marks)			
Module I		5Hours	
Orientation			
➤ Lifestyle			
➤ Fitness			
➤ Food & Nutrition: Sports diet.			
➤ Stress Management			
Module II		5 Hours	
General Fitness & Components of Fitness			
➤ Warming up (Free Hand Exercises).			
➤ Strength—Push-up/Pull-ups			
➤ Speed—30MtrDash.			
➤ Agility—Shuttle Run			
➤ Flexibility—Sit and Reach			
Module III		6 Hours	
Specific Games (Anyone to be selected by the student)			
➤ Volleyball— Attack, Block, Service, Upper Hand Pass and Lower Hand and Pass.			
➤ Throw ball—Service, Receive, Spin attack, Net Drop & Jump throw.			
➤ Kabaddi— Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.			
➤ Basketball-dribbling, passing, shooting etc.			
➤ Table Tennis—Service (Fore Hand & Back Hand)			
➤ Receive (Fore Hand & Back Hand)			
➤ Smash, Athletics (Track / Field Events) -Running, Jumping, Throwing.			

Module IV		6 Hours
Role of Organization and administration		
➤ Planning. ➤ Organizing. ➤ Staffing. ➤ Directing. ➤ Coordinating & controlling. ➤ Reporting & Recording. ➤ Budgeting.		
Module V		6Hours
Aerobics		
➤ Dance Aerobics ➤ Sport Aerobics ➤ Warm up Aerobics ➤ Cardiovascular Aerobics		
Course Outcomes: After completing the course, the students will be able to		
CO1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness.	
CO2	Familiarization of health-related Exercises, Sports for overall growth and development.	
CO3	Create a foundation for the professionals in physical Education and Sports.	
CO4	Participate in the competition at regional / state / national / international levels.	
CO5	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.	
Assessment Details for CIE (both CIE and SEE)		
Weight age	CIE – 100%	• Implementation strategies of the project (PE work). • The last report should be signed by PED, the HOD and principal. • At last report should be evaluated by the PED of the institute. • Finally, the consolidated marks sheet should be sent to the Controller of Examinations office.
Participation of student in all the modules	50 Marks	
Final presentation / exhibition / Participation In competitions / practical on specific tasks Assigned to the students	50 Marks	
Total marks for the course in each semester	100 Marks	
Marks scored for 100 by the students should be Scale to 50 marks in each semester.		
Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.		

CO/PO Mapping											
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	-	-	-	-	-	-	-	2	2	-	-
CO 2	-	-	-	-	-	-	-	2	2	-	-
CO 3	-	-	-	-	-	-	-	2	2	-	-
CO 4	-	-	-	-	-	-	-	2	2	-	-
CO 5	-	-	-	-	-	-	-	3	3	-	-

B.E, Industrial IOT

Semester: III		
Yoga (Common to all Branches)		
Course Code:	MVJ25YO39	CIE Marks: 100
L: T:P:S	0:0:0:28	SEE Marks: -----
Credits:	0	Total :100
Hours:	28	SEE Duration: -----
Course Learning Objectives: The students will be able to		
1	Promote Holistic Wellness Practice in Students.	
2	Develop Physical Awareness and Flexibility	
3	Improve Focus and Academic Performance	
4	Encourage Healthy Lifestyle Habits.	
5	Support mental Health and Emotional balance.	
<u>The Health Benefits of Yoga:</u>		
1)Yoga helps with a person-centered approach to well-being offering physical, mental(cognitive), and spiritual(emotional) benefits for students. These benefits can help students cope with the demands of academic journeys, improve their overall health, and promote personal development.		
● Key Benefits of Various Yoga Techniques: ● Enhances Physical Well-being. ● Boosts Mental Focus. ● Promotes Emotional Stability. ● Reduces Stress Levels. ● Encourages Inner Growth.		
It is also used as an adjunct therapy to support recovery from various physical health conditions such as:		
● Chronic Pain. ● Back Pain. ● Arthritis. ● Cardiovascular Diseases. ● Asthma. ● Chronic Fatigue Syndrome. ● Menstrual Disorders. ● Digestive Issues. ● Thyroid Imbalances. ● Migraine and headache.		

2) Core observations on how yoga functions as a complementary mind-body intervention to support the psychological, physiological and spiritual healing processes associated with various health conditions.

Psychological Benefits:

- Stress reduction.
- Anxiety relief.
- Trauma healing.
- Cognitive and clarity focus.
- Emotional Regulation.
- Aid in managing depression.

Physiological Benefits:

- Enhance Blood Circulation.
- Boost Cardiovascular Health.
- Supports Overall Gut Function.
- Promotes Thyroid Function.
- Relief from Headaches.
- Increased Energy level.

Spiritual Benefits:

- Cultivating gratitude and Compassion
 - Self–realization
 - Balance and Harmony
 - Inner Peace
 - Sense of oneness.
- Mindfulness

MODULE- I

Discipline and Awareness Reflect Habits s Thoughts:

7 Hrs

- **Basic theory of Yoga, Yamas s Niyamas**
Yoga definition, Aims and Objectives, importance of yoga in students.
- **Introduction to Yoga asana**
Yoga asana meaning, principle and health benefits.
- **Ashtanga yoga**
Meaning, breathing techniques.
- **Four paths of yoga**
Karma yoga, Bhakthi yoga, Raja yoga, Jnana yoga.
- **Surya namaskar**
Surya namaskar prayer and its meaning, benefits and importance.
- **Yoga asanas**
Asanas it's need, importance, name and technique.

Sitting: -Vajrasana, - adasana, Ardhashakrasana, Prone line: -Advasana, Bhujangasana Supine line: -Shavasana, Supta baddhakonasana, Balancing posture: -Vrikshasana, Garudasana	
MODULE -II	
Building strength and focus Finding out the obstacle: • Kriya Yoga Tapas, Svadhyaya, Ishwarapranidhana • Five Kleshas Obstacles. • Pranayama Introduction to Pranayama. • Pratyahara Preparing mind for meditation, Breathe focus techniques. • Yoga asanas Standing: -Virabhadrasana, Parshvakona Sitting: -Vajrasana, Paschimottanasana Prone Line: - Dhanurasana, Shalabhasana, Supine Line: -Ananda Balasana, Supta Matsyendrasana , Balancing: -Natarajasana (Dancer Pose)	7 Hrs
MODULE -III	
Awareness and inner balance: Finding how focused is the mind • Dharana: Concentration • Dhyana: Meditation • Swasthya, Smriti, Sankalpa. Tool of academic excellence. • Samyama Patanjali's concept of samyama • Yogasanas Standing: - ArdhaChandrasana, Utkatasana Sitting: - Padmasana (or prep), Gomukhasana Prone Line: - Adho Mukha Svanasana, Naukasana Supine Line: - SuptaBaddhaKonasana, Chakrasana Balancing: - Garudasana (Eagle Pose)	7 Hrs
MODULE -IV	

Integrating Yoga in daily Life: • Yama niyama Acharam: Practice of ethical Discipline (practicing nonviolence, truth, cleanliness) • Ahara- Vihara Samyama: Practice discipline in diet & lifestyle. • Asana- pranayama sadhana: Daily practice of asanas and pranayama • Yogasanas: Standing: -PrasaritaPadottanasana, ParivrttaTrikonasana Sitting: -Baddha Konasana, Marichyasana Prone Line: -Ustrasana (Camel), Makarasana (relaxation) Supine Line: -Sarvangasana, Shavasana Balancing: - Bakasana (Crow – optional or modified)	7 Hrs
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Course outcomes	
CO1	Identify and reflect on personal habits and thoughts.
CO2	Explain the basic theory of Yoga, including Yamas & Niyama.
CO3	Understand the definition, aims, objectives, and importance of Yoga, especially for students.
CO4	Enhance physical and mental strength through advanced Yog asanas.

CO/PO Mapping											
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1		2						3	2	2	
CO 2	2						2	2			
CO 3	2					2	2	3			
CO 4					2		3	3			

Weekly assessment will be done by the instructor by giving different poses / Asanas.
The final assessment scaled up to 100 marks.

Text Book

1	Ajitkumar, "Yogapravesha in Kannada"
2	BKS Iyengar "Light on Yoga"

Reference Books

1	M L Gharote & Dr. S K Ganguly, "Teaching Methods for Yogic practices"
2	Yoga Instructor Course hand book published by SVYASA University, Bengaluru
3	Yamini Muthanna," Yoga for Children –step by step"

B.E, Industrial IOT**Additional Mathematics-I**

Course Code	MVJ25MATDIP310	Scheme	2025
Type of Course	NCMC	Semester	III
Teaching Hours/Week (L: T: P)	2:0:0	CIE Marks	100
Total Hours of Pedagogy (L: T: P: SL&TW)	28:0:0:0	SEE Marks	--
Credits	0	Total Marks	100
Examination type (SEE)	--	Exam Hours	--

Course Objectives:

This course will give ability to:

- To familiarize the important and introductory concepts of Differential calculus, Integral calculus, Vector differentiation, Probability, ordinary differential equations of first order, and analyze the engineering problems.

Syllabus

Differential calculus-nth derivative, Leibnitz theorem, Polar curves - angle between the radius vector and tangent, angle between two curves pedal equation, Taylor's and Maclaurin's series expansions, Integral Calculus: Statement of reduction formulae for the integrals of $\sin^n(x)$, $\cos^n(x)$, $\sin^n x$, $\cos^m x$, Evaluation of these integrals with standard limits-problems, Double -Simple examples, Triple integrals, Vector Differentiation: Differentiation of vector functions, Velocity and acceleration of a particle moving on a space curve, Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields, Vector identities - $\text{div}(\phi \vec{A})$, $\text{curl}(\phi \vec{A})$, $\text{curl}(\text{grad}(\phi))$, $\text{div}(\text{curl} \vec{A})$, Probability: Basic terminology, Sample space and events, Axioms of probability. Addition and multiplication theorems, Conditional probability, Bayes theorem, Introduction – Formation of differential equation, solutions of first order and first-degree differential equations, Variable separable form, homogeneous Exact, linear differential equations, Clairaut's equation.

Course Plan**Module I****Differential calculus**

Sr.No	Topics to be covered	Hours required
1	Differential calculus: Recapitulation of successive differentiation -nth derivative	6
2	Leibnitz theorem (without proof) and Problems	
3	Polar curves - angle between the radius vector and tangent, angle between two curves	
4	pedal equation	
5	Taylor's and Maclaurin's series expansions- Illustrative examples	

Module II**Integral Calculus**

Sr. No	Topics to be covered	Hours required
1	Integral Calculus: Statement of reduction formulae for the integrals of $\sin^n(x)$, $\cos^n(x)$, $\sin^n x$, $\cos^m x$	6
2	Evaluation of these integrals with standard limits-problems	
3	Double -Simple examples	

4	Triple integrals-Simple examples	
Module III		
Vector Differentiation		
Sr. No	Topics to be covered	Hours required
1	Vector Differentiation: Differentiation of vector functions	6
2	Velocity and acceleration of a particle moving on a space curve	
3	Scalar and Vector point functions, Gradient, Divergence, Curl	
4	Solenoidal and Irrotational vector fields	
5	Vector identities - $\text{div}(\nabla \vec{A})$, $\text{curl}(\nabla \vec{A})$, $\text{curl}(\text{grad}(\phi))$, $\text{div}(\text{curl} \vec{A})$.	
Module IV		
Probability		
Sr. No	Topics to be covered	Hours required
1	Probability: Basic terminology, Sample space and events	5
2	Axioms of probability. Addition and multiplication theorems	
3	Conditional probability – illustrative examples	
4	Bayes theorem-examples	
Module V		
Ordinary Differential Equations of First Order		
Sr. No	Topics to be covered	Hours required
1	Introduction – Formation of differential equation, solutions of first order and first degree differential equations	5
2	Variable separable form, homogeneous	
3	Exact, linear differential equations	
4	Some special first order equations: Clairaut’s equation	
5	Some special first order equations: Clairaut’s equation	
Textbooks:		
1. B.S. Grewal, “Higher Engineering Mathematics” Khanna Publishers, 43rd Edition, 2013. 2. Ramana B. V., “Higher Engineering Mathematics”, Tata Mc Graw-Hill, 2006.		
Reference Books:		
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley-India publishers, 10th edition,2014. 4. G. B. Gururajachar: Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19		
Other References:(NPTEL/SWAYAM. Any Other)		
1. https://youtube.com/playlist?list=PL7oBzLzHZ1wXBSiJEgqz_iwVoLiY8qhbv&si=LWY0G3yww0MbHN9G NPTEL course: Mechanics of Materials by Dr. U Saravanan, IIT Madras 1. https://youtu.be/rveuCHNkaC4?si=jIJomstkFZySE0tk Mechanics of Solids by Prof. Priyanka Ghosh, IIT Kanpur. 2. https://youtu.be/U-5tA9ZMsno?si=Wcl7W7JN3Wmg3McP 3. https://youtu.be/COI0BUmNHT8?si=77D82b9BAnf-jVT2 4. https://youtu.be/ES741wq3APA?si=iqR2QZ5xreoVGo1v		

Course Outcomes:

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

- CO1:** Apply the knowledge of calculus to solve problems related to polar curves and its applications
- CO2:** Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes.
- CO3:** Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors and also exhibit the inter dependence of line, surface and volume integrals.
- CO4:** Understand the basic Concepts of Probability
- CO5:** Recognize and solve first-order ordinary differential equations occurring in different branches of engineering

CO-PO Mapping:

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

High-3: Medium-2: Low-1:

Evaluation Method:**Continuous Internal Evaluation (CIE):**

- Two CIE Will be conducted for 50 marks each and average of two will be taken (A)
- Alternative Assessment Tools (AAT) should be a project / Quiz/ Seminar cum Presentation / other suitable alternate assessment methods for 30 marks. Two evaluations will be conducted **(B)**
- Two Assignments for 10 marks each and the sum of both the assignments will be taken for 20 Marks (C)

Final CIE Marks will be calculated as (A+B+C) for 100 marks

Course delivery methods		Assessment methods	
1	Chalk and talk	1	IA tests
2	PPT and Videos	2	Open Book Assignments (OBA)/ Lab Project
3	Flipped Classes	3	AAT (Quiz, Mini Project)