Lokmanya Tilak Jankalyan Shikshan Santha's

Lokmanya Tilak College of Engineering

Sector 4, Vikas Nagar, Koparkhairane, Navi Mumbai 400709

An Autonomous Institute Affiliated to University of Mumbai

Department of Computer Science and Engineering

(Data Science)

CURRICULUM STRUCTURE

For

SECOND YEAR ENGINEERING

(BASED ON NEP 2020)

w.e.f. A.Y. 2025-26

Approved by Board of Studies on 05/04/2025

Approved by Academic Council on 15/04/2025

Department of Computer Science and Engineering (Data Science)

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Preface

Lokmanya Tilak College of Engineering (LTCE) is founded by a Nagpur-based trust known as Lokmanya Tilak Jankalyan Shikshan Sanstha (LTJSS). The Sanstha was established in 1983, by Honourable Dr. Satish Chaturvedi. At present, there are 28 educational institutes run by the Sanstha in Nagpur. The Sanstha derives its philosophy from the magnanimous mathematician, educationist, social reformer Lokmanya Bal Gangadhar Tilak, who dedicated his life for the cause of Swaraj. Lokmanya Tilak College of Engineering was established in 1994, approved by the All-India Council for Technical Education, New Delhi, recognised by the Govt. of Maharashtra, accredited by NAAC with 'A' grade and is affiliated to the University of Mumbai. Within the span of 30 years of its inception, LTCE has grown leaps and bounds in terms of popular courses being offered at U.G., P.G. and Ph.D. level. Four of its branches viz., Computer, Mechanical, Electrical and Electronics and Telecommunications Engg. have been accredited by NBA. The Institute runs the Under-graduate Programmes in Mechanical Engineering, Computer Engineering, Electronics & Telecommunication Engineering, Electrical Engineering, Computer Science & Engineering (Data Science), Computer Science & Engineering (Artificial Intelligence & Machine Learning) and Computer Science & Engineering (IoT & Cyber Security Including Blockchain Technology). Institute also offers Doctoral Programmes in Mechanical Engineering and Computer Engineering. LTCE stands steadfast in its mission of continuing efforts for the betterment of its students and society.

The National Education Policy 2020, recently implemented by the Government of India, envisions providing quality education to all young people, with the primary goal of nurturing well-rounded, thoughtful, and creative individuals. NEP 2020 also emphasizes the importance of developing character, ethical values, constitutional principles, intellectual curiosity, scientific temper, creativity, and other related virtues. The Government of Maharashtra has instructed autonomous colleges to update their curriculum and begin implementing the National Education Policy (NEP) 2020. We are fully committed to ensuring the effective and meaningful adoption of NEP 2020 in its true essence. At "Lokmanya Tilak College of Engineering", the holistic development of learners has always been our top priority and central focus. LTCE embraced the NEP philosophy as early as 2022 wherein we have introduced the concept of Honors and Minors programs on emerging fields as per the guidelines of University of Mumbai and in 2024, we proudly graduated our first batch under this holistic curriculum. The autonomous curriculum for 2024-28 is structured in line with the recommendations of NEP 2020, AICTE, and UGC. It now includes courses in emerging technologies and multidisciplinary areas to ensure relevance to industry and practical applications. Greater focus has been placed on experiential learning to move away from rote memorization.

Sd/-	Sd/-	Sd/-
Dr. Nandini C. Nag	**Dr. Sheeba P. S.**	**Dr. Subhash K. Shinde**
BoS Chairman, CSE (Data Science)	**Dean, Academics & Research**	**Principal**

Illustrative Semester wise Credit distribution structure for Four Year UG Engineering Program One Major, One Multidisciplinary Minor as per Maharashtra State Govt. Resolution:

Courses		Semester								
		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	6-8	8-10							14-18
Engineering Science Course		8-10	4-6							12-16
Programme Core Course (PCC)	Program Courses		2	8-10	8-10	10-12	8-10	4-6	4-6	44-56
Programme Elective Course (PEC)						4	8	2	6	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses			2	2	4	2	2	2	14
Open Elective (OE) Other than a particular program				4	2	2				8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	2	2		2		2			8
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	2			2					4
Entrepreneurship/Economics/ Management Courses				2	2					4
Indian Knowledge System (IKS)			2							2
Value Education Course (VEC)				2	2					4
Research Methodology	Experiential Learning Courses								4	4
Comm. Engg. Project (CEP)/Field Project (FP)				2						2
Project									4	4
Internship/ OJT								12		12
Co-curricular Courses (CC)	Liberal Learning Courses	2	2							4
Total Credits (Major)		**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**160-176**

Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hr. Practical (P) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit

Credit Requirements for Award of Degree:

a) A total of 167 credits are required for a student to be eligible for the award of an **Undergraduate Degree in Engineering**, including a Multi-Disciplinary Minor, in accordance with the Government of Maharashtra GR dated 04/06/2024.

b) A student shall be eligible for the award of an **Undergraduate Degree** with **Honours/Minor** in Emerging Areas upon earning an additional **18 credits**.

Multiple Exits:

Students will have the flexibility to enter a programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs.

Level	Exit After Semester	Minimum Credits Required	LTCE Credits	Qualification Title	Additional Credit requirements
4.5	II (First Year)	40	44	One Year **UG Certificate** in relevant discipline	**8 credits** through Skill-based vocational courses (4 Credits) and Internship/ Apprenticeship/ Project (4 Credits).
5.0	IV (Second Year)	80	86	Two Years **UG Diploma** in relevant discipline	**8 credits** through Skill-based vocational courses (4 Credits) and Internship/ Apprenticeship/ Project (4 Credits).
5.5	VI (Third Year)	120	127	Three Years **B. Voc.** in the relevant Discipline	**8 credits** through Skill-based vocational courses (4 Credits) and Internship/ Apprenticeship/ Project (4 Credits).
6.0	VIII (Fourth Year)	160	167	**B.Tech**. in major discipline with multidisciplinary minor	-----
6.0	VIII (Fourth Year)	160+18= 178	167+18= 185	**B.Tech**. in major discipline with double minor (Multidisciplinary and Emerging minor)	--------

Distribution of Credits:

Type of Course	Course Code	No. of Credits as per Maharashtra Govt.	No. of credits as per LTCE
Basic Science Course	BSC	14-18	**16**
Engineering Science Course	ESC	12-16	**14**
Programme Core Course	PCC	44-56	**49**
Programme Elective Course	PEC	20	**19**
Multidisciplinary Minor	MDM	14	**14**
Open Elective (OE) Other than a particular program	OE	8	**08**
Vocational and Skill Enhancement Course	VSEC	8	**10**
Ability Enhancement Course (AEC -01, AEC-02)	AEC	4	**03**
Entrepreneurship/Economics/ Management Courses	EEMC	4	**04**
Indian Knowledge System (IKS)	IKS	2	**02**
Value Education Course (VEC)	VEC	4	**04**
Research Methodology	ELC	4	**03**
Comm. Engg. Project (CEP)/Field Project (FP)	ELC	2	**02**
Project	ELC	4	**04**
Internship/ OJT	ELC	12	**12**
Co-curricular Courses (CC)	CC	4	**03**
Total Credits (Major)		**160-176**	**167**
Total Credits (Major+ Honors/Minors)		**178-194**	**167+18=185**

Abbreviations:

AEC	Ability Enhancement Course
AEL	Ability Enhancement Laboratory
BSC	Basic Science Course
BSL	Basic Science Laboratory
CEP	Common Engineering Project
CC	Co-curricular courses
CIE	Continuous Internal Evaluation
ESC	Engineering Science Course
ESE	End Semester Exam
ESL	Engineering Science Laboratory
IKS	Indian Knowledge System
L	Lecture
MDM	Multidisciplinary Minor
MSE	Mid Semester Exam
OE	Open Elective
P	Practical
PCC	Programme Core Course
PCL	Programme Core Laboratory
PEC	Programme Elective Course
T	Tutorial
VEC	Value Education Course
VSEC	Vocational and Skill Enhancement Course

Program Structure for Second Year CSE (Data Science)

Second Year Engineering Scheme Semester III (w.e.f. AY 2025-2026)

Course Code	Course Name	Teaching Scheme		Credit Assigned		Total Credits	Examination Scheme					
							Internal Assessment		End Semester Exam		Oral &/ Practical	Total Marks
		L	P	L	P		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)	Marks	Duration (Hrs)		
DSESC 301	Mathematics for Computer Science	3	-	3	-	3	20	20	60	2	-	100
DSPCC 301	Computer Organization & Architecture	3	-	3	-	3	20	20	60	2	-	100
DSPCC 302	Analysis of Algorithm	3	-	3	-	3	20	20	60	2	-	100
OE301x	Open Elective Course	3	-	3	-	3	20	20	60	2	-	100
EEMC301	Entrepreneurship & Financial Management	2	-	2	-	2	20	20	60	2	-	100
VEC301	Environment & Sustainability	2	-	2	-	2	-	50	-	-	-	50
DSVSEC301	Full Stack Java Programming	-	2* + 2	-	2	2	-	25	-	-	25	50
DSPCL 301	Computer Organization & Architecture Lab	-	2	-	1	1	-	25	-	-	25	50
DSPCL 302	Algorithm Lab	-	2	-	1	1	-	25	-	-	25	50
Total		**16**	**08**	**16**	**4**	**20**	**100**	**225**	**300**	**10**	**75**	**700**

***Two hours of practical class to be conducted for full class as Theory Lecture.

OE301x: Open Elective Course	**OE3011**: Biology for Engineers	**OE3012**: Indian Constitution and Governance	**OE3013**: Human Psychology	**OE3014**: Disaster Management and Mitigation

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Program Structure for Second Year CSE (Data Science)

Second Year Engineering Scheme Semester IV (w.e.f. AY 2025-2026)

Course Code	Course Name	Teaching Scheme		Credit Assigned		Total Credits	Examination Scheme					
							Internal Assessment		End Semester Exam		Oral &/ Practical	Total
		L	P	L	P		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)	Marks	Duration (Hrs)		
DSPCC 401	Discrete Mathematics and Graph Theory	3		3	-	3	20	20	60	2	-	100
DSPCC 402	Database Management System	3		3	-	3	20	20	60	2	-	100
DSPCC 403	Operating System	3		3	-	3	20	20	60	2	-	100
XXMD M401	Multidisciplinary Minor	3		3	-	3	20	20	60	2	-	100
OE401x	Open Elective Course	2		2	-	2	20	20	60	2	-	100
EEMC401	Digital Business Management	2		2	-	2	-	50	-	-	-	50
VEC401	Business Communication Skills	-	2* + 2		2	2	-	25	-	-	-	25
DSPCL 402	Database Management System Lab	-	2		1	1	-	25	-	-	25	50
DSPCL 403	Operating System Lab	-	2		1	1	-	25	-	-	25	50
XXMD ML401	Multidisciplinary Minor Lab	-	2		1	1	-	25	-	-		25
DSCEP 401	Mini Project 1	-	2		1	1	-	25	-	-	25	50
Total		**16**	**12**	**16**	**06**	**22**	**100**	**275**	**300**	**10**	**75**	**750**

* Two hours of practical class to be conducted for full class as Theory Lecture.

OE401x: Open Elective Course	**OE4011**: Human Resource Management	**OE4012**: Corporate and Cyber Laws	**OE4013**: Stock Market and Personal Finance	**OE4014**: Nutrition Literacy and Health

Multidisciplinary Minor (MDM) (14 Credits)

Semester	Computer Engineering (CE)	Electronics & Telecommunication Engineering (ET)	Artificial Intelligence & Robotics (AR)	Internet of Things (IT)	Mechanical Engineering (ME)	Electrical Engineering (EE)
IV	**CEMDM401 :** Data Structure and Algorithms	**ETMDM401:** Microprocessor and Microcontroller	**ARMDM401 :** Artificial Intelligence	**ITMDM401:** Internet of Things and Applications	**MEMDM401 :** Basics of Mechanical Engineering	**EEMDM401:** Elements of Electrical System
	CEMDML401: Data Structure and Algorithms Lab	**ETMDML401:** Microprocessor and Microcontroller Lab	**ARMDML401:** AI Lab	**ITMDML401:** Internet of Things Lab	**MEMDML401:** Mechanical Engineering Lab	**EEMDML401:** Elements of Electrical System Lab
V	**CEMDM501 :** Database Management System	**ETMDM501:** Digital Communication & Sensor Technology	**ARMDM501 :** Robotics	**ITMDM501:** Sensors, Actuators and Transducers	**MEMDM501 :** Conventional & Renewable Energy Sources	**EEMDM501:** Special Machines and Smart grid
	CEMDML501: Database Management System Lab	**ETMDML501:** Digital Communication & Sensor Technology Lab	**ARMDML501:** Robotics Lab	**ITMDML501:** Sensors, Actuators and Transducers Lab	**MEMDML501:** Renewable Energy Sources Lab	**EEMDML501:** Special Machines and Smart grid Lab
VI	**CEMDM601 :** AI & Soft Computing	**ETMDM601:** Digital Image Processing	**ARMDM601 :** Industrial Automation	**ITMDM601:** Microcontrollers and Application	**MEMDM601 :** Automobile System	**EEMDM601:** Electric Vehicle Technology
	CEMDML601: AI & Soft Computing Lab	**ETMDML601:** Digital Image Processing Lab	**ARMDML601:** Automation Lab	**ITMDML601:** Microcontrollers Lab	**MEMDML601:** Automobile Lab	**EEMDML601:** Electric Vehicle Technology Lab
VII	**CEMDML701:** Web Design Lab	**ETMDML701:** Mobile Computing Lab	**ARMDML701:** Predictive Maintenance Lab	**ITMDML701:** PLC and SCADA Lab	**MEMDML701:** 3D Printing Lab	**EEMDML701:** Design Management Auditing of Electrical System Lab

Open Elective Courses (OE) (8 Credits)

Semester	Course Code	Course Name
III	OE3011	Biology for Engineers
	OE3012	Indian Constitution and Governance
	OE3013	Human Psychology
	OE3014	Disaster Management and Mitigation
IV	OE4011	Human Resource Management
	OE4012	Corporate and Cyber Laws
	OE4013	Stock Market and Personal Finance
	OE4014	Nutrition Literacy and Health
VIII	OE8011	Intellectual Property Rights (IPR) and Patents
	OE8012	Risk Management
	OE8013	Economics for Engineers
	OE8014	Innovation and Startups

Department of Computer Science and Engineering
(Data Science)
Second Year Engineering Curriculum: Semester III

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	42 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
DSESC 301	Mathematics for Computer Science	20	20	60	1	2	100	

Prerequisite:	
Course Objectives: The course aims to	
1	Matrix algebra to understand engineering problems.
2	To understand some advanced topics of probability, random variables with their distributions and expectations.
3	Linear and Non-linear programming problems of optimization.
4	To understand the basic techniques of statistics like correlation, regression, and curve fitting for data analysis, Machine learning, and AI.
5	To understand the concept of Fourier Series, its complex form and enhance the problem-solving skills.
6	Carry out the operation in modular arithmetic.
Course Outcomes: Learners will be able to	
1	Apply the concepts of eigenvalues and eigenvectors in engineering problems.
2	Understand the concepts of probability and expectation for getting the spread of the data and distribution of probabilities, Use the concept of probability distribution and sampling theory to engineering problems.
3	Apply the concept of Linear Programming Problems to optimization, Solve Non-Linear Programming Problems for optimization of engineering problems.
4	Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI.
5	Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems
6	Learn fundamental knowledge concerning numbers system, measurements, geometric figures and the meanings represented in the figures

Module	Detailed Contents	Hrs.	CO Mapping
01	**Linear Algebra (Theory of Matrices)**	07	CO1
	1.1 Characteristic Equation, Eigenvalues and Eigenvectors, and properties (without proof) 1.2 Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials 1.3 Similarity of matrices, diagonalizable and non-diagonalizable matrices		
	Self-learning Topics: Derogatory and non-derogatory matrices, Functions of Square Matrix, Linear Transformations, Quadratic forms		
02	**Probability**	08	CO2
	2.1 Definition and basics of probability, conditional probability. 2.2 Total Probability theorem and Bayes' theorem. 2.3 Discrete and continuous random variable with probability distribution and probability density function. 2.4 Expectation, Variance, Moment generating function, Raw and central moments up to 4th order 2.5 Probability Distribution: Poisson and Normal distribution, Sampling distribution, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom		
	Self-Learning Topic: Skewness and Kurtosis of distribution (data)		
03	**Linear & Non-linear Programming Problems**	07	CO3
	3.1 Types of solutions, Standard and Canonical of LPP, Basic and Feasible solutions, slack variables, surplus variables, Simplex method. 3.2 Duality, Dual of LPP and Dual Simplex Method 3.3 NLPP with one equality constraint (two or three variables) using the method of Lagrange's multipliers		
	Self-Learning Topic: Sensitivity Analysis, Two-Phase Simplex Method, Revised Simplex Method, NLPP with inequality constraint: Kuhn-Tucker conditions		

04	**Statistical Techniques** 4.1 Karl Pearson's coefficient of correlation (r) 4.2 Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks) 4.3 Lines of regression 4.4 Fitting of first- and second-degree curves. **Self-learning Topics**: Covariance, fitting of exponential curve.	**07**	**CO4**
05	**Fourier Series** 5.1 Definition of Fourier series. 5.2 Fourier series of periodic function with period 2π and $2l$. 5.3 Fourier series of even and odd functions. 5.4 Half range Sine and Cosine Series. **Self-Learning Topic:** Orthogonal and orthonormal set of functions, Complex form of Fourier Series, Fourier Transforms.	**07**	**CO5**
06	**Modular Arithmetic** 6.1. Introduction to Congruence, Linear congruence, reminder theorem, solving polynomials, system of linear congruence. 6.2. Euler theorem, Fermat's little theorem, Application of congruence-RSA algorithm **Self-Learning Topic:** Divisibility, GCD, properties of prime numbers, fundamental theorem of arithmetic.	**06**	**CO6**

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons.
2. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa.
3. Hamdy A Taha, "Operations Research: An Introduction", Pearson.
4. Hira and Gupta, "Operations Research", S. Chand Publication.
5. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication.
6. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill Education.
7. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa Publication.

References:

1. https://archive.nptel.ac.in/courses/111/106/111106051/
2. https://nptel.ac.in/courses/112106134
3. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
4. https://archive.nptel.ac.in/courses/111/105/111105090/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

I. Assignment: 5 Marks
II. Quiz/Open book test/Presentation: 10 Marks
III. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
DSPCC301	Computer Organization and Architecture	20	20	60	1	2	100	

Prerequisite: Basic electronics concepts	
Course Objectives: The course aims to	
1	To have coarse understanding of the basic structure and operation of basic digital circuits and digital computer.
2	To discuss in detail arithmetic operations in digital systems.
3	To discuss generation of control signals and different ways of communication with I/O devices.
4	To study the hierarchical memory and principles of advanced computing.
Course Outcomes: Learners will be able to	
1	To learn different number systems and various logic gates.
2	To learn basic structure of computer systems and demonstrate the arithmetic algorithms.
3	To demonstrate the memory organization.
4	To understand the generation of control signals of computers.
5	To describe the concepts of I/O transfer techniques and different Buses.
6	To describe the concepts of advanced processor

Module	Detailed Contents	Hrs.	CO Mapping
01	**Data Representation and Logic Gates** Introduction to number systems: Binary, Octal & Hexadecimal number systems.1's and 2's complement of Binary number systems & Binary arithmetic operations. Integer representation of Binary: Signed and unsigned binary numbers. Floating Point representation of Binary: IEEE 754 standard. Introduction to Logic gates: Truth table, Logical symbol & output equation. Laws of Boolean Algebra and DeMorgan's theorem.	**08**	**CO1**
02	**Processor Organization and Arithmetic Algorithms** Computer Architecture vs Computer Organization. Basic architectural models of Computer systems: Harvard and Von Neumann models. Intel 8085 CPU architecture: Block diagram, Register organization, Flags, Instruction formats, Instruction interpretation & sequencing. Concept of Instruction cycle. Booth's Multiplication algorithm of Binary number system. Restoring and non-restoring division algorithms of Binary system.	**08**	**CO2**
03	**Memory Systems** Properties/Characteristics of memory systems. Classification of memory system: RAM, ROM, PROM, EPROM, EEPROM etc. Introduction to flip-flop and its use as a single bit memory element. Memory hierarchy: Analysis of 2 & 3 level memory hierarchy. Cache memory: Concept, Locality of reference, Cache mapping techniques, Design problems based on Cache mapping techniques, Cache coherency. Introduction to Interleaved memory systems. **Self-learning topic: Secondary storage devices: Magnetic and optical storage devices.**	**08**	**CO3**
04	**Control Unit designs** Hardwired and Microprogrammed Control unit. Table and Delay element method of the Hardwired Control unit designs. Concept of Microinstruction and Microprogram in Microprogrammed Control unit.	**06**	**CO4**

	Microinstruction formats: Horizontal and Vertical microinstructions. Microinstruction sequencing and execution. Microprogram examples for simple assembly language instructions.		
05	**I/O Techniques and Communications** Serial vs Parallel data transfer techniques. Parallel data transfer methods: Programmed data transfer, Interrupt Driven data transfer, DMA data transfer. Introduction and features of system buses like PCI, USB etc. Bus contention problem and Bus arbitration. Bus Arbitration methods: Daisy chaining, Polling and Independent Requesting bus arbitrations. **Self-Learning Topic: Serial communication standard like RS232C**	**06**	**CO5**
06	**Advanced Processor Concepts** Concept of Linear Pipelining. Non-pipelined vs Pipelined processors. Performance measures of Linear pipeline: CK frequency, Speedup, Efficiency and Throughput. Pipeline hazards: Structural, Control and Data Dependent hazards. Flynn's classification of Computer Systems: SISD, SIMD, MISD and MIMD. Concept of Scalar, Superscalar and Vector processors. **Self-Learning Topic: Case study of PARAM vector processor from C-DAC**	**06**	**CO6**

Text Books:

1. William Stallings: Computer Organization and Architecture, 7th Edition, Pearson-Prentice Hall.
2. Hamacher, Zaky: Computer Organization, 5th Edition, McGraw Hill Publication.
3. R. P. Jain: Modern Digital Electronics, 4th Edition, McGraw Hill Publication.
4. Hwang, Briggs: Computer Architecture and Parallel Processing, McGraw Hill Publication.

References:

1. Morris Mano: Computer System Architecture, 3rd Edition.
2. John P. Hayes: Computer Architecture and Organization, 3rd Edition, McGraw Hill Publication.
3. https://onlinecourses.nptel.ac.in/noc19_cs47/previewJ

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks

Quiz/Open book test/Presentation: 10 Marks

3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
DSPCC302	Analysis of Algorithm	20	20	60	1	2	100	

Prerequisite: Data Structure concepts	
Course Objectives: The course aims to	
1	To provide mathematical approaches for Analysis of Algorithms.
2	To understand and solve problems using various algorithmic approaches.
3	To analyse algorithms using various methods
Course Outcomes: Learners will be able to	
1	Analyze the space and time complexity of algorithms.
2	Describe, apply and analyze the complexity of Divide and Conquer strategy algorithms.
3	Describe, apply and analyze the complexity of Greedy Method algorithms.
4	Describe, apply and analyze the complexity of Dynamic Programming algorithms.
5	Apply Backtracking, Branch and Bound strategies.
6	Apply String Matching Algorithms.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction** 1. Space and time complexity 2. Asymptotic notations: Big-Oh, Omega, Theta notations 3. Mathematical Background for algorithm analysis 4. Analysis of Selection Sort, Insertion Sort 5. Recurrences: The Substitution Method, Recursion tree method, Master method **Self-Learning Topic:** Heap Sort	06	CO1
02	**Divide and Conquer Approach** 1. General Method 2. Merge Sort 3. Quick Sort 4. Finding minimum and maximum 5. Binary search	06	CO2

	6. Strassen's Matrix multiplication		
03	**Greedy Method Approach** 1. General Method 2. Single source shortest path: Dijkstra's Algorithm 3. Fractional Knapsack problem 4. Job sequencing with deadlines 5. Minimum cost Spanning Trees: Kruskal and Prim's Algorithms	**08**	**CO3**
04	**Dynamic Programming Approach** 1. General Method 2. Multistage Graphs 3. Single source shortest path: Bellman-Ford Algorithm 4. All-pair shortest path: Floy-Warshall Algorithm 5. Matrix Chain Multiplication 6. Assembly Line Scheduling 7. 0/1 Knapsack Problem 8. Travelling Salesperson Problem 9. Longest Common Subsequence	**12**	**CO4**
05	**Backtracking and Branch and Bound** 1. General Method 2. Backtracking: 1. N-queen problem 2. Sum of Subsets 3. Graph coloring 4. Branch and Bound: 1. Knapsack problem 2. 15-Puzzle problem	**06**	**CO5**
06	**String Matching Algorithms** 1. The Naïve string matching Algorithm 2. The Rabin Karp Algorithm 3. The Knuth-Morris-Pratt Algorithm	**04**	**CO6**

Textbooks:	
1	T. H. Coremen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to Algorithms". 2nd Edition, PHI Publication 2005.
2	Ellis Horowitz, Sartaj Sahni, S. Rajsekaran, "Fundamentals of Computer Algorithms", University Press.
References:	
1	Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw-Hill Edition.
2	S. K. Basu, "Design Methods and Analysis of Algorithm, PHI
3	https://nptel.ac.in/courses/106106127
4	https://onlinecourses.nptel.ac.in/noc25_cs33/preview
5	https://onlinecourses.nptel.ac.in/noc25_cs23/preview

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1) Assignment: 5 Marks
2) Quiz/Open book test/Presentation: 10 Marks
3) Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
OE3011	**Biology for Engineers**	20	20	60	1	2	100	

Prerequisite: Basic concepts of core sciences like physics, chemistry, and mathematics	
Course Objectives: The course aims to	
1	To familiarize the students with the basic biological concepts and their engineering applications.
2	To enable the students with an understanding of biodesign principles to create novel devices and structures.
3	To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems
4	To motivate the students develop the interdisciplinary vision of biological engineering.
Course Outcomes: Learners will be able to	
1	Understand the biological concepts from an engineering perspective.
2	Understand the artificial systems mimicking human action and collaborate the concepts of biomimetics for specific requirements.
3	Elucidate the basic biological concepts via relevant industrial applications and case studies.
4	Think critically towards exploring innovative biobased solutions for socially relevant problems.
5	Evaluate the principles of design and development, for exploring novel bio-engineering projects.
6	Integrate biological principles for developing next generation technologies.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction of Cell and Biomolecules:** Structure and functions of a cell. Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, Proteins, lipids. Importance of special biomolecules: Properties and functions of enzymes, vitamins and hormones.	06	**CO1**
02	**Analogy of biological organs** Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease) Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye) Kidney as a Filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine), Heart as a Pumping system Process: (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, stents, pacemakers). **Self-Learning Topic:** CPR techniques. Photosynthesis & solar cells, Xylem & plumbing, Thermoregulation in human body & heat transfer in machine, Defense mechanism in organism, signaling processing in biology and electronics.	10	**CO2**
03	**Nature Inspired Materials and Mechanism:** Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train). Biomaterials: Types, properties and applications **Self-Learning Topic:** Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).	08	**CO3**
04	**Biological Inspired Techniques.** Bioprinting techniques and materials, Electrical tongue and electrical nose in food science, Self-healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).	08	**CO4**

	Self-Learning Topic: DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis.		
05	**Bio-Medical Devices** Diagnostic (X-ray machines, CT scanners and MRI machines.) Therapeutic (ventilators, infusion pumps and pacemakers), Monitoring (Oximeter, Glucometer,Thermometer, BP monitor) Implantable devices and Smart Devices	04	**CO5**
06	**Bio-Engineering Applications** Bio-medical imaging: Principle, types and examples Biosensors: Principle, types and examples Bioprinting: 3D printing of biological tissues and organ engineering and transplanting Artificial Intelligence in biomedical field	06	**CO6**

Text Books:

1. Stuart Fox, Krista Rompolski, "Human Physiology", McGraw-Hill eBook. 16th Edition, 2022
2. Leslie Cromwell, "Biomedical Instrumentation", Prentice Hall 2011.
3. Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., "Biology for Engineers", Tata McGraw-Hill, New Delhi, 2012.
4. Ibrahim Ozbolat, "3D Bioprinting: Fundamentals, Principles and Applications" Academic Press, 2016.
5. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
6. T Johnson, Biology for Engineers, CRC press, 2011 Molecular Biology and Biotechnology 2nd ed. J.M. Walker and E.B. Gingold. Panima Publications. PP 434.
7. Dr. U. Satyanarayana Dr. U. Chakrapani, "Biochemestry (with Clinical Concepts & Case Studies)", Elsevier 4th Edition, New Delhi 2013.

References:

1. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, "Outlines of Biochemistry", John Wiley and Sons, 2009
2. Molecular Biology by G. Padmanabhan, K. SivaramSastry, C. Subramanyam, 1995, Mac Millan
4. AlbertsEt.Al. The molecular biology of the cell, 6/e, Garland Science, 2014
5. https://onlinecourses.nptel.ac.in/noc19_ge31/preview
6. VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
7. https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
8. https://nptel.ac.in/courses/121106008

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

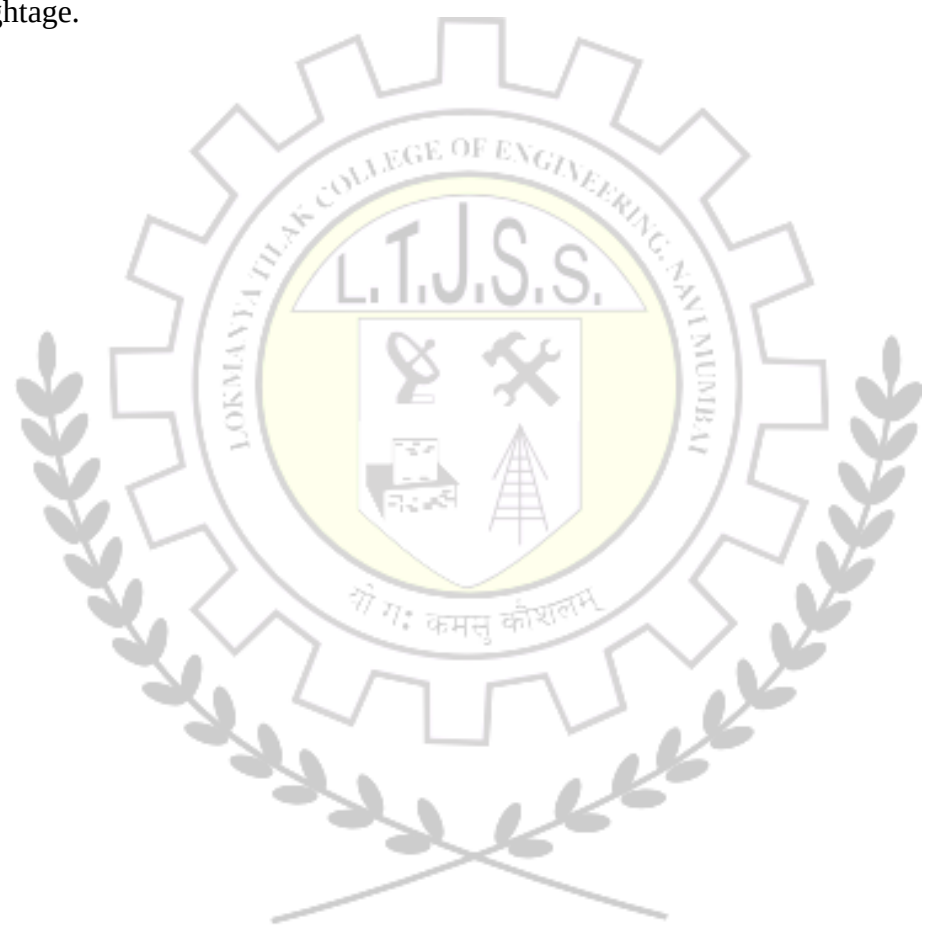
Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.



Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
OE3012	**Indian Constitution & Governance**	20	20	60	1	2	100	

Prerequisite: Know-how of Indian history and polity	
Course Objectives: The course aims to	
1	To create awareness about Indian Constitution to undergraduate students
2	To give knowledge about the system of government (central and state) and also the fundamental rights and duties enshrined in the Indian Constitution
3	To create awareness about Indian Judiciary, Constitutional Bodies, Regulatory Bodies and Public Policy
4	To give knowledge about important aspects of Governance
Course Outcomes: Learners will be able to	
1	To remember and understand the fundamental Rights and Duties
2	To understand the system of Indian Government
3	To discuss and summarize the Powers and Functions of Central and State Government
4	To explain Indian Judiciary System and Constitutional Bodies
5	To outline the functionalities of various Regulatory Bodies
6	To understand the important aspects of Good Governance

Module	Detailed Contents	Hrs.	CO Mapping
01	**Constitutional Framework**	8	**CO1**
	Constitutional law as the Supreme law of land Historical Background of Indian Constitution		

	Making of Indian Constitution Salient Features of the Constitution Preamble of the Constitution Fundamental Rights and Duties Directive Principles of State Policy		
	Self-Learning Topic: Sources of the Constitution, Comparison of the Constitutions, Government of India Act, 1935		
02	**System of Indian Government**	7	**CO2**
	Parliamentary System Federal System Legislative Relations between the Centre and States Inter-State Relations Emergency Provisions		
	Self-Learning Topic: Parliament and its Committees		
03	**Central (Union) and State Government**	7	**CO3**
	Election, Qualifications, Oath, Powers and Functions of: President and Vice-President Prime Minister State Governor Chief Minister Central and State Council of Ministers		
	Self-Learning Topic: Panchayati Raj and Municipalities		
04	**Indian Judiciary and associated Constitutional Bodies**	8	**CO4**
	Supreme Court of India State High Court, Sub-ordinate Courts Election Commission of India Comptroller and Auditor General of India Attorney General of India Advocate General of the State		
05	**Regulatory Bodies and Public Policy**	7	**CO5**
	Insurance Regulatory and Development Authority (IRDAI) Securities and Exchange Board of India (SEBI) Telecom Regulatory Authority of India (TRAI)		

	Bar Council of India (BCI) All India Council for Technical Education (AICTE) National Policy for Empowerment of Women, National Health Policy National Policy on Skill Development, Education Policy		
	Self-Learning Topic: Autonomous and Advisory Bodies		
06	**Important Aspects of Governance** Good Governance, e-Governance Citizen's Charter People's Participation Public Sector Reforms Corporate Governance	5	**CO6**

Text Books:

1. Lawman's Bare Act - The Constitution of India, Kamal Publishers, New Delhi.
2. M Laxmikanth, Indian Polity, 5th Edition, McGraw Hill Education
3. M Laxmikanth, Governance in India, 2nd Edition, McGraw Hill Education
4. Durga Das Basu, Introduction to the Constitution of India, 23rd Edition, LexisNexis

References:

1. https://iipa.org.in/upload/polity1.pdf
2. https://iipa.org.in/upload/polity2.pdf
3. https://cdnbbsr.s3waas.gov.in/s380537a945c7aaa788ccfcdf1b99b5d8f/uploads/2024/07/20240716890312078.pdf

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
OE3013	**Human Psychology**	20	20	60	1	2	100	

Prerequisite:	
Course Objectives: The course aims to	
1	Understand the fundamental concepts and theories of human psychology.
2	Analyse cognitive, emotional, and social development across the human lifespan.
3	Evaluate different psychological approaches to behaviour, perception and learning.
4	Apply psychological principles to real-life scenarios, including workplace and interpersonal relationships.
Course Outcomes: Learners will be able to	
1	Identify key psychological concepts and their relevance in daily life.
2	Understand and analyse cognitive functions like memory, perception and problem-solving.
3	Apply psychological theories to interpret human emotions and behaviour.
4	Examine different personality types and their influence on individual behaviour.
5	Evaluate mental health conditions and discuss various therapeutic approaches.
6	Relate psychology to real-world applications in education, workplace and health.

Module	Detailed Contents	Hrs	CO Mapping
01	**Introduction to Psychology** Definition and scope of psychology, importance in daily life, historical perspectives, Functionalism, Psychoanalysis, Behaviourism, Humanism, Cognitive Psychology.	05	**CO1**
02	**Human Cognition & Personality**	06	**CO2**

	Sensation & perception, stages of memory (sensory, short-term, long-term), forgetting and memory enhancement techniques, intelligence (IQ, emotional intelligence). Theories of personality		
	Self-Learning Topic: Memory Enhancement Techniques and their Effectiveness		
03	**Emotions & Motivation**	07	**CO3**
	Basic emotions and their role in behaviour, Theories of emotion, Intrinsic vs. extrinsic motivation, major motivation theories, application of motivation in workplace and education.		
	Self-Learning Topic: Case Study on Emotional Intelligence in Leadership and Workplace Productivity.		
04	**Personality & Behavioural Psychology**	08	**CO4**
	Types of personalities, social perception and group behaviour, factors influencing attitude formation, persuasion, leadership styles, social influence (conformity, obedience, compliance), communication and its impact on behaviour. Overview of psychological disorders: Anxiety, Depression, Schizophrenia, OCD.		
	Self-Learning Topic: The Role of social media in Shaping Human Behaviour and Perceptions.		
05	**Stress & Well-being**	08	**CO5**
	Theories of stress, impact of stress on physical and mental health, coping mechanisms (problem-focused vs. emotion-focused coping), resilience and positive psychology techniques for well-being.		
	Self-Learning Topic: Meditation, Mindfulness, and Stress Reduction Techniques – A Practical Guide.		
06	**Applications of Psychology**	08	**CO6**
	Role of psychology in workplace settings (Industrial & Organizational Psychology), Human-Computer Interaction, ethical considerations in psychology (confidentiality, informed consent, ethical dilemmas).		
	Self-Learning Topic: Psychological Factors Influencing Consumer Behaviour and Marketing Strategies		

Text Books:

1. Psychology, Author: Saundra K. Ciccarelli, J. Noland White, Publisher: Pearson, 6th Edition.
2. Understanding Psychology, Author: Robert S. Feldman, Publisher: McGraw-Hill, 14th Edition.

3. Introduction to Psychology, Author: James W. Kalat, Publisher: Cengage Learning, 11th Edition.

References:

1. https://onlinecourses.nptel.ac.in/noc20_hs28/preview
2. https://www.apa.org/
3. https://positivepsychology.com/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
OE3014	**Disaster Management and Mitigation**	20	20	60	1	2	100	

Prerequisite: Require knowledge of Environmental Science concepts	
Course Objectives: The course aims to	
1	Introduce the fundamental concepts of disaster management
2	Understand the causes,impact,and risk analysis of various disasters.
3	Familiarise students with disaster mitigation ,preparedness and response strategies
4	Educate about the role of technology,engineering solutions,and policies in disaster risk reduction
5	Enable students to design and implement disaster management strategies in engineering projects.
Course Outcomes: Learners will be able to	
1	Understand the different types of disasters and their effects on the environment and society
2	Analyse disaster risk and vulnerabilities related to engineering systems
3	Understand structural and non-structural mitigation measures
4	Apply disaster preparedness and response strategies in engineering practices
5	Understand use of recent technologies for disaster mitigation
6	Understand policies, Governance and legal framework for disaster management

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Disaster management** 1.1 Definition: Disaster, Hazard, Vulnerability, Risk, Direct and Indirect Effects of Disaster 1.2 Types of disasters: Natural (Earthquake, Flood, Cyclone, Drought, Tsunami, Landslides) & Man-Made (Industrial, Chemical, Nuclear, Biological, Fire, Accidents, Terrorism). 1.3 Phases of Disaster Management Cycle (Prevention, Mitigation, Preparedness, Response, Recovery, Rehabilitation). **Self-Learning Topic:** List some natural and Man-made disasters that happened in India in the last 5 years.	08	CO1
02	**Module Title: Risk Assessment and Vulnerability Analysis** 2.1 Hazard Identification and Risk Assessment (HIRA) with objectives, key components, Steps, tools and techniques used. 2.2 Vulnerability and Capacity Assessment (VCA): components and process. 2.3 Disaster Risk Reduction (DRR): Concepts and Approaches 2.4 Community-Based Disaster Risk Reduction (CBDRR): Principles and Key components.	07	CO2
03	**Disaster Mitigation measures.** 3.1 Structural Mitigation Measures: Earthquake-resistant structures, Cyclone shelters, Flood embankments, Landslide control structures 3.2 Non-Structural Mitigation Measures: Early Warning Systems, Public Awareness and Education, Insurance and Financial Mitigation.	06	CO3
04	**Disaster Preparedness and Response** 4.1 Preparedness Planning, Incident Command System (ICS), Emergency Operations Centers (EOC), Search and Rescue (SAR) operations, Relief and Rehabilitation measures 4.2 Logistics and Supply Chain in Disaster Management. 4.3 Role of Government, NGOs, Armed Forces, and International Agencies. 4.4 Do's and Don'ts in case of Disaster .	07	CO4
05	**Applications of Technology in Disaster Management** 5.1 Remote Sensing and GIS Applications. 5.2 Role of Internet and software for effective disaster management. 5.3 ICT and Communication Technologies. 5.4 Drones and Unmanned Systems 5.5 Case studies of Technological Interventions. **Self-Learning Topic:** Roles of Engineers in disaster management and mitigation with examples.	07	CO5
06	**Policies, Governance and Legal Framework**		CO6

	6.1 Paradigm shift in Disaster Management. 6.2 Disaster Management Act, 2005 (India) / Relevant National Acts. 6.3 National Institute of Disaster Management (NIDM), National Disaster Management Authority (NDMA) and State DMAs 6.4 International Frameworks: Sendai Framework, SDGs, Role of Policies in Engineering Practices. 6.5 Case studies on successful Disaster Management strategies.	07	

Text Books:

1. “Disaster Management" by Harsh K. Gupta
2. "Introduction to International Disaster Management" by Damon P. Coppola
3. "Disaster Management and Preparedness" by Collins Larry M. and Schneid Thomas D.
4. “Disaster Management and Mitigation”, by B.K. Khanna, New India Publishing Agency.
5. “An Introduction to Disaster Management: Principles and Practice”, by Satish Modh.
6. Natural Hazards and Disaster Management, Vulnerability & Mitigation by R B Singh, Rawat Publications.

References:

1. National Disaster Management Authority (NDMA), India: Guidelines on Earthquakes, Floods, Cyclones, Industrial Disasters, Urban Flooding, etc. Available at: https://ndma.gov.in IS Codes for Earthquake Resistant Design (IS 1893, IS 13920).
2. United Nations Office for Disaster Risk Reduction (UNDRR).
3. UNISDR Guidelines and Sendai Framework Documents

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignments/ Case studies: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
EEMC301	Entrepreneurship & Financial Management	20	20	60	1	2	100	

Course Objectives: The course aims to	
1	Introduce students to the concepts of entrepreneurship and help them to identify entrepreneurial opportunities.
2	Provide a brief overview of business planning and funding options.
3	Understand the basic concepts of time value of money, returns and risks, working capital and sources of finance.
4	To provide overview of capital budgeting, capital structure, dividend policy
Course Outcomes: Learners will be able to	
1	Understand the concept of fundamental entrepreneurship, develop an entrepreneurial mindset, and recognize the relevance of entrepreneurship across various industries.
2	Identify and evaluate entrepreneurial opportunities through systematic market research and develop a comprehensive and viable business plan for a startup.
3	Describe the essential aspects of funding and understand various sources of finance
4	Apply the principles of capital structure to effectively strategize funding for startups.
5	Analyse the concept of capital budgeting and working capital management
6	Evaluate investment, financing, and dividend decisions to optimize business performance and sustainability.

Module	Detailed Contents	Hrs	CO Mapping
01	**Foundations of Entrepreneurship** Understanding entrepreneurship: Definition, scope, and significance, Key characteristics of successful entrepreneurs, Exploring entrepreneurial ecosystems: Components and impact, Developing an entrepreneurial mindset: Creativity, risk-taking, and resilience, The role of entrepreneurship across industries **Self-Learning Topic:** Case study on successful entrepreneurs.	04	**CO1**
02	**Evaluating Entrepreneurship Opportunities** Assessing entrepreneurial opportunities, Market research and feasibility studies, Lean startup methodologies, Elements of business plan, Strategic marketing and sales approaches **Self-Learning Topic:** Understanding the procedure and types of permissions to initiate the startups	04	**CO2**
03	**Fundamentals of Funding and Finance** Time value of money, return and risk, Stages of financing, Debt, venture capital and other forms of financing, Sources of startup funding, Introduction to venture capital and angel investors, Crowdfunding and bootstrapping overview	04	**CO3**
04	**Capital Structure** Determinants of capital structure: Key factors influencing an entity's financial structure, Theories and models of capital structure: Analyzing various conceptual approaches, Traditional and modern theories: Net Income (NI) Approach, Net Operating Income (NOI) Approach	05	**CO4**
05	**Capital Budgeting and Working Capital Management** Introduction to capital budgeting: Meaning and importance of capital budgeting, Key Inputs for capital budgeting decisions, Working capital management: Meaning and concept of working capital, Importance of working capital management, Investment appraisal techniques: Accounting rate of return (ARR), Payback period & discounted payback period, Net present value (NPV), Profitability index (PI), Internal rate of return (IRR)	06	**CO5**
	Dividend Policy		

06	Introduction to dividend policy: Meaning and significance of dividend policy in financial management, Determinants of dividend decisions: Key factors influencing an entity's dividend policy, Overview of dividend policy theories and approaches: Walter's Model- Relationship between dividend decisions and firm valuation, Gordon's Model- Dividend relevance and its impact on stock prices	05	**CO6**

Text Books:

1. Entrepreneurship: A Real -World Approach by Rhonda Abrams.
2. Entrepreneurship- Theory, Process Practice –by Kuratko &Hodgetts, Thompson South- Western Publication.
3. Alexander Osterwalder and Yves Pigneur, "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers".
4. Indian Financial System, 9" Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
5. Financial Management, 11h Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

References:

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses" by Eric Ries.
2. Fundamentals of CORPORATE FINANCE, S. A. Ross, R. W. Westerfield, and B. D. Jordan (11th ed.), McGraw Hill, 2018.
3. https://onlinecourses.nptel.ac.in/noc25_ge11/preview
4. https://nptel.ac.in/courses/127105007
5. https://onlinecourses.nptel.ac.in/noc21_mg93/preview

Internal Assessment (40 Marks)

1. **Mid Semester Exam (20 Marks)**

   Mid semester examination will be based on 40% to 50% of the syllabus.

2. **Continuous Internal Evaluation (20 Marks)**
   1. Assignment/Case study: 5 Marks
   2. Quiz/Open book test/Presentation: 10 Marks
   3. Regularity and attendance: 5 Marks

3. End Semester Examination (60 Marks)

   End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
VEC 301	Environment & Sustainability	NA	50	NA	NA	NA	50	

Prerequisite: Knowledge of Universal human values & geography	
Course Objectives: The course aims to	
1	To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
2	Understand and identify environmental issues relevant to India and global concerns
3	To familiarize the concept of sustainable development goals
4	Familiarize environment related legislations
Course Outcomes: Learners will be able to	
1	Demonstrate an understanding of the basic concepts of the environment, ecosystems, and biodiversity
2	Identify and understand the Global Environmental concerns.
3	Learn & understand the concepts of Biodiversity.
4	Learn & understand the implementation of Environment Management.
5	Understand and apply the concept of Sustainable Development Goals (SDGs) in addressing environmental and socio-economic issues.
6	To Gain knowledge of environment related legislations.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction and Definition of Environment**:	06	CO1
	Significance of Environment Management for contemporary managers, Environmental issues relevant to India, The Energy scenario		

	Self-Learning Topic: Content of Environment		
02	**Global Environmental concerns** Global warming-causes, effect, process, Greenhouse effect, Acid Rain, Ozone Depletion, Hazardous Wastes, Energy resources, Endangered life-species, Loss of Biodiversity. Emerging technologies to address Global warming **Self-Learning Topic: Various types of Pollutions.**	05	**CO2**
03	**Biodiversity** Ecosystems and interdependence between living organisms, habitats, limiting factors, Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation, hot-spots of biodiversity, threats to biodiversity	04	**CO3**
04	**Implementation of Environment Management** Role and functions of Government as a planning and regulating agency, NGO, Corporate Environmental practices, AI driven environmental management.	05	**CO4**
05	**Sustainability Practices & Management** Sustainable practices, Environmental impact assessment, impact analysis, Environmental life cycle analysis, Environmental risk assessment, ecological Sustainable development, Principles of sustainable development, sustainable development goals, economic development & Environment, green growth, AI and Sustainability practices.	05	**CO5**
06	**General overview of major legislations:** Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act. **Self-Learning Topic:** Indian Constitution	03	**CO6**

Text Books:

1. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
2. Environmental Management V Ramachandra and Vijay Kulkarni, TERI Press

References:

1.Indian Standard Environmental Management Systems Requirements with Guidance for Use, Bureau of Indian Standards, February 2005.

Continuous Internal Evaluation (50 Marks)

1. Seminar: 10 Marks
2. Field Visit/ NSS activity as case study: 20 Marks
3. Regularity and attendance: 05 Marks
4. Course project & Report (Group activity): 15 Marks.

Ccourse Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
DSVSEC301	**Full Stack Java Programming**	-	25	25	-	-	50	

Prerequisite: Basic Programming constructs in C & Python.	
Course Objectives: The course aims to	
1	Understand the Basic OOP concepts in Java
2	Understand the concepts of inheritance and exceptions in Java
3	Design and implement programs involving Client and Server Side Programming
4	Describe and utilize the functioning of DOM and Java script
5	Study different design patterns in web programming and understand the working of React framework.
6	Describe the Spring Framework and implement the related case studies
Course Outcomes: Learners will be able to	
1	Understand and apply the fundamentals of Java Programming and Object-Oriented Programming.
2	Analyze and Illustrate Inheritance and Exception Handling Mechanisms
3	Ellaborate and Design applications using Client and Server Side Programming
4	Understand the concepts in JavaScript for interactive Web Development
5	Implement the real-world web application development using React
6	Design and Develop Enterprise-Level Applications using Spring Framework

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to OOP in Java**	04	

	1.1: OOP Concepts: Objects, classes, encapsulation, abstraction, inheritance, polymorphism, message passing. 1.2: Classes & Objects: Data members, member functions, constructors (types), static members, method overloading. 1.3: I /O in Java: BufferedReader, Scanner. 1.4: Packages: Types, user-defined packages. **Self-Learning Topic**: Branching & Looping: Control structures, Array and Vectors in Java		**CO1**
02	**Inheritance & Exception Handling** 2.1: Inheritance: Types of inheritance, Method overriding, super, abstract class and abstract method, final, Multiple inheritances using interface, extends keyword. 2.2: Exception Handling: try, catch, finally, throw and throws, Multiple try and catch blocks, user defined exception. **Self-Learning Topic:** Multithreading in Java	03	**CO2**
03	**Client and Server-Side Programming** 3.1: Java Database Connectivity (JDBC): Architecture, drivers, database connection (MySQL, Oracle), executing SQL queries. 3.2: Client-Side Scripting: HTML: Elements, attributes, structure, links, images, tables, forms, CSS3: Syntax, inclusion, colors, backgrounds, fonts, selectors. 3.3: Server-Side Java: Servlets: Lifecycle, requests/responses, session management, Handling forms and user Inputs. 3.4: Java Server Pages: Introduction to JSP, Architecture, components, scripting elements, JSTL. **Self-Learning Topic**: Database Connectivity in Servlets and Implement JSP with JDBC to fetch data from a database	07	**CO3**
04	**Fundamentals of Java Script** 4.1: JavaScript: Introduction, conditionals statements, Loops, functions, arrays, objects, control flow, Math functions, Browser Object Model , Document Object Model. 4.2: DOM Manipulation : Introduction to DOM , Accessing relative nodes, Checking the node type, Dealing with attributes, Creating and manipulating nodes, DOM HTML Features, Attributes as properties, Table methods, DOM Traversal, NodeIterator, TreeWalker, Selector methods, Detecting DOM Conformance, DOM style methods, Custom tooltips, Collapsible sections, Accessing style sheets Events, Fetch & Callbacks: Event Flow, Event Handlers/Listeners,The Event Object, Types of Events,Cross-Browser Events, HTTP Responses, Working with JSON data.	05	**CO4**

05	**Web Programming using React**	05	**CO5**
	5.1: Design Pattern: Understanding MVC architecture Implementing MVC with servlets and JSP Developing a complete web application Solving company's use cases. 5.2: React Framework: Introduction to React JS, Components and Elements of React, Rendering Components, React State and Props, Events, Hooks, Routing Conditional Rendering, Lists and Keys, Forms, create a single page application using React.		
06	**Applications of Spring Framework**	04	**CO6**
	6.1: Spring Framework: Introduction to Microservices, Basics Dependency injection and inversion of control (IoC), Spring annotations, Database integration and Aspect-oriented programming (AOP) with spring, creating spring boot application.		
	Self-Learning Topic: Building RESTful APIs with spring boot.		

Text Books:

1. Herbert Schildt, "Java The Complete Reference" Ninth Edition, Oracle Press
2. Christopher Schmitt and Kyle Simpson, "HTML5 Cookbook",O'Really Press
3. Nicholas C. Zakas,"Professional JavaScript™ for Web Developers", Wiley Publishing
4. Amuthan G., "Spring MVC, Beginners Guide" Pakt Publication
5. Chris Minnick, "BEGINNING ReactJS Foundations Building User Interfaces with ReactJS", Wrox publication
6. Iuliana Cosmina, Rob Harrop, "Pro Spring 5 An In-Depth Guide to the Spring Framework and Its Tools",Fifth Edition,APress

References:

1. Laura Lemay, Charles L. Perkins","Teach Yourself JAVA in 21 Days",Sams.net Publishing
2. Eureka, Ribbon, Zuul and Cucumber Moises Macero,"Learn Microservices with Spring Boot A Practical Approach to RESTful Services using RabbitMQ", APress
3. Alex Banks & Eve Porcello," React FUNCTIONAL WEB DEVELOPMENT WITH REACT AND REDUX", O'Really Press

Online Resources:

Sr. No.	Website Name
01	https://www.javatpoint.com/html5-tutorial
02	https://www.w3schools.com/js/
03	https://www.tutorialspoint.com/spring_boot/index.htm
04	https://www.w3schools.com/REACT/DEFAULT.ASP

Suggested List of Experiments

Sr. No.	Experiments	CO Mapping
01	Programs on classes and objects	**CO1**
02	Programs on method overloading.	**CO1**
03	Programs on constructor overloading.	**CO1**
04	Programs on various types of inheritance.	**CO2**
05	Programs on Exception handling techniques.	**CO2**
06	Program to create a website using HTML CSS and JavaScript	**CO3**
07	Program based on Document Object Model to change the background color of the web page automatically after every 5 seconds	**CO4**
08	Program using Java Script to validate the email address entered by the user (check the presence of "@" & "." character. If this character is missing, the script should display an alert box reporting the error and ask the user to re-enter it again).	**CO4**
09	Program on Implementing Generic and HTTP servlet.	**CO3**
10	Design a login webpage in JSP that makes validation through Database using JDBC and call the servlet for various operations	**CO5**
11	Program on Implicit and Explicit objects in JSP	**CO5**
12	Program for making use of React Hooks that displays four buttons namely, "Red", "Blue", "Green", "Yellow". On clicking any of these buttons, the code displays the message that you have selected that particular color	**CO5**
13	Program to create a Monolithic Application using SpringBoot.	**CO6**

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mini Project :05 Marks
3. Assignment (01) and MCQ (01) :05 Marks
4. Regularity and Attendance: 05 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					
DSPCL301	Computer Organization & Architecture Lab	-	25	25	-	-	50	1

Prerequisite: Basic electronics concepts	
Course Objectives: The course aims to	
1	To implement operations of the arithmetic unit using algorithms.
2	To design and implement memory subsystems including cache memory.
3	To emphasize on the use of Assembly language programs.
4	To understand and demonstrate the functionality of system buses, simulate or analyse the linear pipelined execution in a computer system
Lab Outcomes: Learners will be able to	
1	To understand the basics of digital components
2	To implement various algorithms for arithmetic operations
3	To understand and analysing memory hierarchy and implement various cache mapping methods
4	To understand the concept of microprogramming for the assembly language instruction
5	To demonstrate the evolution of system buses and simulate bus arbitration mechanism
6	To analyse, simulate linear pipeline and to detect linear pipeline hazards

Suggested List of Experiments

Sr. No.	Experiments	LO Mapping

01	Verify the truth table of various logic gates.	LO1
02	Verify the DeMorgan's theorem using logic gates.	LO1
03	Implementation of IEEE 754 standard for Floating Point representation of data.	LO2
04	Implementation of Booth's multiplication algorithm for binary number system.	LO2
05	Implementation of the Restoring division algorithm for binary number system.	LO2
06	Implementation of the Non-restoring division algorithm for binary number system.	LO2
07	Design of flip-flops.	LO1, LO3
08	Analysis of memory hierarchy.	LO3
09	Implementation of various Cache mapping methods.	LO3
10	Generation of Microprogram for simple assembly language instruction.	LO4
11	Case study on evolution of system buses.	LO5
12	Simulation of Daisy chaining bus arbitration.	LO5
13	Simulation of linear pipeline.	LO6
14	Analysis of linear pipeline.	LO6
15	Detection of data dependent hazards in linear pipelines.	LO6

Continuous Internal Evaluation (25 Marks)
1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)
An Oral & Practical exam will be held based on entire syllabus.

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
DSPC L302	Algorithm Lab	-	25	25	-	-	50	

Prerequisite: C Programming, Data Structure concepts	
Course Objectives: The course aims to	
1	To introduce the methods of designing and analysing algorithms.
2	Design and implement efficient algorithms for a specified application.
3	Strengthen the ability to identify and apply the suitable algorithm for the given real-world problem.
4	Analyse worst-case running time of algorithms and understand fundamental algorithmic Problems.
Course Outcomes: Learners will be able to	
1	Analyze and Implement basic sorting Algorithms.
2	Analyze and Implement Divide and Conquer Strategy Algorithms.
3	Analyze and Implement Greedy Method Algorithms.
4	Analyze and Implement Dynamic Programming Algorithms.
5	Implement Backtracking, Branch and Bound Algorithms.
6	Implement String Matching Algorithms.

Suggested List of Experiments (Implementation should be in C language only)

Sr. No.	Experiments	CO Mapping
01	**Introduction**	CO1
	Selection Sort Insertion Sort	
02	**Divide and Conquer Approach**	CO2
	Merge Sort Quick Sort Finding Min and Max Binary Search Strassen's Matrix Multiplication	
03	**Greedy Method Approach**	CO3
	Dijkstra's Algorithm Fractional Knapsack Job Sequencing with Deadlines Kruskal and Prim Algorithms for finding MST	
04	**Dynamic Programming Approach**	CO4
	Bellman Ford Algorithm Floyd-Warshall Algorithm 0/1 Knapsack Problem Longest Common Subsequence	
05	**Backtracking and Branch and Bound**	CO5
	N-queen Sum of Subsets Graph Coloring 15-Puzzle Problem	
06	**String Matching Algorithms**	CO6
	The Naïve String-Matching Algorithm The Rabin Karp Algorithm The Knuth-Morris-Pratt Algorithm	

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Department of Computer Science and Engineering
(Data Science)
Second Year Engineering Curriculum: Semester IV

Coure Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
DSPCC401	Discrete Mathematics & Graph Theory	20	20	60	1	2	100	

Prerequisite: Basic Mathematics	
Course Objectives: The course aims to	
1	Introduce foundational concepts such as sets, logic, functions, relations for problem-solving.
2	Develop critical thinking and problem-solving skills by applying discrete mathematical principles to real-world situations, algorithms, and computer science-related problems
3	Enhance understanding mathematical structures such as graphs, trees, and algebraic structures for real time application.
4	Apply discrete mathematics tools in various computer science fields such as data structures, algorithms, automata theory, and software design.
Course Outcomes: Learners will be able to	
1	Understand the basic principles of sets and operations in sets.
2	Verify the correctness of an argument using propositional logic, predicate logic, and truth tables.
3	Describe the concept of relations, poset, and lattice.
4	Use the properties of functions and counting techniques to complete operations on discrete structures
5	Apply algebraic structures and group codes in different fields like data analysis, cryptography, networking etc.

6	Apply the concepts of graph theory in solving real world problems.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Set Theory** Fundamentals - Sets and subsets, Operations on sets Laws of Set Theory, Power Sets, and Products Partition of sets, The Principle of Inclusion - Exclusion **Self Learning Topic:** Venn Diagrams	4	CO1
02	**Logic** Propositions and Logical operations, Truth tables Equivalence, Implications, Laws of Logic, Normal forms Predicates and quantifiers Mathematical Induction	6	CO2
03	**Relations** Definition, Paths and Digraphs Types of binary relations Operations on relations, Closures, Warshall's algorithm Equivalence and partial ordered relations Poset, Hasse diagram and Lattice	10	CO3
04	**Functions** Types of functions - Injective,Surjective and Bijective Composition of functions , Identity and Inverse function Pigeon-hole principle Generating Functions and Recurrence Relations Recursive Functions	8	CO4
	Algebraic Structures and Coding Theory		

05	Algebraic structures with one binary operation: semigroup, monoid and group, Abelian group Isomorphism, Homomorphism and Automorphism Cyclic groups, Normal subgroups CodingTheory: Codes, Group codes Error detection and error correction	**6**	**CO5**
	Self Learning Topic: Decoding		
06	**Graphs**	**8**	**CO6**
	Definitions, Paths and circuits: Eulerian and Hamiltonian Types of graphs, Sub Graphs Isomorphism of graphs Graph Traversal: BFS,DFS, Applications: Traveling salesman problem		
	Self Learning Topic: Trees		

Text Books:

1. Bernad Kolman, Robert Busby, Sharon Cutler Ross, Nadeem-ur- Rehman, "Discrete Mathematical Structures", Pearson Education
2. C.L.Liu, Elements of Discrete Mathematics, second edition 1985, McGraw-Hill Book Company. Reprinted 2000
3. K.H.Rosen, Discrete Mathematics and applications, fifth edition 2003, TataMcGraw Hill publishing Company.
4. J. P. Trembley, R. Manohar "Discrete Mathematical Structures with Applications to Computer Science",TataMcgraw-Hill.

References:

1. Y N Singh, "Discrete Mathematical Structures", Wiley-India.
2. Narsing Deo, "Graph Theory with applications to engineering and computer science", PHI Publications.
3. https://nptel.ac.in/courses/106/106/106106094/
4. https://www.coursera.org/specializations/discrete-mathematics

Internal Assessment (40 Marks)

1. Mid Semester Exam (20 Marks)
Mid semester examination will be based on 40 % to 50% of the syllabus.

2. Continuous Internal Evaluation (20 Marks)
   A. Assignment: 5 Marks
   B. Quiz/Open book test/Presentation: 10 Marks

C. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
DSPCC402	Database Management System	20	20	60	1	2	100	

Prerequisite: Basic knowledge of database concepts	
Course Objectives: The course aims to	
1	Familiarize fundamental concepts of database management System
2	Develop entity relationship data model and its mapping to relational model
3	Learn relational algebra and SQL to formulate queries
4	Apply normalization techniques to normalize the database
5	Understand concepts of transaction, concurrency control and database recovery techniques
6	Study Data warehousing fundamentals.
Course Outcomes: Learners will be able to	
1	Demonstrate understanding of DBMS to design ER and EER models for real life applications.
2	Construct relational model and write relational algebra queries.
3	Analyse the query statement and formulate SQL queries.
4	Apply the concept of normalization to relational database design.
5	Describe the concept of transaction, concurrency and recovery techniques.
6	Comprehend fundamentals of data warehousing.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to database and ER model**		
	1.1 Introduction, Characteristics of databases, Data abstraction, Data Independence, Database system architecture, Database users, Database Administrator		

	1.2 Entity–Relationship Data Model: Types of Entity sets, Types of Attributes, Keys, relationships Relationship constraints: Cardinality and Participation	**09**	**CO1**
	1.3 Extended Entity-Relationship (EER) Model: Generalization, Specialization and Aggregation		
02	**Relational Model and Relational Algebra**	**07**	**CO2**
	2.1 Introduction to Relational Model, relational schema and keys		
	2.2 Mapping the ER and EER Model to the Relational Model		
	2.3 Relational Algebra- Operators, Queries		
	Self-Learning: Indexing and hashing		
03	**Structured Query Language (SQL)**	**10**	**CO3**
	3.1 Overview of SQL, Data Definition Commands Integrity constraints- key constraints, domain Constraints, referential integrity, check constraints, null constraints, unique constraints Data Manipulation commands, string operations, aggregate functions, group by clause, having clause, set operations, Data Control commands		
	3.2 Joins, Subquery, exists operator, in operator, Nested queries		
	3.3 Views, Triggers		
	Self-Learning: NO SQL		
04	**Relational-Database Design**	**04**	**CO4**
	Anomalies in relational database designs, Concept of normalization, Function dependencies, 1NF, 2NF, 3NF, BCNF.		
05	**Transactions Management, Concurrency and Recovery**	**08**	**CO5**
	5.1 Transaction concept, Transaction states, ACID properties, Transaction Control Language (TCL) Commands		
	5.2 Concurrency, Concurrent Executions, Serializability types - Conflict and View, Concurrency Control protocols - Lock-based, Timestamp-based		
	Self-Learning: Recovery System- Log based recovery, Deadlock handling		
06	**Data Warehousing Fundamentals**	**04**	**CO6**
	Introduction to Data warehouse, Data warehouse architecture, ETL		

	operations, dimensional modeling, OLAP operations.		
	Total	**42**	

Text Books:

1	Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, McGraw Hill
2	Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education
3	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, TMH
4.	Paulraj Ponniah, Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals, John Wiley & Sons, Inc.

References Books/online references:

1	Date, C.J., Database in depth: Relational Theory for Practitioners, O'Reilly Media Inc
2	Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning
3	Atul Kahate, Introduction to Database Management Systems, Pearson Education India
4	G. K. Gupta, Database Management Systems, McGraw Hill
5	**NPTEL Course:** Database Management System, IIT, Kharagpur by Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay, Prof. Kaushi Dutta Web Link-https://nptel.ac.in/courses/106105175
6	**MOOC Course:** DBMS Web link- https://www.mooc-list.com/tags/dbms

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

- Assignment: 5 Marks
- Quiz/Open book test/Presentation: 10 Marks
- Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					
DSPCC403	Operating System	20	20	60	1	2	100	3

Prerequisite: Data structures and Computer architecture	
Course Objectives: The course aims to	
1	To introduce basic concepts and functions of operating systems.
2	To understand the concept of process, thread, and resource management.
3	To understand the concepts of process synchronization and deadlock.
4	To understand various Memory, I/O, and File management techniques.
Course Outcomes: Learners will be able to	
1	Understand the objectives, functions, and structure of OS.
2	Analyze the concept of process management and evaluate performance of process scheduling algorithms.
3	Understand and apply process synchronization.
4	Apply and analyze deadlock handling.
5	Evaluate the performance of Memory allocation and replacement policies.
6	Apply and analyze different techniques of file and I/O management.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Operating system Overview**		
	Introduction, Objectives, Functions and Evolution of Operating System, System Boot Operating system structures: Layered, Monolithic, and Microkernel	4	CO1

	Linux Kernel, Shell, and System Calls		
02	**Process and Process Scheduling**		
	Concept of a Process, Process elements, Process States, Process Control Block. Uniprocessor Scheduling Types: Preemptive and Non-preemptive scheduling algorithms (FCFS, SJF, SRTN, Priority, RR) Threads: Definition and Types, Concept of Multithreading	7	CO2
03	**Process Synchronization**		
	Concurrency: Principles of Concurrency, Inter-Process Communication: Message passing and Shared Memory, Process Synchronization. Mutual Exclusion: Requirements, Hardware Support (TSL), Operating System Support (Binary and Counting Semaphores), Producer and Consumer problem	7	CO3
04	**Deadlock Management**		
	Deadlock: Principles of deadlock, Conditions for deadlock, Resource Allocation Graph Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm, Deadlock Detection and Recovery, Dining Philosophers Problem	7	CO4
05	**Memory Management**		
	Memory Management Requirements, Memory Partitioning: Fixed, Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best Fit, First Fit, Worst Fit, Paging and Segmentation, TLB. Virtual Memory: Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU, Thrashing	9	CO5
06	**File Management and I/O Management**		
	Overview of File, File Organization, and Access Methods File Directory, Directory Structure: Single level directory, Two level directory, Tree structure directory, Acyclic directory structure I/O devices, Hard Disk Organization, I/O interface, Modes of transfer: Programmed I/O, Interrupt initiated I/O, Direct Memory Access (DMA) Disk Scheduling: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK.	8	CO6
	Self-learning Topics: Case Study on any one Operating System.		

Textbooks:	
1	William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918.

2	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons, Inc., 9thEdition, 2016, ISBN 978-81-265-5427-0.
References:	
1	Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rd Edition.
2	Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition.
3	Maurice J. Bach, "Design of UNIX Operating System", PHI.
4	Sumitabha Das, "UNIX: Concepts and Applications", McGraw Hill, 4th Edition.
5	https://nptel.ac.in/courses/117/106/117106113/

Assessment: -

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs.)		Total Marks	2 Hrs.
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
OE4011	**Human Resource Management**	20	20	60	1	2	100	

Prerequisites: Knowledge in Business Fundamentals.	
Course Objectives: The course aims to	
1	Develop an understanding of the fundamental concepts, functions and process of Human Resource Management.
2	Obtain the knowledge related to the nature and scope of organizational behaviour and its relevance in Organizational Management.
3	Understand the importance and process of Human resource planning and its applications.
4	Familiarize with various selection procedures and practices related to recruitment, selection and training.
5	Analyze the role of AI and similar technological trends in HR in the digital world.
Course Outcomes: Learners will be able to	
1	Understand the concepts, functions and process of Human Resource Management.
2	Acquire knowledge related to the nature and scope of organizational behavior.
3	Compare and classify concepts of Human resource planning and its applications.
4	Differentiate between various selection procedures and practices related to recruitment, selection and training.
5	Assess the role of AI and similar technological trends in HR in the digital world.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Human Resource Management (HRM)** Introduction and Significance of Human Resource Management, Definition, Scope, Features, Importance and Evolution of the concept of HRM, Functions and Objectives of HRM, Principles of HRM, Limitation of HRM, Role and Quality of Human Resource Managers, Need for HRM Approach.	04	CO1
02	**Organizational Behaviour (OB)** Introduction and Origin of Organizational Behaviour, Nature, Scope and its relevance to Organizational Effectiveness, Understanding employee behavior, Meaning and Determinants of Personality, Personality Development, Personality Types and assessment of Personality Traits, Attitude and Behaviour, Group Behaviour, Team Effectiveness, Motivation and Theories of Motivation , Leadership. **Self-Learning Topic:** Case studies on topics related to Group behaviour, Motivational Theories.	06	CO2
03	**Human Resource Planning (HRP)** Concept and Objective of Human Resource Planning, Importance and Process of Human Resource Planning, Challenges and Factors affecting HRP ,Steps and Effective HRP, Job Analysis, Job Description and Job Specification, Role Analysis. **Self-Learning Topic:** Study and comparison of various Job Descriptions in an organization.	06	CO3
04	**Recruitment, Selection, Performance Management, Training and Development** **Recruitment:** Definition, Recruitment policy, Constraints and Challenges of Recruitment, sources and methods of Recruitment, New Approaches to recruitment. **Selection:** Selection and its Process,Developing effective selection methods including different types of Tests, Interviews and assessments,Induction and Orientation. **Performance Management:** Internal Mobility, Compensation Management, Fixing of wages, Legislation and objectives of performance appraisal, Learning performance appraisal methods, Understanding the concepts of feedback and coaching, Wages and Benefits, Labour Laws. **Training and Development:** Objectives, Need, Importance of Training, Training Vs. Development, Systematic Approach to Training, Training Methods, Career Planning, Career Development. **Self-Learning Topic:** Recent Trends in Recruitment	07	CO4

05	**Emerging Trends in HR**	**05**	**CO5**
	The evolving role of HR in a digital world , The rise of Remote/Hybrid work, Employee engagement strategies,AI in HR, Data analytics in HRM .		
	Self-Learning Topic: International HRM		

Text Books:

1 K. Aswathappa, “Human Resource Management: Text and Cases”, McGraw-Hill Publication.

2 Laurie Mullins, “Management & Organizational Behavior”, Pearson Publication.

3 B.P.Singh, “Human Resource Management: Concepts and Practices”, Excel Books Publication.

4 Deepa Gupta,M.Gupta,Karth Gupta, “HR Analytics:The Future of HR”,PHI Learning

References:

1 Raymond Noe, John Hollenbeck, Barry Gerhart, Patrick Wright, “Fundamentals of Human Resource Management”, McGraw-Hill Publication.

2 Venkata Ratnam C. S. & Srivastava B. K., “Personnel Management and Human Resources”, Tata McGraw Hill, New Delhi.

3 P. C. Tripathi, "Personnel and Human Resource Management”, S. Chand & Sons Publication.

Assessments :

Internal Assessment (40 Marks)

1. **Semester Exam (20 Marks)**
   Mid semester examination will be based on 40 % to 50% of the syllabus.

2. **Continuous Internal Evaluation (20 Marks)**

1. Case Study : 5 Marks
2. Group Activity / Presentation: 10 Marks
3. Regularityand attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
OE4012	Corporate and Cyber Laws	20	20	60	1	2	100	

Prerequisite: Basic Legal Awareness	
Course Objectives: The course aims to	
1	Provide fundamental knowledge of corporate laws
2	Analyse the legal and regulatory framework governing corporate transactions
3	Explore the fundamentals of cyber law and cybersecurity,
4	Examine emerging trends in corporate and cyber laws
Course Outcomes: Learners will be able to	
1	Understand corporate law fundamentals, business entity structures, and corporate governance.
2	Understand legal provisions of the Companies Act, SEBI regulations, CSR laws, and contract laws.
3	Identify cybercrimes, attack methods, and information security risks.
4	Explain cyber law aspects related to e-commerce, IPR, evidence, and criminal law.
5	Analyse IT Act provisions and cybersecurity compliance standards.
6	Evaluate emerging trends in corporate governance, AI regulation, and digital assets laws.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Corporate Laws**	05	CO1
	Concept, Nature, and Scope of Corporate Laws, Legal Personality of Companies, Types of Business Entities (Private, Public, LLP, Sole Proprietorship), Incorporation and Registration of Companies, Lifting or piercing the corporate Veil, Corporate Governance and Ethics.		
	Self-Learning Topic: Comparative Study of Corporate Laws Across		

	Countries		
02	**Regulatory Framework for Companies** Overview of the Companies Act, Key Legal Provisions (Formation, Compliance, Penalties), Shareholder Rights & Director Responsibilities, Company Act 2013 (Key Provisions). Securities and Exchange Laws (SEBI regulations). Corporate Social Responsibility (CSR) Regulations, Contract Law and Business Transactions, Mergers, Acquisitions, and Competition Law	**06**	**CO2**
03	**Introduction to Cybercrime** Definition of Cybercrime and information security, Classifications of cybercrime, Planning of Cyber-attacks, Social Engineering, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Identity Theft. **Self-Learning Topic:** Botnets, DoS and DDoS Attacks, SQL Injection, Buffer Overflow.	**04**	**CO3**
04	**The Concept of Cyberspace** E-Commerce, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking. **Self-Learning Topic:** Global Trends in Cyber Law	**05**	**CO4**
05	**Indian IT Act & Information Security Standard compliances** Penalties, Adjudication and Appeals Under the IT Act 2000, IT Act 2008 and its Amendments. Compliance Standards: SOX, HIPAA, ISO, NERC, PCI-DSS, NIST **Self-Learning Topic:** GLBA, FISMA	**05**	**CO5**
06	**Emerging Trends in Corporate and Cyber Laws** Environmental, Social, and Governance Compliance, Digital Corporate Governance, Artificial Intelligence (AI) Regulation, Digital Assets and Cryptocurrency Regulations	**03**	**CO6**

Text Books:

1. "Company Law" by Avtar Singh, Eastern Book Company
2. "Indian Corporate Law" by N.D. Kapoor, Sultan Chand & Sons
3. "Business Law Including Company Law" by S.S. Gulshan and G.K. Kapoor
4. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
5. "Cyber Security & Cyber Laws" by Nilakshi Jain & Ramesh Menon.

References:

1. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
2. Cyber Law Emerging Trends and Challenges, Dr. Aditya Tomer, Dr. Harshita Singh & Ms. Garima Wadhwa, Redshine Publication

Online Resources:

1. https://www.geeksforgeeks.org/corporate-law/
2. https://www.geeksforgeeks.org/cyber-laws-in-india/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
OE4013	**Stock Market & Personal Finance**	20	20	60	1	2	100	

Prerequisite: Statistical calculations	
Course Objectives: The course aims to	
1	Explain students with knowledge of Securities Market
2	Impart the students to understand the legal frame work of securities Market
3	Empowers the students to have depth knowledge in different segment of stock exchange
4	Build long term personal finance portfolio
Course Outcomes: Learners will be able to	
1	Understand the basic concept of stock market
2	Exercise the Trading on Stock Market
3	Analyze the fundamental and technical aspect of the stock
4	Understand the legal Frame work of Securities Market
5	Calculate the personal financial needs
6	Determine the personal financial goals

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Stock Market and Trading** 1.1 Overview of Stock Market: History, evolution, and types of stock markets. 1.2 Trading Basics: Understanding buying and selling (Entry and Exit form stock), bulls and bears, and market trends. 1.3. Investment Goals and Risk Management: Setting investment objectives, risk tolerance, and asset allocation. 1.4. Stock Market Indices and Sectors: Understanding major stock market indices (e.g., Sensex, Nifty 50, S&P 500, Dow Jones) and sectors (e.g., technology, finance). **Self Learning Topic: Stock brokers in India, fees and charges levied on trader**	04	**CO1**
02	**Financial Markets and Instruments** 2.1 Types of Financial Markets: Money market, bond market, commodity market, and foreign exchange market. 2.2. Stock Market Instruments: Stocks, bonds, ETFs, mutual funds, and derivatives (options, futures). 2.3 Market Participants: Understanding the roles of investors, traders, brokers, and market makers. 2.4 Trading psychology- A practical approach **Self Learning Topic: Difference between Investor and trader, Difference between Investment and Saving**	04	**CO2**
03	**Stock Analysis and Selection** 3.1 Introduction to Technical Analysis: Understanding charts, trends, and patterns. 3.2 Chart Types and Patterns: Line charts, bar charts, candlestick charts, and common patterns (e.g., head and shoulders, triangles). 3.3 Trend Analysis and Indicators: Moving averages, relative strength index (RSI), and other technical indicators. 3.4 Charting Tools and Software: Overview of popular charting platforms (e.g., TradingView, MetaTrader). 3.5 Fundamental Analysis- SMA, EMA, MACD, Bollinger bands, 3.6 Stock analysis through Ratios – P/E ratio, P/B ratio, ROE, EPS, Debt-to-capital ratio, Interest coverage ratio (ICR), Enterprise value to EBIT, Operating margin, Quick ratio **Self Learning Topic:** Find the long term stocks, short term stocks in current scenario of market and Explain Why to invest in these stocks.	06	**CO3**

04	**Stock Market regulations** 4.1 SEBI Acts - Securities Contracts (Regulation) Act, 1956, Securities and Exchange Board of India Act, 1992, Depositories Act 1996, Securities Laws (Amendment) Act, The Finance Act. 4.2 Role of SEBI, Stock exchanges, Stock brokers and Investors 4.3 Stock market Surveillance – ASM, GSM, ESM, T2T 4.4 Investor protection, Investor education, Investor awareness	04	**CO4**
	Self Learning Topic: Case study of Stock Market Frauds		
05	**Introduction to Personal Finance** 5.1 Need for Personal Finance Management 5.2 Income tax planning 5.3 Assessment of personal risk profile 5.4 Understanding the Salary slips 5.5 Insurance (Need of Insurance, Separating investment from insurance Life Insurance, Term Insurance, Mediclaim, Property) **Self Learning Topic: Learn and Understand the Union Budget, Global Budget**	05	**CO5**
06	**Financial Planning for Engineers** 6.1 Time value of money, Return on Investment, Modes of personal Investment and savings (Gold, bonds, Fixed Deposits, Mutual Funds, Crypto currency, Real estate etc. 6.2 Portfolio building (Personal portfolio components, Self-analysis, Govt and Private Agencies) 6.3 Money management (Engineering Students loan, home loan, credit card, Cash) 6.4 Handling the finance in uncertainty and risk – Pandemic, personal, social, professional life **Self-Learning Topic: Build your dream portfolio, make your own balance sheet as an engineering student**	**05**	**CO6**

Reference Books

1. How the stock market works, M Becket, Kogan Page, 3rd Edition, 2010 (https://procapital.mohdfaiz.com/books/books-image/mainBook/245114947.pdf)
2. The Intelligent Investor, Benjamin Graham, Perfect Bound, eISBN 0-06-058328-2, June2003 (https://sims.sairam.edu.in/wp-content/uploads/sites/7/2024/03/THE-INTELLIGENT-INVESTOR.pdf)
3. How to Make Money in Stocks, William J. O'Neil, 4th edition, 2009 (https://tradingpsychologist.in/wp-content/uploads/2023/09/How-to-Make-Money-In-Stocks.pdf)

4. Hand Book For Investing & Investor Protection, Dr. Naresh Maheshwari, ICWA New Delhi, January 2011, https://www.farsightshares.com/wp-content/uploads/2019/05/hand_book.pdf

Web Material

Module	Text Books	References/links
1	Introduction to Stock Markets, Zerodha	https://zerodha.com/varsity/modules/
2	Technical Analysis, Fundamental Analysis, Zerodha	https://zerodha.com/varsity/module/technical-analysis/
3	NCFM Technical Analysis Module, NSE limited	https://zerodha.com/z-connect/wp-content/uploads/2014/06/TA_wrkbk.pdf
4	Hand Book For Investing & Investor Protection, Dr. Naresh Maheshwari, ICWA New Delhi, January 2011	https://www.farsightshares.com/wp-content/uploads/2019/05/hand_book.pdf
5	Financial Education Booklet, SEBI, November 2020	https://investor.sebi.gov.in/pdf/downloadable-documents/Financial%20Education%20Booklet%20-%20English.pdf
6	Personal Financial Planning, IDOL, University of Mumbai, May 2023	https://mu.ac.in/wp-content/uploads/2023/05/M.Com-Sem-IV-Personal-Financial-Planning.pdf

NPTEL and Swayam Links

1. Financial Markets, Institutions and Financial Services By Prof. Divya Verma | Guru Gobind Singh Indraprastha University, Delhi https://onlinecourses.swayam2.ac.in/cec25_mg11/preview
2. Financial Institutions and Markets, Dr. Jitendra Mahakud, IIT Kharagpur https://archive.nptel.ac.in/courses/110/105/110105121/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment/Paper trading/Dummy trading: 5 Marks
2. Quiz/Open book test/ Presentation/ Trading Dmonstration: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
OE4014	Nutrition Literacy and Health	20	20	60	1	2	100	

Prerequisite:	
Course Objectives: The course aims to	
1	Understand the fundamentals of nutrition and its role in human health.
2	Learn about energy balance and the principles of diet planning.
3	Analyze the impact of nutrition on lifestyle diseases and their prevention.
4	Gain knowledge about food safety, preservation techniques, and quality control.
5	Explore sustainable nutrition practices and advancements in food technology.
6	Understand dietary recommendations for special conditions and future trends in nutrition.
Course Outcomes: Learners will be able to	
1	Understand the fundamental concepts of nutrition, including macronutrients, micronutrients, and their roles in maintaining health.
2	Analyze energy balance, metabolism, and the principles of diet planning for different age groups and lifestyles.
3	Identify the impact of nutrition on common lifestyle diseases and understand preventive measures through diet and lifestyle modifications.
4	Evaluate food safety standards, food labeling, and regulations to promote healthy food choices.
5	Assess the significance of nutritional requirements during different life stages.
6	Apply nutrition literacy principles to enhance personal well-being and spread awareness about balanced diets and healthy eating habits.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Fundamentals of Nutrition** Introduction to Nutrition: Definition, Importance, and Scope Food Groups and Their Nutritional Value Essential Nutrients: Macronutrients and Micronutrients Water and Dietary Fiber Nutritional Deficiencies: Causes, Symptoms, and Prevention	5	CO1
02	**Energy Balance and Diet Planning** Energy Metabolism: Basal Metabolic Rate (BMR) and Total Energy Expenditure (TEE) Principles of a Balanced Diet Dietary Guidelines and Food Pyramid Meal Planning for Different Age Groups Special Dietary Considerations: Pregnancy, Lactation, and Vegetarianism	5	CO2
03	**Nutrition and Lifestyle Diseases** Role of Nutrition in Preventing Lifestyle Diseases Obesity, Diabetes, and Cardiovacular Diseases Hypertension and Osteoporosis Nutritional Management and Intervention Strategies	4	CO3
04	**Food Safety and Quality** Food Contamination and Foodborne Diseases Food Preservation Techniques Food Adulteration and its Detection Food Safety Standards and Regulations	4	CO4
05	**Sustainable Nutrition and Food Technology** Sustainable Food Production and Consumption Genetically Modified Foods and Their Impact Functional Foods and Nutraceuticals Role of Technology in Food Science	5	CO5
06	**Special Diets and Future Trends** Diets for Specific Health Conditions Personalized Nutrition and Nutrigenomics Emerging Trends in Nutrition and Health Future Challenges in Nutrition Science	5	CO6

Text Books:

1. **Srilakshmi, B.** – *Dietetics*, New Age International Publishers, 8th Edition, 2019.
2. **Srilakshmi, B.** – *Nutrition Science*, New Age International Publishers, 6th Edition, 2021.
3. **Swaminathan, M.** – *Essentials of Food and Nutrition*, Vol. I & II, The Bangalore Printing and Publishing Co. Ltd., 2nd Edition, 2012.
4. **Rao, U.** – *Advanced Human Nutrition*, CBS Publishers & Distributors, 1st Edition.

References:

1. **Wardlaw, G. M., Smith, A. M.** – *Contemporary Nutrition*, McGraw-Hill Education, 11th Edition, 2018.
2. **Gibney, M.J., Lanham-New, S.A., Cassidy, A., Vorster, H.H.** – *Introduction to Human Nutrition*, Wiley-Blackwell, 2nd Edition, 2013.
3. **Whitney, E., Rolfes, S.R.** – *Understanding Nutrition*, Cengage Learning, 15th Edition, 2018.
4. **Bamji, M. S., Krishnaswamy, K., Brahmam, G.N.V.** – *Textbook of Human Nutrition*, Oxford & IBH Publishing, 4th Edition, 2019.

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
EEMC401	Digital Business Management	--	50	--	--	--	50	

Prerequisite: Entrepreneurship and finance management	
Course Objectives: The course aims to	
1	Familiarize with digital business concept along with drivers
2	Acquaint with E-commerce
3	Understand and various approaches and techniques for E-business and management
4	Give insights into E-business and its strategies
Course Outcomes: Learners will be able to	
1	Understand the fundamental concepts and drivers of digital business management.
2	Analyze impact of e-commerce on business model
3	Develop insights into building digital business application & infrastructure.
4	Acquire knowledge management skills for E-business operations.
5	Understand different E-business strategies
6	Prepare business plan and analyze case study.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Digital Business:**	08	**CO1**
	Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business-** Big Data & Analytics, Mobile, Cloud Computing, social media, BYOD, and Internet of Things (digitally intelligent machines/services) Opportunities and Challenges in Digital Business.		
02	**Overview of E-Commerce:**	05	**CO2**
	E-Commerce- Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals. Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing.		
	Self-Learning Topic: OLA, UBER Application		
03	**Digital Business Support services:**	05	**CO3**
	ERP as e –business backbone, knowledge Tope Apps, Information and referral system **Application Development:** Building Digital business Applications and Infrastructure.		
	Self Learning Topic: ERP for some application		
04	**Managing E-Business:**	03	**CO4**
	Managing Knowledge, Management skills for e-business, Managing Risks in e –business Security Threats to e-business -Security Overview, Electronic Commerce Threats.		
05	**E-Business Strategy:**	04	**CO5**
	E-business Strategic formulation- Analysis of Company‘s Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)		
06	**Materializing e-business:**	03	

	From Idea to Realization-Business plan preparation		**CO6**
	Self-Learning Topic: Case Study		
		28	

Text Books:

1. Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
2. Trend and Challenges in Digital Business Innovation, VinocenzoMorabito, Springer
3. Electronic Commerce- A Managerial and Social Networks Perspective ,Eighth Edition,Efraim Turban ,David King ,Jae KyuLee,Ting-Peng Liang ,Deborrah C. Turban, Springer
4. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
5. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
6. Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5
7. Measuring Digital Economy-A new perspective- DoI:10.1787/9789264221796-enOECD Publishing

References:

1. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
2. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan
3. E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of Electronic Governance
4. https://onlinecourses.nptel.ac.in/noc19_mg54/preview
5. https://nptel.ac.in/courses/110105083
6. https://onlinecourses.swayam2.ac.in/imb25_mg31/preview

Internal Assessment (50 Marks)

Continuous Internal Evaluation (50 Marks)

1. Assignment: 15 Marks
2. Quiz/Open book test: 10 Marks
3. Case study/Presentation: 20
4. Regularity and attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2*+ 2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					2
VEC401	Business Communication Skills	-	25		-	-	25	

Prerequisite: Learners should have completed FE Semester I Professional Communication and Ethics course.	
Course Objectives: The course aims to enable learners to	
1	Draft effective Business and Technical Reports and Proposals
2	Learn impactful oral and visual aids to make effective presentations
3	Strategize and document business meetings
4	Lead people and successful projects using interpersonal skills
5	Apply Skills necessary for employment purposes and emerge successful
Course Outcomes: Learners will be able to	
1	Prepare well drafted documents like Business and Technical Reports and Proposals
2	Develop impactful presentations using oral and visual aids
3	Plan and prepare strategies for business meetings and document it
4	Manage and lead people and successful projects using interpersonal skills
5	Acquire skills for employment purposes to successfully navigate industry and career challenges

Module	Detailed Contents	Hrs.	CO Mapping
01	**Business and Technical Writing Skills**	8	CO1
	Project based learning: Project Report Preparation Purpose and classification of reports Types of reports Parts and Formats Preparation of a Report (Group work): Front Matter,Main matter, Back matter/Appended Pages etc. Business Proposal		
	Self-Learning Topic: Business Vocabulary and Writing strategies APA, MLA, IEEE style Plagiarism checker tools		
02	**Business Presentation Skills**	4	CO2
	Four *P*'s of Presentation (*Plan, Prepare, Practice, Perform*) Making Effective Slides Types of Presentation Aids Closing a Presentation and Handling Questions Group Presentation based on project Report		
	Self Learning Topic: Design softwares and Apps (e.g. Canva) Social Media Presentation		
03	**Business Meetings and Documentation**	4	CO3
	Effective Meeting Strategies and Skills Documentation of a Meeting: Notice Agenda, and Minutes of a Meeting		
	Self Learning Topic: Meeting Roles and Responsibilities (Chairperson, Secretary, Analyst etc.)		
	Interpersonal Skills		

04	Emotional Intelligence Time Management Assertiveness and Self confidence Team building Leadership Conflict Resolution and Negotiation **Self-Learning Topics:** Oral speaking skills Listening skills Dressing etiquette	**6**	**CO4**
05	**Employment Skills** Structured and Unstructured Group Discussions Types of Group Discussions (Factual, Abstract, Strategic, Case Study, Picture based) Resume Writing: How to build your Resume Interview skills: Formats (Structured, Behavioural, Situational, Stress, Case interviews etc.) Types of Questions (Open ended, Closed, Hypothetical, Leading, Loaded etc.) Strategies for successful interviews Interview File Mock Interviews **Self-Learning Topic:** Statement of Purpose (SOP) Vocabulary building Sentence construction and Grammar rectifications.	**6**	**CO5**

Text Books:

1. Meenakshi Raman, Sangeeta Sharma, Technical Communication, Principles and Practice (2004), Oxford Press.
2. Bovee C.L. & Thill J.V. , Business Communication Today (2021), NJ: Pearson
3. Butterfield J., Verbal Communication: Soft Skills for a Digital Workplace (2017), Boston MA Cengage Learning.

References:

1. BCOLA-138 Business Communication - Course
   https://onlinecourses.swayam2.ac.in/nou25_cm09/preview
2. Business Communication Essentials - Course
   https://onlinecourses.swayam2.ac.in/imb25_mg05/preview
3. Softskills for Business - Course
   https://onlinecourses.swayam2.ac.in/imb25_mg87/preview

Suggested List of Assignments

Sr. No.	Experiments	CO Map-ping
01	Synopsis of Report	**CO 1**
02	Print out of PPT slides	**CO 2**
03	Notice, Agenda and Minutes of Meeting	**CO 3**
04	Activity sheets of Interpersonal skills	**CO 4**
05	Employment skills record (Resume and Group Discussion)	**CO 5**

Continuous Internal Evaluation (25 Marks)

1. Assignment/ Role play/ Activity: 10 Marks
2. Project Book Report: 05 Marks
3. Project Presentation: 05 Marks
4. Regularity and attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
DSPCL402	Database Management System Lab	-	25	25	-	-	50	

Prerequisite: Basic knowledge of database concepts	
Course Objectives: The course aims	
1	To explore design and develop ER and relational models.
2	To use SQL and procedural interfaces to SQL comprehensively.
3	To introduce the concepts of transactions and transaction processing.
4	To design a database with frontend and backend connectivity.
Lab Outcomes: Learners will be able to	
1	Identify case study for the real-world application and write a detailed statement of the problem. Design ER-EER diagrams by identifying entities, their relationships with attributes.
2	Transform ER /EER model into relevant relational model.
3	Apply DDL, DML, DCL and TCL commands to construct relational database.
4	Write simple queries to perform different database operations.
5	Construct queries to perform complex database operations.
6	Design data warehouse dimensional model for suitable application

Suggested List of Experiments

Sr. No.	Experiments	LO Mapping
1	Identify the case study and write a detailed statement of the problem. Design an Entity-Relationship (ER) & Extended ER (EER) Model.	LO1
2	Mapping ER-EER model to Relational schema model.	LO2
3	Create a database using Data Definition Language (DDL) commands and apply integrity constraints for the specified system.	LO3
4	Perform simple queries by applying Data Manipulation Language (DML) commands for the specified system.	LO3
5	Perform queries for string manipulation and aggregate functions.	LO3
6	Implement various join operations.	L04
7	Perform nested and subquery operations.	LO5
8	Implementation of Views and Triggers.	LO5
9	Design and implement dimension model (Star and Snowflake schema) for suitable case study.	LO6
10	Perform OLAP operations based on experiment-9 case study.	LO6
11	Implement procedure and functions.	LO5
12	Perform Data Control Language (DCL) commands.	LO5
13	Demonstrate the concept of transactions with Transaction Control Language (TCL) commands.	LO5
14	Apply normalization concept to real life database application design and demonstrate frontend and backend database connectivity.	LO1-LO6

Note: Lab work shall consist of a minimum 10 experiments covering all the modules. Any other experiment based on syllabus may be included, which would help the learner to learn advanced topics/concepts.

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)

An Oral & Practical exam will be held based on entire syllabus.

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					
DSPCL403	Operating System Lab	-	25	25	-	-	50	1

Prerequisite: Knowledge of Operating system principles, C Programming	
Course Objectives:	
1	To gain practical experience with designing and implementing concepts of operating systems such as system calls, CPU scheduling, process management, memory management, file systems and deadlock handling using C language in Linux environment.
2	To familiarize students with the architecture of Linux OS.
3	To provide necessary skills for developing and debugging programs in Linux environment.
4	To learn programmatically to implement simple operation system mechanisms.
Course Outcomes: Learners will be able to	
1	Demonstrate basic Operating system Commands, Shell scripts, System Calls and API wrt Linux.
2	Implement various process scheduling algorithms and evaluate their performance.
3	Implement and analyze concepts of synchronization.
4	Implement techniques for deadlock handling.
5	Implement various Memory Management techniques and evaluate their performance.
6	Demonstrate and analyze concepts of file management and I/O management techniques.

Suggested List of Experiments

Sr. No	Experiments	CO Mapping
01	Explore the usage of basic Linux Commands and system calls for file, directory, and process management. For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc. system calls: open, read, write, close, getpid, setpid, getuid, getgid, getegid, geteuid. sort, grep, awk, etc.)	CO1
02	Write shell scripts to do the following:	CO1

	1. Display OS version, release number, kernel version. 2. Display the top 10 processes in descending order. 3. Display processes with the highest memory usage. 4. Display the current logged in user and log name. 5. Display the current shell, home directory, operating system type, current path setting, current working directory.	
03	Implement any one basic command of linux like ls, cp, mv, and others using kernel APIs.	CO1
04	1. Create a child process in Linux using the fork system call. From the child process obtain the process ID of both child and parent by using getpid and getppid system call. 2. Explore wait and waitpid before termination of the process.	CO1
05	1. Write a program to demonstrate the concept of non-preemptive scheduling algorithms. 2. Write a program to demonstrate the concept of preemptive scheduling algorithms.	CO2
06	Write a C program to implement a solution for Producer consumer problem through Semaphore.	CO3
07	3. Write a program to demonstrate the concept of deadlock avoidance through Banker's Algorithm. 4. Write a program to demonstrate the concept of the Dining Philospher's Problem.	CO4
08	1. Write a program to demonstrate the concept of fixed and dynamic techniques. 2. Write a program to demonstrate the concept of dynamic partitioning placement algorithms i.e. Best Fit, First Fit, Worst-Fit etc.	CO5
09	1. Write a program to demonstrate the concept of demand paging using simulation. 2. Write a program in C demonstrating the concept of page replacement policies for handling page faults eg: FIFO, LRU etc.	CO5
10	1. Write a C program to simulate File allocation strategies typically sequential, indexed, and linked files. 2. Write a C program to simulate file organization of multi-level directory structure. 3. Write in C to do disk scheduling - FCFS, SCAN, C-SCAN.	CO6

Continuous Internal Evaluation (25 Marks)
1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Oral & Practical Exam (25 Marks)
An Oral & Practical exam will be held based on entire syllabus.

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral/ Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
DSCEP401	Mini Project 1	-	25	25	-	-	50	

Course Objectives: The course aims	
1	To understand the process of identifying needs and transforming them into well-defined problems.
2	To gain experience in collaborative problem-solving within a group setting.
3	To develop the ability to apply fundamental engineering principles to propose effective solutions.
4	To inculcate the process of self-learning and research.
Course Outcomes: Learners will be able to	
1	Identify and define problems based on societal /research needs.
2	Apply theoretical knowledge and practical skills to collaboratively address real-world societal challenges.
3	Develop effective interpersonal skills to function as a productive team member or a capable leader.
4	Interpret and analyze results obtained through theoretical analysis, experimentation, or simulations.
5	Evaluate the societal and environmental implications of proposed solutions, promoting sustainable development.
6	Adhere to standard engineering norms and professional practices.
7	Demonstrate proficiency in both written and oral communication.
8	Engage in self-directed learning within group settings, fostering a mindset of lifelong learning.
9	Apply project management principles effectively throughout the execution of project work.

Guidelines	
1	**Group Formation:** Students shall form project groups consisting of **three to four members**. Groups with fewer than three or more than four members will not be permitted, as the activity is designed to encourage collaborative work.
2	**Problem Identification:** Students are required to **conduct a survey** to identify relevant needs, which will be refined into a **problem statement**. This problem statement must be finalized in **consultation with the faculty supervisor, Head of Department, or an internal faculty committee**.
3	**Implementation Planning:** Each group must prepare and submit an **implementation plan** in the form of a **Gantt chart, PERT chart, or CPM chart**, outlining the **weekly schedule and milestones** of the mini project.
4	**Documentation and Logbook:** A **logbook** shall be maintained by each group to record **weekly progress**, with space for the faculty supervisor to provide **verifications/observations/comments**.
5	**Faculty Guidance:** Faculty supervisors may provide **input and guidance**, but the emphasis should remain on **self-learning and student-driven effort** throughout the project.
6	**Problem Understanding and Solution Design:** Each group is expected to **comprehend the problem thoroughly**, brainstorm and evaluate **multiple solution approaches**, and **select the most viable solution** in consultation with the faculty supervisor.
7	**Model Development and Demonstration:** The selected solution shall be developed into a **functional model** using relevant **components and techniques from the students' domain areas**, and must be **demonstrated effectively**.
8	**Validation and Reporting:** The solution must be **validated with proper justification**, and the group is required to **submit a comprehensive project report** adhering to the **standard format prescribed by the Institute**.

Project Guidance and Evaluation Framework:

1. The **Head of the Department (HoD)** shall assign a **faculty guide** to each mini project and constitute a **Project Review Committee** to oversee the project activities.
1. The assigned **guide will be responsible for weekly monitoring** of the group's progress and providing necessary feedback to ensure steady advancement.
2. The **Project Review Committee** will conduct **at least two formal evaluations per semester**, assessing the progress through **student presentations**.
1. **Assessment criteria** will include each student's **individual contribution**, **depth of understanding**, and **ability to respond effectively to questions** during evaluations.

Continuous Internal Evaluation (25 Marks)

1. Marks awarded by guide: 10 Marks *
2. Marks awarded by project review committee: 10 Marks #
3. Quality of Project report: 5 Marks

*** Marks Distribution by the Guide**

Scope and Objective of the Project	02
Extensive Literature Survey	02
Progress of Project Work and Weekly Reporting	02
Team Work and Ethics	02
Attendance	02
Total (10)	**10**

 # Project Review Marks Distribution

Review 1	**Review 2**	**Marks**
Presentation Skills	Presentation Skills	02
Literature Review	Design methodology/ Modern tools used	02
Clarity of problem definition & feasibility	Conceptual understanding & demonstration	02
Methodology of the proposed work	Project time management	02
Usefulness to society/ Environment sustainability	Teamwork & contribution	02
Total Marks (10)	**Total Marks (10)**	**Average Marks (10)**

Oral/ Practical Exam (25 Marks)

1. Final project presentation: 15 Marks
1. Project report: 10 Marks

References for Project:

https://www.guvi.in/blog/top-mini-project-ideas-for-college-students/
https://www.geeksforgeeks.org/project-idea-college-network/?ref=ml_lbp
https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/ai-project-ideas
https://roadmap.sh/backend/project-ideas
https://webflow.com/blog/website-ideas
https://gist.github.com/MWins/41c6fec2122dd47fdfaca31924647499
https://www.projectpro.io/article/artificial-intelligence-project-ideas/461
https://github.com/The-Cool-Coders/Project-Ideas-And-Resources
https://nevonprojects.com/project-ideas/software-project-ideas/
https://roadmap.sh/projects

Department of Computer Science and Engineering
(Data Science)
Multidisciplinary Minor (MDM) (14 Credits)

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
CEMDM401	**Data Structure and Algorithm**	20	20	60	1	2	100	

Prerequisite: Concepts in C Programming and Python	
Course Objectives: The course aims to	
1	Introduce the fundamental knowledge & need of Data Structures and abstract the concept of Algorithm for problem solving.
2	Implement fundamental knowledge and applications of Stack, Queue, Linked List, Trees, Graphs etc.
3	Understand the working of different Sorting, Searching & Hashing techniques.
4	Understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
Course Outcomes: Learners will be able to	
1	Classify and apply linear and non-linear data structure concepts and compare functions using asymptotic analysis to describe the relative merits.
2	Apply various operations on Stack and Queue.
3	Develop the ability to demonstrate the operations of Linked list.
4	Demonstrate and apply Trees & Graph data structures.
5	Analyse various Sorting and Searching Algorithms and their performance characteristics.
6	Describe the hash function and concepts of collision and its resolution methods

Module	Detailed Contents	Hrs.	CO Mapping
	Prerequisite: Control Structures, Arrays, Recursion, Pointers, Structures, Memory Allocation Techniques, Self-referential structures.		
01	**Introduction** Introduction to Data Structures, Concept of ADT, Types of Data Structures-Linear and Nonlinear, Operations on Data Structures. Algorithm: Performance characteristics of algorithm, Importance of Algorithm Analysis, Complexity of an Algorithm, Introduction to Asymptotic Analysis and Notations.	**8**	**CO1**
02	**Stack & Queue** Introduction to Stack, ADT of Stack, Operations on Stack, Array Implementation of Stack. Applications of Stack- Infix Expression to Postfix Expression Conversion, Infix Expression to Prefix Expression Conversion, Postfix Expression Evaluation. Introduction to Queue, ADT of Queue, Operations on Queue, Array Implementation of Queue, Types of Queues, Applications of various types of Queues. **Self-Learning Topic:** Well form-ness of Parenthesis using Stack	**8**	**CO2**
03	**Linked List** Introduction, Representation of Linked List, Types of Linked List - Singly Linked List, Doubly Linked List. Operations on Singly Linked List and Doubly Linked List. Linked representation of Stacks, and Linked representation of Queues. Application of Linked List-Polynomial Representation and Addition. **Self-Learning Topic:** Linked List v/s Array.	**8**	**CO3**
04	**Trees & Graph** Introduction, Tree Terminologies, Binary Tree, Binary Tree Representation, Types of Binary Tree, Binary Tree Traversals, Binary Search Tree, Operations on Binary Search Tree, AVL tree. Applications of Binary Tree- Expression Tree, Huffman Encoding. Graph: Introduction, Graph Terminology, Memory Representation of Graph, Operations Performed on Graph. Graph Traversal, Breadth First Search, Depth First Search, Applications of the Graph, Shortest Path, Minimum Spanning Tree.	**9**	**CO4**

05	**Searching & Sorting**	**5**	**CO5**
	Searching: Sequential Search, Index Sequential Search, Binary Search **Sorting:** Bubble Sort, Quick Sort, Merge Sort, Selection Sort, Insertion Sort		
06	**Hashing**	**4**	**CO6**
	Hashing-Concept, Hash Functions, Common hashing functions Collision resolution Techniques.		

Text Books:

1. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and its Applications", McGraw-Hill Higher Education.
2. "Fundamentals of Computer Algorithms" Ellis Horowitz, Sartaj Sahani and Sanguthevar Rajasekaran, Second Edition, Universities Press (India) Pvt. Ltd.
3. "Learning with Python" Allen Downey, Jeffrey Elkner, Chris Meyers, Dreamtech Press.

References:

1. Jean Paul Tremblay, Paul G. Sorenson; An introduction to data structures with applications; Tata McGraw-Hill; 1984
2. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw-Hill Edition.
3. Narasimha Karumanchi, Data Structures and Algorithms, 5th Edition, CareerMonk, 2016.
4. https://nptel.ac.in/courses/106/102/106102064/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/ Open book test/ Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
ETMDM401	Microprocessor and Microcontroller	20	20	60	1	2	100	

Prerequisite: Basic electronics, Number systems, Computer Organization and Architecture	
Course Objectives: The course aims to	
1	Understand the architecture, operation, and memory organization of Intel 8086 microprocessor and 8051 microcontrollers.
2	Prepare students for advanced processor architectures.
3	Explore instruction sets, addressing modes, and assembly language programming for Intel 8086 microprocessor and 8051 microcontroller to develop basic programs.
4	Analyze peripheral interfacing techniques with microcontrollers.
5	Apply microcontroller concepts in industrial process control.
Course Outcomes: Learners will be able to	
1	Describe the architecture, operation, and interrupt handling of the Intel 8086 microprocessor
2	Utilize Intel 8086 instruction sets, addressing modes, and assembly language programming to develop basic programs
3	Demonstrate the architecture and architectural features of Intel 80386DX and Pentium processor
4	Illustrate the architecture and memory organization of the Intel 8051 microcontroller.
5	Apply instruction sets, addressing modes, and assembly language programming of the Intel 8051 microcontroller to develop basic programs.
6	Implement peripheral interfacing techniques and process control using the Intel 8051 microcontroller

Module	Detailed Contents	Hrs.	CO Mapping
01	**Intel 8086 Microprocessor Architecture** Intel 8086 Microprocessor features, Pipelined architecture and operation Intel 8086 Programmer's model, Memory banking Segmentation - Logical address, Offset and Physical address Multiplexed buses in 8086 processor and the demultiplexing Intel 8284 Clock generator- Power-on-reset and CK generation Minimum and Maximum mode configurations, Minimum mode timing diagram Interrupt mechanism and Interrupt processing in Intel 8086 processor **Self-learning topic:** Intel 8288 Bus Controller	07	**CO1**
02	**Intel 8086 Instruction Set and Programming** Major Instruction groups in Intel 8086 Microprocessor Data Transfer instructions, String instructions with repeat prefixes Arithmetic instructions, Rotate and Shift instructions Classification and concepts of branch instructions Addressing modes of Intel 8086 Microprocessor Simple programs based on the assembly language of Intel 8086 Microprocessor **Self-learning topic:** Assembler directives	07	**CO2**
03	**Introduction to Intel 80386DX and Pentium Processor** Intel 80386DX Microprocessor- 32-bit Microprocessor architecture block diagram Registers of 80386DX processor- Data, Pointer, Index, Eflag and Control registers Operating modes- Real, Protected and V-86 modes Protected mode address translation mechanism Pentium processor – Features, Block diagram of pentium and it's Superscalar operation Integer and Floating-point pipeline stages of Pentium L1 Data and Code Cache designs of Pentium Processor **Self-learning topic:** Branch prediction, Pentium versions, Pentium-4's Net-Burst Architecture	07	**CO3**
04	**Intel 8051 Microcontroller Architecture**	06	

	Block diagram of Intel 8051 Microcontroller Details of the general registers and SFR's Internal RAM and ROM organization I/O port functionality, Counters and timers, Serial ports Interrupt mechanism of 8051 controller and Interrupt priorities Interfacing external memory to 8051 microcontrollers		**CO4**
05	**Intel 8051 Instruction Set and Programming** Major Instruction groups in Intel 8051 Microcontroller Data Transfer instructions, Logical and bit level instructions Arithmetic instructions Branching instructions – JUMP and CALL instructions Addressing modes of Intel 8051 Microcontroller Simple programs based on the assembly language of Intel 8051 Microcontroller	07	**CO5**
06	**Interfacing I/O devices to Intel 8051 Microcontroller** Concept of matrix keyboard interfacing Interfacing of 7-segment display, LCD display interfacing Stepper motor interfacing, Printer interfacing Interfacing High power devices through an Optoisolator, relays Concept of A/D and D/A converter interfacing Case study of Industrial Process Control system like liquid level control, temperature level control etc.	08	**CO6**

Text Books:

1. John Uffenbeck: The 80X86 Family Design Programming and Interfacing, 2nd Edition, Pearson Education
2. Barry B. Brey: Intel Microprocessors, 2nd Edition, Prentice Hall Publication
3. Mazidi, Mazidi & McKinlay: The 8051 Microcontroller and Embedded Systems, 2nd Edition, Pearson Education
4. Raj Kamal: Microcontrollers Architecture, Programming, Interfacing and System Design, Pearson Education

References:

1. Douglas Hall: Microprocessors and Interfacing, McGraw Hill Publication
2. Kenneth Ayala: The 8051 Microcontroller, 3rd Edition, Thomson Learning
3. https://archive.nptel.ac.in/courses/108/103/108103157/
4. https://archive.nptel.ac.in/courses/108/105/108105102/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
ARMDM401	Artificial Intelligence	20	20	60	1	2	100	

Prerequisite: Discrete Mathematics, Data Structures	
Course Objectives: The course aims to	
1	To conceptualize the basic ideas and techniques underlying the design of intelligent systems.
2	To make students understand and explore the mechanism of mind that enables intelligent thought and action.
3	To make students understand advanced representation formalism and search techniques.
4	To make students understand how to deal with uncertain and incomplete information.
Course Outcomes: Learners will be able to	
1	Ability to develop a basic understanding of AI building blocks presented in intelligent agents.
2	Ability to choose an appropriate problem-solving method and knowledge representation technique.
3	Ability to analyze the strength and weaknesses of AI approaches to knowledge– intensive problem solving.
4	Ability to design models for reasoning with uncertainty as well as the use of unreliable information.
5	Ability to design and develop AI applications in real world scenarios.
6	Ability to understand Emerging AI Technologies and Future Trends in Mechanical Engineering.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Fundamentals of AI and Machine Learning** Introduction to AI, Machine Learning (ML), and Deep Learning Role of AI in Mechanical Engineering Types of Machine Learning: Supervised, Unsupervised, and Reinforcement Learning Data Collection and Preprocessing for Mechanical Applications Case Study: AI-Driven Material Selection for Engineering	06	CO1
02	**AI in Mechanical Design and Product Development** Generative Design and AI-Assisted Computer-Aided Design (CAD) AI in Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD) Optimization Techniques for Mechanical Systems Using AI AI-Driven Topology Optimization for Lightweight Structures Case Study: AI in Aerospace Component Design.	07	CO2
03	**AI in Manufacturing and Smart Factories** AI in Industry 4.0 and Digital Twins Computer Vision for Quality Control and Defect Detection AI for Process Automation and Control in Manufacturing AI-Based Supply Chain and Inventory Management Case Study: AI-Powered Predictive Quality Control in Automotive Manufacturing	08	CO3
04	**AI in Robotics and Autonomous Systems** AI in Industrial Robotics and Automation Path Planning and Motion Control Using AI AI in Collaborative Robotics (Cobots) AI for Autonomous Vehicles and Drones in Mechanical Applications Case Study: AI-Driven Robotic Assembly System	08	CO4
05	**AI for Predictive Maintenance and Condition Monitoring** AI-Based Fault Detection and Diagnosis Machine Learning for Vibration Analysis and Wear Prediction IoT and AI Integration for Real-Time Condition Monitoring AI in Energy Efficiency and Performance Optimization	07	CO5

	Case Study: Predictive Maintenance in Heavy Machinery		
06	**Emerging AI Technologies and Future Trends in Mechanical Engineering** AI for Sustainable and Green Engineering AI in Additive Manufacturing (3D Printing) AI in Human-Machine Interaction and Augmented Reality Ethical Considerations and Challenges in AI Adoption Capstone Project: AI-Driven Solution for a Mechanical Engineering Problem	**07**	**CO6**

Text Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition" Pearson Education, 2020.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, First edition, 2011
3. George F Luger, "Artificial Intelligence" Low Price Edition, Fourth edition, Pearson Education.,2005
4. Ramin S. Esfandiari"Artificial Intelligence Techniques in Mechanical Engineering: A Practical Approach"McGraw-Hill Education.

References:

1. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
4. Elaine Rich and Kevin Knight, "Artificial Intelligence", Third Edition, McGraw Hill Education,2017 .

Useful Links:

1.https://nptel.ac.in/courses/106/105/106105078/

2.https://thestempedia.com/blog/simple-ai-and-machine-learning-projects-for-students-and-beginners/

3.https://nptel.ac.in/courses/106/105/106105079/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
ITMDM401	Internet of Things and Applications	20	20	60	1	2	100	

Prerequisite: Student should be able to a solid foundation in basic electrical principles, including AC circuits, magnetism, and electromechanical energy conversion.	
Course Objectives: The course aims to	
1	Understand the fundamentals of IoT architecture and protocols.
2	Explore sensors, actuators, and embedded systems in electrical engineering.
3	Apply IoT technologies to solve electrical engineering problems.
4	Analyze case studies in smart grids, energy management, automation, and power systems.
Course Outcomes: Learners will be able to	
1	Understand the concept of IoT.
2	Illustrate IOT architecture and applications in various fields.
3	Demonstrate use Devices, Gateways and Data Management in IoT.
4	Understand various wired and wireless protocols.
5	Understand emerging technological options, platforms and case studies of IoT implementation in home & city automation.
6	Understand Data Analytics and Security in IoT.

Module	Detailed Contents	Hours	CO Mapping
01	**Introduction to IoT:**	06	CO1
	Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Sources of IoT; Sensing, Actuation, Basics of Networking; Software Architectures		

	and Software Inter-operability, Applications in Electrical Engineering.		
	Self-Learning Topic: Privacy and Security		
02	**IoT Architecture:**	**06**	**CO2**
	Introduction, Functional View, Information View, Deployment and Operational View, Real-World Design Constraints- Introduction, Technical Design constraints, Data representation and visualization,		
	Self-Learning Topic: Interaction and remote control.		
03	**Sensors and Embedded Systems**	**06**	**CO3**
	Types of Sensors Used in Electrical Applications (Voltage, Current, Power, Temperature), Interfacing Sensors with Microcontrollers (e.g., Arduino, Raspberry Pi, ESP32), Signal Conditioning and Data Acquisition, Postioning and localization, Medium access control, Introduction to Embedded Programming (C/C++, Python)		
	Self-Learning Topic: operating systems, time synchronization		
04	**Networking and Communication Protocols for IoT:**	**10**	**CO4**
	Cloud based IoT platforms, Zigbee and Zwave, advantage of low power mesh networking. Long distance Zigbee; Bluetooth/BLE: Low power vs high power, speed of detection, class of BLE. Wireless protocols such as Piconet and packet structure for BLE and Zigbee. Web Communication Protocols for connected devices, Web connectivity using Gateway, SOAP, REST, HTTP, RESTful and WebSockets (Publish –Subscribe), MQTT, AMQP, CoAP Protocols.		
	Self-Learning Topic: ThingsBoard, Blynk, Firebase, AWS IoT		
05	**IoT Applications:**	**10**	**CO5**
	IoT in Power and Energy Systems Smart Grids and IoT Integration, Energy Monitoring and Management Systems, Real-time Load Monitoring, Predictive Maintenance of Electrical Equipment using IoT, Fault Detection in Power Lines, Smart Street Lighting Systems, IoT-enabled Electric Vehicle Charging Stations. **Industrial and Home Automation** IoT-based Control of Electrical Loads, Home Automation: Lighting, HVAC, Smart Meters, Industrial Automation: PLCs, SCADA Systems with IoT Integration, Safety and Fault Detection Systems. Case Study: Agriculture, Healthcare, Activity monitoring.		

	Self-Learning Topic: IoT for Renewable Energy Monitoring (Solar, Wind)		
06	**Data Analytics and Security in IoT**	**04**	**CO6**
	Basics of Data Logging and Visualization, Introduction to Edge and Cloud Computing, Cybersecurity in IoT Systems, IoT Standards and Compliance		
	Self-Learning Topic: IEEE standards used in protection and data management.		

Text / Reference Books: -

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Misra, A. Mukherjee, and A. Roy, Introduction to IoT. Cambridge University Press, 2020.
3. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. 2020.
4. Adrian McEwen, Hakim Cassimally Designing the Internet of Things , John Wiley, 2014
5. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013.
6. CunoPfister, "Getting Started with the Internet of Things", OReilly Media, 2011
7. A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
8. Samuel Greenguard, "Internet of Things", MIT Press, 2015.
9. Mandler, B., Barja, J., Mitre Campista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing
10. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley-Blackwell.
11. Internet of things (IoT): Technologies, Applications, Challenges, and Solutions Edited by B.K. Tripathy J. Anuradha, CRC Press, 2018
12. Simone Cirani, Gianluigi Ferrari, Luca Veltri, "Internet of Things: Architectures, Protocols and Standards"

Web Reference /Video Courses

NPTEL Course: Introduction to Internet of Things By Prof. Sudip Misra, IIT Kharagpur

References:

1. Introduction to the Internet of Things (IoT), Publisher: Cisco Networking Academy.
2. Internet of Things (IoT) – Lecture Notes & Tutorials, Author: Dr. Rajkumar Buyya (University of Melbourne)
3. A Reference Architecture for the Internet of Things, Publisher: IEEE / ITU-T
4. The Internet of Things: Enabling Technologies, Platforms, and Use Cases, Author: Pethuru Raj
5. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases, Authors: David Hanes, Gonzalo Salgueiro, Patrick Grossetete

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	3 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					3
MEMDM401	Basics of Mechanical Engineering	20	20	60	1	2	100	

Prerequisite: Engineering Mechanics, chemistry,	
Course Objectives: The course aims to	
1	Explain: Fundamental concepts, laws of classical thermodynamics, principle of working and operation of thermodynamic cycles, scope and applications in research
2	To understand the nature of stresses developed in simple geometries
3	To understand the material used and their application in manufacturing
Course Outcomes: Learners will be able to	
1	Understand the fundamental concepts of Mechanical engineering
2	Understand & apply the basic laws of thermodynamics to analyze energy conversion systems
3	Understand the Basics of kinematics and various mechanism.
4	Understand the working principles and applications of common mechanical mechanisms such as linkages, gears.
5	Classify engineering materials and explain their mechanical properties, structure, and industrial applications.
6	Understand the working principles of Power Plants & types of Renewable energy sources

Module	Detailed Contents	Hrs.	CO Mapping
01	**Fundamentals of Mechanical Engineering** Introduction to Mechanical Engineering and its applications Basic concepts: systems, units, energy, force, work, power Engineering materials: types, properties, and applications Stress-strain basics and Hooke's Law Simple numerical problems on stress and strain	06	CO1
02	**Basics of Thermodynamics** Introduction to Thermodynamics and basic definitions,Zeroth, First, and Second Laws of Thermodynamics,Properties of pure substances (pressure, volume, temperature),Heat and work interactions,Ideal and real gases. Introduction to heat engines, refrigerators, and heat pumps Introduction to I.C. Engines: SI and CI engines Engine components and working principles,2-Stroke vs 4-Stroke engines.	09	CO2
03	**Theory of Machines** Basics of kinematics and dynamics of machines,Types of links, kinematic pairs and chains,Four-bar mechanism, slider-crank mechanism,Gear trains: simple and compound,Cam and follower basics,Flywheel and governor (conceptual overview)	07	CO3
04	**Mechanical Systems and Machines** Basic machine elements: gears, belts, pulleys, bearings Introduction to mechanisms and kinematics of machines Simple lifting machines (screw jack, pulley block) Power transmission: shaft, couplings, and keys Basics of vibrations and balancing (introductory)	08	CO4
05	**Materials Science & Manufacturing Processes** Classification of materials: metals, ceramics, polymers, composites,Mechanical properties: hardness, toughness, ductility, strength,Heat treatment process. Overview of manufacturing: importance and types Basic casting process: pattern, moulding, and casting Introduction to welding, brazing, and soldering	07	CO5

	Basics of machining: turning, milling, drilling Introduction to 3D printing and modern manufacturing trends		
06	**Power Plants & Renewable energy sources** Overview of power plants: thermal, hydro, nuclear (layout & working briefly) Renewable energy sources: solar, wind, biomass (brief)	**05**	**CO6**

Text Books & References:

1. R.K. Rajput – *Basic Mechanical Engineering*
2. V. B. Bhandari – *A Textbook of Machine Design*
3. R.S. Khurmi – *Theory of Machines*
4. Kalpakjian & Schmid – *Manufacturing Engineering and Technology*
5. *William D. Callister – Materials Science and Engineering*

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)
Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)
1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		End Semester Exam (ESE)			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	100
EEMDM401	Elements of Electrical Systems	20	20	60	1	2	

Course Objectives:

1. To list & describe the different methods of Power generation
2. To elaborate the various types of transmission lines
3. To understand the basics of illumination and various types of electrical loads
4. To understand and calculate the power consumption in electrical system
5. To explain the various types of electrical energy storage system
6. To discuss the various types of electrical meters

Course Outcomes:

1. Understand the different methods of Power generation
2. Evaluate the sending end and receiving end voltage of transmission line
3. Study the basics of illumination and various types of electrical loads
4. Understand the ratings and calculate the electrical energy consumption
5. Study the various types of electrical storage
6. Illustrate the working of different types of meters in electrical system

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
1.	Generation of Electrical Power	Basics of different Power generating systems: thermal (fossil fuels, nuclear), renewable (solar, wind, hydro, geothermal), nuclear and emerging technologies (tidal, wave, biomass). Basic Layout of hydroelectric power station, thermal power plant, solar generation, nuclear power plant with their advantages and disadvantages. Cost of generation, peak load and base load plant.	**10**	**CO1**
2.	Transmission	Study of different types of transmission lines (Short, medium and long) ,Different types of conductors used (Single and three phase transmission line).Application of KVL, KCL to	**07**	**CO2**

		find sending end and receiving end voltage and Calculations of Power transmitted.		
3.	Utilization of Electrical Energy	Basic structure of Electrical power Generation, Transmission and distribution systems: grid structure. Illumination: Introduction, Terms used in illumination ,Laws of illumination, Numericals on illumination. Types of Electrical loads: Residential: Basics of refrigeration and air-conditioning Industrial :Machines (Motors and generators: AC vs. DC) Self learning topics: Electric Heating and welding. Basics of DC motors, single and three phase induction motor.	**10**	**CO3**
4.	Ratings & Calcu-lation of Energy Consumption	Power rating of household appliances such as tube light, fan, air conditioners, PCs, laptops, printers, etc. Definition of "unit" used for consumption of electrical energy, understand the calculation of electricity bill for LT & HT consumers.	**05**	**CO4**
5.	Energy Storage	Battery Technologies: Chemistry basics: lead-acid, lithium-ion, sodium-ion, solid-state batteries. Charging and discharging characteristics. Battery management systems (BMS). Battery storage: types (lead-acid, lithium-ion, flow batteries), applications.	**05**	**CO5**
6.	Measurement in Electrical Energy Systems	Importance of measurement in electrical energy systems. Basic principles of Digital and analog electrical measurement. Moving coil and Moving iron Ammeters & Volt-meters, Power measurement by wattmeter in single phase circuit	**05**	**CO6**

Text Books:

1. Mahesh Verma, Power Plant Engineering, Metrolitan Book Co Pvt Ltd
2. RK Rajput, A Text Book of Power System engineering, Laxmi Publication
3. D. P. Kothari, I. J. Nagrath, Power System Engineering, 3 Edition, Mc GrawHill
4. B.R. Gupta, Power System Analysis And Design, S.Chand
5. Mehta V.K., Principles of Power System, S Chand
6. AK Sawhney, Electrical & Electronic Measurements and Instrumentation, Dhanpat Rai & Sons

7. Dincer I., and Rosen M. A. (2011); Thermal Energy Storage: Systems and Applications,Wiley

References:

1. W. D. Stevenson, Elements of Power System, 4 Edition TMH
2. Trevor M. Letcher, Storing Energy with Special Reference to Renewable Energy Source, Elsevier, 2016.
3. RS Sirohi & Radhakrisnan, Electrical Measurement & Instrumentation, New Age International

Online References:

Sr. No.	Website Name
1	https://www.energy.gov/eere/renewable-energy

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)
End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution					Exam Duration (Hrs)	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE	Total Marks	Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
CEMDML401	Data Structure and Algorithm Lab	-	25	-	-	-	25	

Prerequisite:	
Course Objectives: The course aims to	
1	Introduce the essential concepts and requirements of data structures.
2	Apply fundamental knowledge and applications of Stack, Queue, Linked List, Trees, Graphs etc.
3	Understand the working of different Sorting, Searching & Hashing techniques.
4	Understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
Course Outcomes: Learners will be able to	
1	Classify and apply linear and nonlinear data structure concepts, as well as perform operations including insertion, deletion, and traversal.
2	Apply various operations on Stack and Queue.
3	Develop the ability to demonstrate the operation of Linked list.
4	Demonstrate and apply Trees & Graph data structures.
5	Analyse various Sorting and Searching Algorithms and their performance characteristics.
6	Describe the hash function and concepts of collision and its resolution methods

Suggested List of Experiments

Sr. No.	List of Experiments	LO Mapping
01	Implementation of Insertion and deletion in a specific position in an Array using Function.	LO1
02	Array Implementation of Stack.	LO2
03	Array Implementation of Linear Queue.	LO2
04	Array Implementation of Circular Queue.	LO2
05	Implement Singly Linked List.	LO3
06	Implementation of Queue using Linked List.	LO3
07	Implementation of Stack using Linked list.	LO3
08	Implementation of Binary Search Tree and its traversal methods.	LO4
09	Program to count Number of leaf nodes, find the biggest and smallest and height of the tree.	LO4
10	Implementation of binary search and selection search algorithm.	LO5
11	Implementation of selection sort and insertion sort algorithm.	LO5
12	Study of hash function for immutable and mutable objects.	LO6
13	Program to illustrate how to hash a file	LO6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
ETMDML401	Microprocessor and Microcontroller Lab	-	25	-	-	-	25	

Prerequisite: Basic electronics concepts	
Course Objectives: The course aims to	
1	Implement assembly language programs for Intel 8086 and 8051 microcontroller to perform various operations.
2	Interface general purpose peripheral devices with the Intel 8051 microcontroller for real-time applications.
Lab Outcomes: Learners will be able to	
1	Develop simple programs based on the assembly language of Intel 8086 Microprocessor using various instructions and addressing modes.
2	Write appropriate instructions for simple programs based on 8051 microcontroller
3	Interfacing of peripherals for 8051 microcontroller

Suggested List of Experiments

Sr. No.	Experiments	LO Mapping
01	Simple assembly language program for addition, subtraction and multiplication for 8086 processor.	LO1
02	Simple assembly language program for packed BCD arithmetic operations for 8086 processor.	LO1
03	Simple assembly language program for unpacked BCD arithmetic operations for 8086 processor.	LO1
04	Memory block transfer program for 8086 processor.	LO1
05	Finding largest/smallest number from given array.	LO1
06	Sorting the given array in ascending order.	LO1
07	Any program based on mixed language for 8086 processor.	LO1
08	Simple program for addition and subtraction for 8051 microcontroller.	LO2
09	Simple program for multiplication and division for 8051 microcontroller.	LO2
10	Software delay generator using 8051 microcontroller.	LO2
11	Interface single LED to 8051 microcontroller and write a program to blink that LED with some delay.	LO3
12	Interface 7-segment display to 8051and write a program to display a character on it.	LO3
13	Interface LCD panel to 8051 microcontroller and write a program to display a sample message.	LO3
14	Interface D/A converter to 8051 microcontroller and generate waveforms using this interface.	LO3
15	Stepper motor interfacing to 8051 microcontroller.	LO3

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
ARMDML401	**Artificial Intelligence Lab**	-	25	-	-	-	25	

Course Objectives: The course aims to	
1	To provide hands-on experience in using AI and machine learning techniques for solving mechanical engineering problems like design, manufacturing, and maintenance.
Course Outcomes: Learners will be able to	
1	Familiar with basic tools for AI and prepare data for analysis.
2	Apply machine learning to predict mechanical properties.
3	Group similar data points (e.g., materials or components) without labeled data.
4	Use reinforcement learning to optimize a mechanical system & designing optimized mechanical structure
5	Use machine learning to enhance FEA simulations & AI based quality control
6	Predict and diagnose mechanical failures before they happen. & path planning for robotics

Sr. No.	List of Experiments	CO Mapping
01	Introduction to Python for AI and Data Preprocessing	CO1
02	Using Supervised Learning for Mechanical Data	CO2
03	Clustering Mechanical Data (Unsupervised Learning)	CO3
04	Reinforcement Learning for System Optimization	CO4
05	Generative Design for Structural Optimization	CO4
06	AI in Finite Element Analysis (FEA)	CO5
07	AI-Based Quality Control	CO5
08	Predictive Maintenance Using AI	CO6
09	Path Planning for Robotics	CO6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance and assignments: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution				Exam Duration (Hrs)	Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
ITMDML401	**Internet of Things and Applications-Lab**	-	25	-	-	-	25	

Prerequisite: Students know the construction, working principle and operation of DC machines, transformers and Induction motors	
Course Objectives: The course aims to	
1	To Understand the definition and significance of the Internet of Things.
2	To Discuss the architecture, operation, and business benefits of an IoT solution**.**
3	To Explore the relationship between IoT, cloud computing, and Data Analytics.
4	To Explore the interconnection and integration of the physical world and be able to design & develop IOT applications.
Course Outcomes: Learners will be able to	
1	Adapt different techniques for data acquisition using various IoT sensors for different applications.
2	Demonstrate the working of actuators based on the collected data**.**
3	Use different IoT simulators and correlate working of IoT protocols.
4	Adapt different techniques for Integrating IoT services to other third-party Clouds**.**
5	Execute data analysis and encryption methodologies for deployment of IoT applications**.**
6	Implement IoT protocols for communication to realize the revolution of internet in mobile devices, cloud and sensor networks.

Suggested List of Experiments

Sr. No.	Experiments	CO Mapping
01	To measure voltage, current, and power consumption of an appliance using ESP32 and display the data on an OLED screen or send it to a cloud platform.	CO1
02	To control a light or appliance remotely using a mobile app (Blynk) using ESP32.	CO1
03	To measure room temperature and send the data to an online IoT platform using ESP32	CO1
04	To monitor transformer temperature and raise alerts on overheating.	CO2
05	To display power usage data from a sensor on a custom web dashboard using RasberyPi	CO2
06	To automate a streetlight system based on surrounding light intensity using ESP32	CO2
07	To monitor the ON/OFF status of an appliance and view it remotely using ESP32.	CO2
08	To detect motion and capture an image using Raspberry Pi camera using Raspberry Pi	CO2
09	Simulate an energy meter that calculates power usage using Arduino and sensors.	CO3
10	Simulate a weather station that logs temperature and humidity online using Tinkercad + ThingSpeak	CO3
11	Simulate an automatic light that turns on when it gets dark using Tinkercad or Proteus	CO3
12	Simulate a simple smart grid system that balances load using IoT control logic using MATLAB Simulink	CO3
13	Simulate control of home devices via mobile interface using Tinkercad + Blynk API Simulation	CO3
14	To study and demonstrate working of 6LoWPAN in Contiki OS (simulator)	CO4
15	Write a program on Raspberry Pi to push and retrieve the data from cloud like thingspeak/thingsboard/AWS/ Azure etc	CO4
16	Write a program to collect data from sensor encrypt data send it to receiver (server) and decrypt is at receiving end Ardino/Raspberry Pi/ Contiki OS (simulator)	CO5

17	To study and implement IoT Data processing using Pandas.	CO5
18	Write a program for Arduino / Raspberry Pi Publishing MQTT Messages to ESP8266	CO6
19	To study and implement interfacing of actuators based on the data collected using IoT sensors. (like led switch ON/OFF, stepper motor)	CO6
20	Write a program to Control Your ESP8266 From Anywhere in the World	CO6

Online References:

1. https://spoken-tutorial.org/watch/Arduino/Introduction+to+Arduino/English/
2. https://pythonprogramming.net/introduction-raspberry-pi-tutorials/
3. https://iotbytes.wordpress.com/basic-iot-actuators/
4. http://www.contiki-os.org/
5. https://www.bevywise.com/iot-simulator/
6. https://mqtt.org/

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme						Practical
		Marks Distribution			Exam Duration (Hrs)		Total Marks	2 Hrs
		Internal Assessment		Oral & Practical	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					1
MEMDML401	**Mechanical Engineering Lab**	-	25	-	-	-	25	

Prerequisite:	
Course Objectives: The course aims to	
1	Practically verify the concepts learnt in theory course
2	Fundamental laws of thermodynamics through experimental analysis.
3	To acquaint with the material testing by performing experiment related to Hardness , Fatigue, Tension, , Deflection, Torsion, Impact and Flexural Test
Course Outcomes: Learners will be able to	
1	Verify Law of Thermodynamics & various boilers accessories and mountings
2	Understand and demonstrate the working of 2-stroke & 4-stroke Engine.
3	Verify the Bernoulli's Principle & Calibration of Venturimeter,Orifice meter
4	Perform Tension test to analyze the stress - strain behavior of materials
5	Perform heat treatment process of metal sample
6	Perform flexural test with central and multi point loading conditions

Sr. No.	List of Experiments	CO Mapping
01	Verification of the Zeroth Law of Thermodynamics.	CO1
02	Experiment on boilers and their accessories and mountings.	CO1
03	Demonstration of 2-stroke & 4-stroke Engine.	CO2
04	Calibration of Venturimeter,Orifice meter	CO3
05	Verification of Bernoulli's equation	CO3
06	Tension test on mild steel bar	CO4
07	Brinell hardness Test	CO4
08	Experiments based on heat treatment method	CO5
09	Flexural test on beam (Multi-point load)	CO6

Continuous Internal Evaluation (25 Marks)

1. Lab Performance and assignments: 10 Marks
2. In-Semester Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks

Course Code	Course Name	Examination Scheme					
		Marks Distribution			Exam Duration (Hrs)		Total Marks
		Internal Assessment		Oral & Practical			
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)		MSE	ESE	
EEMDML401	Elements of Electrical Systems Lab	-	25	-	-	-	25

Course Objectives:

1. Evaluate the performance of transmission lines.
2. Understand the performance parameters of a generator.
3. Evaluate the characteristics of batteries.
4. Study the operation and performance of an electric motor.
5. Analyze the performance of renewable energy sources.
6. Familiarize with electrical measurement techniques.

Course Outcomes:

1. To study various aspects of performance of different renewable energy sources.
2. To study different types of lamps used in Electrical system..
3. To evaluate the efficiency and performance of DC machines (motor and generator) under varying speed and load conditions.
4. To demonstrate the effective use of various meters to perform voltage, current and power measurements of single and three phase circuits.
5. To study the nature of V-I characteristics for single phase and three phase loads.
6. To analyze the behavior of a transmission line under varying load conditions

Online Resources:

Sr. No.	Website Name
1.	https://www.vlab.co.in/broad-area-electrical-engineering
2.	https://www.vlab.co.in/broad-area-electronics-and-communications

Suggested List of Experiments:

Sr No	Experiments
01	Measure and plot the no load magnetization (open circuit) characteristic (V-I curve) of a DC generator.
02	Calculate efficiency and voltage regulation of DC generator using external characteristics.
03	Case study to get the current-voltage (I-V) characteristics of a solar PV panel under different light intensities (simulated using lamps).
04	Calculate the MPPT of a solar PV panel under different light intensities (simulation using lamps).
05	Measure speed-torque characteristics of a DC motor under different load conditions.
06	Calculate efficiency and analyze the starting and running performance of a DC motor under different load conditions.
07	Measure charge-discharge characteristics of different types of batteries (e.g., lead-acid, lithium-ion).
08	To analyze efficiency, capacity, and voltage profiles of different types of batteries (e.g., lead-acid, lithium-ion) (simulation based or hands on).
09	Perform voltage, current and power measurements in single phase circuit using analog meters and verify Ohm's law.
10	Perform voltage, current and power measurements in single phase circuit using digital meters and verify Ohm's law.
11	Perform voltage, current and power measurements in three phase circuit using analog meters and verify Ohm's law.
12	Perform voltage, current and power measurements in three phase circuit using digital meters and verify Ohm's law.
13	To perform load test using 1- phase and 3 phase sources and loads using MATLAB Simulink
14	To deduce the transmission line performance i.e. sending end voltage and receiving end voltage for long, medium and short transmission lines using MATLAB Simulink.
15	Generation of sinusoidal voltage waveform using MATLAB Simulink.
16	Simulation of transmission line model using MATLAB Simulink
17	To perform speed control of DC motor using MATLAB Simulink
18	To perform practical using breadboard to extract the charging and discharging characteristics of capacitor.

19	Case Study to compare efficiency and reliability of different renewable energy sources
20	Case Study to analyze the effectiveness of energy storage in balancing supply and demand in distribution networks.
21.	Study of different types of lamps and to measure the intensities of different lamps using lux meter.
22.	To measure voltage, current and power of different types of lamps.

Continuous Internal Evaluation (25 Marks)

1. Lab Performance: 10 Marks
2. Mid Semester Oral & Practical Exam during lab session: 10 Marks
3. Regularity and Attendance: 5 Marks