



## Autonomy Scheme

### Master of Technology

#### SJCEM : R - 25

Sr. No.	Heading	Particulars
1	<b>Title of the Course</b>	<b>Computer Engineering</b>
2	<b>Eligibility for Admission</b>	As per the Institute Examination Ordinance
3	<b>Theory Passing Marks (IAE / ESE)</b>	40%
4	<b>Continuous Assessment (CA) / Oral / Practical</b>	50%
5	<b>To be implemented from Academic Year</b>	With effect from Academic Year:2024-2025
6	<b>Total Credits</b>	Maximum 80



## Preface

University Grants Commission vide Letter No. F. 2-10/2023 (AC-Policy) dated 19<sup>th</sup> January 2024 conferred the autonomous status to St. John College of Engineering and Management, Village Vevoor, Manor Road, Palghar (East), 401404 affiliated to University of Mumbai for a period of 10 years from the academic year 2024-2025 to 2033-2034 as per clause 7.5 of the UGC (Conferment of Autonomous Status Upon Colleges and Measures for Maintenance of Standards in Autonomous Colleges) Regulations 2023. Designing the curriculum as an autonomous institution raises challenges pertaining to maintaining quality engineering education.

Systematic approach has been adapted in the design and implementation of curriculum with the intent of ensuring quality education catering to the sensitive needs of a learner, society, and industry. The curriculum is aligned with NEP and UGC guidelines as per Government of Maharashtra guidelines for autonomous institutions Government Resolution dated 4<sup>th</sup> July 2023. Based on recent recommendations of the GR, holistic curriculum for 2024-28, a “H-Tree Model” of Engineering Education is offered. A unique “H-Tree Model” of Engineering Education Curriculum is followed and curriculum is designed to systematically develop IQ (Intelligence Quotient), PQ (Physical Quotient), EQ (Emotional Quotient), and SQ (Spiritual Quotient) of a learner. This curriculum aims at the development of an all-rounded personality with holistic approach to education in which a learner receives 34% teacher-led learning, 15% peer learning, 26% self-learning, and 25% experiential learning. The curriculum model is outcome based that focuses on learning by doing. Curriculum is designed to provide multiple learning opportunities for students to acquire and demonstrate competencies for rewarding careers. It ensures multiple choices to a learner acquiring skills through systematic planning. It has 7 verticals aligned to GR recommendations with strong science and mathematics foundation and program core, sequel of electives, multidisciplinary minor courses, humanities & management courses, and sufficient experiential learning through projects and semester-long industry/research internship along with employable skill-based courses. A learner gets an opportunity to acquire skills through NSDC aligned courses during summer vacations. Additional options of choosing from Honors/Double Minor / Honors with Research are also provided to a learner.

The curriculum balances contact hours and total credits of the entire program. The total credits are 80, wherein focus is not only on providing knowledge but also on building skills, attitude and self-learning. Therefore, in the present curriculum, skill-based laboratories, mini-projects, multi-disciplinary projects, and internships are made mandatory across all disciplines of engineering, which will definitely facilitate self-learning of students. The overall credits and approach of curriculum proposed in the scheme and syllabus are in line with AICTE model curriculum. SJCEM : R - 25 curriculum will be implemented for Computer Engineering from the academic year 2025-26.



## Nomenclature

Abbreviation	Title
BSC	Basic Science Courses
ESC	Engineering Science Courses
PCC	Program Core Courses
PEC	Program Elective Courses
MDM	Multidisciplinary Minor
OE	Open Elective
SC	Skill Courses
LLC	Liberal Learning Courses
VSEC	Vocational and Skill Enhancement Course
VEC	Value Education Course
SEC	Skill Enhancement Courses
AEC	Ability Enhancement Course
IKS	Indian Knowledge System
CC	Co-curricular Courses
EEMC	Entrepreneurship/Economics/Management Courses

### Credit Specification:

- Theory: 1 credit = 15 hours of teaching
- Lab: 1 Credit = 30 hours of lab work.
- Workshop Based Activities: 1 Credit = 30 hours of hands-on activities related to vocation/professional practice/skill based
- Seminar/Group Discussion: 1 Credit = 15 hours of participation
- Community Engagement Projects: 1 Credit = 30 hours of contact time along with 15 hours of activities preparation, report writing, independent reading etc.

Dr. Sunny Sall  
BoS Chairman

Dr. Kamal Shah  
Principal



**St. John College of Engineering and Management**

**Autonomous Institute**

**(A Christian Religious Minority Institution)**

Approved by AICTE and DTE, Affiliated to University of Mumbai / MSBTE

DTE Code : 3218 AICTE Permanent ID : 1-4790201



**NAAC Accredited with Grade 'A+', Three Programs NBA Accredited**

# Master of Technology In Computer Engineering

## Semester – I

SJCEM : R - 25

**Effective from Academic Year 2025-26**



## Program Structure for Master of Technology in Computer Engineering

(With Effect from 2025-2026)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
25MECSPCC101	PCC	Algorithm & Complexity	3	-	-	3	-	-	3
25MECSPCC102	PCC	Advance Computer Network and Design	3	-	-	3	-	-	3
25MECSPEC11X	PEC	Department Level Optional Course-1	3	-	-	3	-	-	3
25MECSPEC12X	PEC	Department Level Optional Course-2	3	-	-	3	-	-	3
25MECSOE10X	OE	Institute Level Optional Course-I	3	-	-	3	-	-	3
25MECSPCL101	-	Computational Laboratory-I	-	-	2	-	-	1	1
25MECSVSE101	VSE	Skill Based Lab-I	-	-	4	-	-	2	2
		<b>Total</b>	<b>15</b>	<b>-</b>	<b>6</b>	<b>15</b>	<b>-</b>	<b>3</b>	<b>18</b>

Course Code	Vertical	Course Name	Evaluation Scheme					Total
			IAE 1	IAE 2	ESE	CA	OR/PR	
25MECSPCC101	PCC	Algorithm & Complexity	20	20	60	-	-	100
25MECSPCC102	PCC	Advance Computer Network and Design	20	20	60	-	-	100
25MECSPEC11X	PEC	Department Level Optional Course-1	20	20	60	-	-	100
25MECSPEC12X	PEC	Department Level Optional Course-2	20	20	60	-	-	100
25MECSOE10X	OE	Institute Level Optional Course-I	20	20	60	-	-	100
25MECSPCL101	-	Computational Laboratory-I	-	-	-	25	25	50
25MECSVSE101	VSE	Skill Based Lab-I	-	-	-	50	50	100
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>300</b>	<b>75</b>	<b>75</b>	<b>650</b>



## Elective Subjects

<b>Course Code</b>	<b>Department Level Optional Course-1</b>	<b>Course Code</b>	<b>Institute Level Optional Course</b>
25MECSPEC1101	Logic & Automated Reasoning	25MECSOE101	Product Life Cycle Management
25MECSPEC1102	Database System: Design and Implementation	25MECSOE102	Reliability Engineering
25MECSPEC1103	Computational Intelligence	25MECSOE103	Management Information System
25MECSPEC1104	Modern Operating System	25MECSOE104	Design of Experiments
	<b>Department Level Optional Course-2</b>	25MECSOE105	Operations Research
25MECSPEC1201	Component Based System Design	25MECSOE106	Cyber Security and Laws
25MECSPEC1202	ICT for Social Cause	25MECSOE107	Disaster Management and Mitigation Measures
25MECSPEC1203	Internet of Everything	25MECSOE108	Energy Audit and Management
25MECSPEC1204	Web Application Security	25MECSOE109	Development Engineering

<b>Course Title: Algorithm &amp; Complexity</b>													
<b>Semester: I</b>			<b>Term: ODD</b>				<b>Course Code: 25MECSPCC101</b>						
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>	
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>								
3	-	-	3	-	-	3	20	20	60	-	-	100	

IAE: Internal Assessment Examination

ESE: End Semester Examination

**Course Objectives:** The course is aimed

1. To analyze the algorithms using space and time complexity.
2. To teach problem formulation and problem solving skills.
3. To acquire knowledge of various applied algorithms.
4. To understand selected topics in algorithms that have found applications in areas such as geometric modelling, graphics, robotics, vision, computer animation, etc.

**Course Outcomes:**

After completion of the course, learner will be able to:

1. Analyze various algorithms with practical applications along with their resource requirements.
2. Explore advanced design and analysis techniques.
3. Explain major graph algorithms and their analyses.
4. Analyze linear programming and string matching algorithms.
5. Identify NP-complete problems and offer solutions to solve such problems.

Module	Contents	Hours	COs
<b>I</b>	<b>Foundations</b>	<b>04</b>	CO1
	Algorithms, Growth of Functions- Asymptotic notation, Mathematical Background for algorithm analysis Recurrences, The substitution method, The recursion-tree method, The master method, Randomized algorithms <b>Self-learning Topics:</b> Analyzing algorithms.		
<b>II</b>	<b>Advanced Design and Analysis Techniques</b>	<b>06</b>	CO2
	Dynamic Programming-Elements of dynamic programming, Matrix-chain multiplication Greedy Algorithms-Elements of the greedy strategy, Huffman codes Amortized Analysis-Aggregate analysis, The accounting method, The potential method, Dynamic tables <b>Self-learning Topics:</b> Amortized Analysis.		
<b>III</b>	<b>Graph Algorithms</b>	<b>08</b>	CO3
	Single-Source Shortest Paths-The Bellman-Ford algorithm, Dijkstra's algorithm, Difference constraints and shortest paths All-Pairs Shortest Paths-The Floyd-Warshall algorithm Maximum Flow-Flow networks, The Ford-Fulkerson method, Maximum bipartite matching <b>Self-learning Topics:</b> Dijkstra's algorithm.		
<b>IV</b>	<b>Computational Geometry</b>	<b>07</b>	CO4
	Line-segment properties, determining whether any pair of segments intersects, Finding the convex hull, Finding the closest pair of points <b>Self-learning Topics:</b> Geometry.		
<b>V</b>	<b>NPC and Approximation Algorithms</b>	<b>09</b>	CO5
	NP-Completeness: NP-completeness and reducibility, NP- completeness proofs, NP-complete problems, Approximation algorithms: The vertex-cover problem, The traveling-salesman problem, The set-covering problem, The subset-sum problem <b>Self-learning Topics:</b> Approximation Algorithms.		
<b>VI</b>	<b>Applied Algorithms</b>	<b>11</b>	CO6
	Number-Theoretic: Number Theoretic notion, Greatest common divisor, The Chinese remainder theorem, RSA String Matching Algorithms: The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm, Longest common subsequence Parallel Algorithm: Mesh Algorithm and its applications Probabilistic Algorithm: Game Theoretic Techniques Randomized Algorithms: <b>Self-learning Topics:</b> Monte Carlo and Las Vegas algorithms		
	<b>Total</b>	<b>45</b>	



## **Evaluation and Assessment Scheme:**

### **A. Internal Assessment Examination (IAE):**

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### **B. End Semester Theory Examination (ESE):**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## **Reference Books:**

1. Aho, Hopcroft, Ullman: "The Design and analysis of algorithms", Pearson Education
2. Vijay V. Vajirani, "Approximation Algorithms", Springer.
3. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI
4. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGrawHill Edition

## **Text Books:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", PHI, India Second Edition
2. Horowitz, Sahani and Rajsekar, "Fundamentals of Computer Algorithms", Galgotia
3. Rajeev Motwani, PrabhakarRaghavan, "Randomized Algorithm", Cambridge University Press



Course Title: Advance Computer Network and Design												
Semester: I			Term: ODD				Course Code: 25MECSPCC102					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination  ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. To study the problem of congestion control and service integration in TCP/IP networks focusing on protocol design, implementation and performance issues.</li> <li>2. To understand the principles of network design and enable students to setup, configure and interconnect an IP network.</li> <li>3. To debate the current trends and leading research in the computer networking area.</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the theoretical issues in protocol design and apply it to Quality of service in networks</li> <li>2. Understand issues in the design of network processors and apply them to design network systems</li> <li>3. Simulate working of wired and wireless networks to understand networking concepts.</li> <li>4. Develop solutions by applying knowledge of mathematics, probability, and statistics to network design problems.</li> <li>5. Understand the basics of software defined networking and explore research problems in that area.</li> </ol>												

Module	Contents	Hours	COs
<b>I</b>	<b>Internetworking</b>	<b>09</b>	<b>CO1</b>
	<ul style="list-style-type: none"> <li>Congestion control and Resource allocation: Issues of Resource Allocation, Queuing Disciplines: FIFO, Fair Queuing, TCP Congestion Control: Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.</li> <li>Congestion-Avoidance Mechanisms: DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance, Quality of Service: Application Requirements, Integrated Services (RSVP), Differentiated Services (EF, AF).</li> </ul> <p><b>Self-learning Topics:</b> Congestion control and Resources.</p>		
<b>II</b>	<b>Routing</b>	<b>08</b>	<b>CO2</b>
	<p>IPv4 Routing Principles, Routing Information Protocol (RIP), IGRP and EIGRP, OSPF for IPv4 and IPv6, Border Gateway Protocol (BGP), EIGRP, High Availability Routing.</p> <p><b>Self-learning Topics:</b> IPv4 and IPv6 Routing</p>		
<b>III</b>	<b>IPv6</b>	<b>06</b>	<b>CO3</b>
	<p>IPv4 deficiencies, patching work done with IPv4, IPv6 addressing, multicast, Anycast, ICMPv6, Neighbor Discovery, Routing, Resource Reservation</p> <p><b>Self-learning Topics:</b> IPv6 protocols.</p>		
<b>IV</b>	<b>Network Design</b>	<b>11</b>	<b>CO4</b>
	<ul style="list-style-type: none"> <li>Designing the network topology and Solutions-Top down Approach: PPDIIO – Network Design Layers - Access Layer, Distribution Layer, Core/Backbone Layer, Access Layer Design, and Backbone Network Design.</li> <li>Enterprise LAN Design: Ethernet Design Rules and Campus Design best practices, Virtualization and Data Center Design, Wireless LAN Design, WAN Design: Traditional WAN Technologies, VPN Design</li> </ul> <p><b>Self-learning Topics:</b>.LAN and WAN Technology</p>		
<b>V</b>	<b>Ad Hoc Wireless Networks</b>	<b>06</b>	<b>CO5</b>
	<p>MAC Protocols for Ad Hoc Wireless Networks: MACA/W, MACA-BI, DPRMA, MACA/PR. Routing Protocols for Ad Hoc Wireless Networks: DSDV, DSR, AODV, and ZRP. Transport Layer: ATCP.</p> <p><b>Self-learning Topics:</b> Wireless Networks</p>		
<b>VI</b>	<b>Software Defined Networking and OpenFlow</b>	<b>05</b>	<b>CO6</b>
	<p>Introduction to Software Defined Networking, Control and Data Planes, SDN Controllers, Introduction to Openflow Protocol, Network Function Virtualization-Concepts.</p> <p><b>Self-learning Topics:</b> Networking and Openflow protocol,</p>		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:



## **A. Internal Assessment Examination (IAE):**

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

## **B. End Semester Theory Examination (ESE):**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## **Reference Books:**

1. William Stallings, High-Speed Networks and Internets, Pearson Education, 2nd Edition, 2002.
2. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Third Edition, Addison Wesley, 2004.
3. Pujolle, Software Networks: Virtualization, SDN, 5G, Security, Wiley.

## **Text Books:**

1. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Elsevier, Fourth Edition.
2. Philip M. Miller, TCP / IP: The Ultimate Protocol Guide Applications, Access and Data Security - Vol 2, Wiley
3. Pete Loshin, IPv6: Theory, Protocols and Practice, Morgan Kaufmann, 2nd Edition, 2004
4. Anthony Bruno, Steve Jordan, Official Cert Guide: CCDA, Cisco Press
5. C. Siva Ram Murthy, B.S. Manoj, Ad Hoc Wireless Networks: Architectures and, Prentice Hall, 2004.
6. Thomas D NAdeau and Ken Grey, Software Defined Networking, O'Reilly, 2013



Course Title: Logic & Automated Reasoning												
Semester: I			Term: ODD				Course Code: 25MECSPEC1101					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"><li>1. Represent mathematical and other knowledge using logical formalism</li><li>2. Understand theoretical concepts and results that form the basis of current automated reasoning systems.</li><li>3. Understand advanced techniques of resolution theorem proving and be able to use them.</li></ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"><li>1. Comprehend syntax and semantics of Propositional logic, first-order logic, inference system, proof, soundness and completeness.</li><li>2. Apply various deductive algorithms and models for reasoning</li><li>3. Emphasize various techniques for automated reasoning, theorem proving.</li></ol>												

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Logic</b>	<b>05</b>	<b>CO1</b>
	Propositional Logic, First-Order Logic, Modal Logic, Temporal Logic, Program Verification. <b>Self-learning Topics:</b> Mathematical Logic		
<b>II</b>	<b>Propositional Logic</b>	<b>11</b>	<b>CO2</b>
	Formulas, Models, Tableaux: Propositional Formulas, Interpretations, Logical Equivalence, Sets of Boolean Operators, Satisfiability, Validity and Consequence, Semantic Tableaux, Soundness and Completeness Resolutions: Conjunctive Normal Form, Clausal Form, Resolution Rule, Soundness and Completeness of Resolution Binary Decision Diagrams: Motivation Through Truth Tables, Definition of Binary Decision Diagrams, Reduced Binary Decision Diagrams <b>Self-learning Topics:</b> Formulas, Completeness Resolutions and Decision Diagrams		
<b>III</b>	<b>First-Order Logic</b>	<b>11</b>	<b>CO3</b>
	Formulas, Models, Tableaux: Relations and Predicates, Formulas in First-Order Logic, Interpretations, Logical Equivalence, Semantic Tableaux, Soundness and Completion of Semantic Tableaux Resolution: Ground Resolution, Substitution, Unification, General Resolution, Soundness and Completeness of General Resolution Introduction to Logic Programming: Prolog <b>Self-learning Topics:</b> Resolution		
<b>IV</b>	<b>Reasoning Methods</b>	<b>08</b>	<b>CO4</b>
	SAT Solvers: Properties of Clausal Form, Davis-Putnam Algorithm, DPLL Algorithm Deductive Systems: Gentzen System, Hilbert System Terms and Normal Forms: First-Order Logic with Functions, PCNF and Clausal Form, Herbrand Models. <b>Self-learning Topics:</b> Properties of Clausal Form and Herbrand Models		
<b>V</b>	<b>Automated Reasoning</b>	<b>05</b>	<b>CO5</b>
	Automated Reasoning for Web system, Semantic Web applications, REWERSE-automated reasoning method and tools <b>Self-learning Topics:</b> Web System		
<b>VI</b>	<b>Theorem Proving</b>	<b>05</b>	<b>CO6</b>
	Some exposure to theorem proving systems such as Prolog, PVS, SPIN <b>Self-learning Topics:</b> PVS and SPIN		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):



Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

**B. End Semester Theory Examination (ESE):**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

**Reference Books:**

1. Handbook of Practical Logic and Automated Reasoning, John Harrison, Cambridge University Press
2. Michael Huth and Mark Ryan, Logic in Computer Science: Modelling and Reasoning about Systems, Cambridge University Press.

**Text Books:**

1. Mordechai Ben-Ari, Mathematical Logic for Computer Science, Third Edition, Springer
2. Arindama Singh, Logics for Computer Science, Prentice Hall of India.

<b>Course Title: Database Systems: Design and Implementation</b>												
<b>Semester: I</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSPEC1102</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment            Examination ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. To introduce principles and foundations of distributed database.</li> <li>2. To impart knowledge of query processing and optimization.</li> <li>3. To introduce the concept of document-oriented database.</li> <li>4. To create awareness about potential security threats to a database and mechanisms to handle it.</li> <li>5. Understand the usage of advanced data models for real life application.</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Design distributed database for better resource management.</li> <li>2. Understand and analyse Query processing and optimization techniques.</li> <li>3. Describe developments in database technology.</li> <li>4. Apply appropriate security techniques to the database systems.</li> <li>5. Implement advanced data models for real life applications.</li> </ol>												



Module	Contents	Hours	COs
<b>I</b>	<b>Introduction, Distributed database design</b>	<b>06</b>	<b>CO1</b>
	Centralized versus non centralized Databases, Homogeneous and Heterogeneous DDBMS and their comparison, Distributed database design: Concept, Objective of Data Distribution, Data Fragmentation, The allocation of fragment, Concepts of replication servers Transparencies in Distributed Database Design  <b>Self-learning Topics:</b> DDBMS and their comparison		
<b>II</b>	<b>Query Processing and Optimization</b>	<b>09</b>	<b>CO2</b>
	Query Processing Problem, Objectives of Query Processing, Complexity of Relational Algebra Operations, Layers of Query Processing Query Decomposition and Data Localization: Query Decomposition, Localization of Distributed Data.  <b>Self-learning Topics:</b> Query Processing		
<b>III</b>	<b>Document oriented database Object Oriented Database:</b>	<b>07</b>	<b>CO3</b>
	Need of object-oriented database, Impedance matching problem between OO languages and Relational database, Case study db4O Document Oriented Database: Need of Document Oriented database, difference between Document Oriented Database and Traditional database, Types of encoding XML, JSON, BSON, Representation XML, Json Objects. Case study on doc oriented based such a Mariadb  <b>Self-learning Topics:</b> object-oriented database		
<b>IV</b>	<b>Advanced data models</b>	<b>07</b>	<b>CO4</b>
	Temporal data models, Aspects of valid time, Bitemporal time and bi-temporal time with examples of each. Spatial model: Types of spatial data models - Raster, Vector and Image  <b>Self-learning Topics:</b> Data Model		
<b>V</b>	<b>Data Security Introduction to Database Security Issues</b>	<b>07</b>	<b>CO5</b>
	Authentication and authorization, Database auditing, Discretionary Access Control Based on Granting and Revoking Privileges, Mandatory Access Control and Role-Based Access Control for Multilevel Security Introduction to Statistical Database Security  <b>Self-learning Topics:</b> Database Security		
<b>VI</b>	<b>Advance Databases</b>	<b>09</b>	<b>CO6</b>
	MYSQL Postgres, Mobile databases, NoSQL, Native XML databases (NXD), Document oriented databases, Graph database Federated Databases: Architecture, Development task, System operation  <b>Self-learning Topics:</b> MYSQL Databases		
	<b>Total</b>	<b>45</b>	



## **Evaluation and Assessment Scheme:**

### **A. Internal Assessment Examination (IAE):**

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### **B. End Semester Theory Examination (ESE):**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## **Reference Books:**

1. Chhanda Ray, "Distributed Database System", Pearson Education India
2. Hector Garcia-Molina, Jeffery D. Ullman, Jennifer Widom, "Database system Implementation"
3. Thomas M.Connolly Carolyn Begg, Database Systems: A practical Approach to Design, Implementation and Management, 4/e.

### **Text Books:**

1. Elmasri & Navathe, "Fundamentals of Database Systems" IV edition. PEARSON Education.
2. Korth, Silberschatzsudarshan, "Database systems, concepts" 5th edition McGraw Hill
3. Ruosell J.T. Dyer, Learning MySQL and Mariadb.
4. M. Tamer Ozsu , Patrick Valduriez, "Principles of Distributed Database", Pearson Education India

<b>Course Title: Computational Intelligence</b>												
<b>Semester: I</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSPEC1103</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment            Examination ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. To explore the various computational Intelligence techniques</li> <li>2. To become familiarized with Neural Network, Fuzzy logic &amp; evolutionary techniques</li> <li>3. To learn to apply computational Intelligence to different applications</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the importance of computational Intelligence</li> <li>2. Analyze various computational Intelligence technology</li> <li>3. Design and implement various intelligent system.</li> </ol>												

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Computational Intelligence paradigms</b>	<b>06</b>	<b>CO1</b>
	Artificial Neural Networks, Fuzzy Systems, Genetic Algorithms, Swarm Intelligence, Artificial Immune System, Applications <b>Self-learning Topics:</b> Intelligence paradigms		
<b>II</b>	<b>Artificial Neural Networks &amp; SVM</b>	<b>11</b>	<b>CO2</b>
	Basic models of ANN: NN Architecture, MP Neuron, Linear separability, activation functions, types of learning Learning Rules: Hebbian, Perceptron, Delta, Winnertake all Supervised NN: Perceptron Network: SDPTA, SCPTA, MCPTA, Adaline networks Support Vector Machine: Binary SVM <b>Self-learning Topics:</b> SVM		
<b>III</b>	<b>Fuzzy Systems</b>	<b>08</b>	<b>CO3</b>
	Fuzzy Sets: Definition, operations, properties, relations, characteristics, membership functions, defuzzification. <b>Self-learning Topics:</b> Fuzzy Sets		
<b>IV</b>	<b>Optimization</b>	<b>09</b>	<b>CO4</b>
	GA: Selection, Encoding, Crossover, Mutation, Examples. Swarm Intelligence: Single Solution Particle Swarm Optimization: Guaranteed Convergence PSO, Social-Based Particle Swarm Optimization, Hybrid Algorithms, Sub-Swarm Based PSO, Multi-Start PSO Algorithms, Repelling Methods, Binary PSO, Ant Algorithm: Simple Ant Colony Optimization <b>Self-learning Topics:</b> GA ,Intelligence		
<b>V</b>	<b>Artificial Immune System</b>	<b>05</b>	<b>CO5</b>
	Natural Immune System: Classical view, Antibodies and antigens, Artificial Immune Models: Artificial Immune system algorithm, classical view models, CLONALG <b>Self-learning Topics:</b> Natural Immune System		
<b>VI</b>	<b>Applications</b>	<b>06</b>	<b>CO6</b>
	Character Recognition, Genetics Algorithm in game playing, Color Recipe prediction- Single MLP approach ANT algorithm/Swarm Intelligence – TSP, Best path finding <b>Self-learning Topics:</b> MLP approach ANT algorithm		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.



## **Text Books:**

1. Andries P. Engelbrecht, Computational Intelligence an Introduction, Wiley, 2nd Edition
2. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Wiley, 2nd edition
3. Jacek M. Zurada, Introduction to Artificial Neural Systems, West Publication
4. Theodoridis and Koutroumbas , Pattern Recognition, 4th Edition, Academic Press

<b>Course Title: Modern Operating System</b>												
<b>Semester: I</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSPEC1104</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination            ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. To learn the architectural differences and issues related to Operating System.</li> <li>2. To get a comprehensive knowledge of the distributed systems and Real time operating system.</li> <li>3. To get a thorough knowledge of database operating systems and cloud operating System.</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Apply the principles and concepts in analyzing and designing Operating System.</li> <li>2. Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system</li> <li>3. Analyze the performance and reliability of different Operating Systems.</li> <li>4. Analyze and solve concurrency control problems in database operating system</li> </ol>												

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction</b>	<b>05</b>	<b>CO1</b>
	Types of Operating Systems, DOS, Middleware, RTS, DBOS. Introduction to process, Concurrent processes, Critical Section problems, other synchronization problems. <b>Self-learning Topics:</b> Architectures and design issues of Network operating system		
<b>II</b>	<b>Distributed operating Systems, Scheduling and synchronization</b>	<b>10</b>	<b>CO2</b>
	Scheduling: Issues in load distributing, Components of load distributing algorithms, Stability, Load distributing algorithms, Performance Comparison, selecting a suitable load sharing Algorithm. Synchronization: Physical and logical clocks. Distributed Mutual Exclusion: Introduction, Classification of Mutual Exclusion algorithms, Mutual Exclusion Algorithms. Distributed Deadlock: Introduction, deadlock handling strategies, Deadlock detection: Issues and resolution, Control Organizations, Centralized algorithms, Distributed algorithms, Hierarchical algorithms. <b>Self-learning Topics:</b> Scheduling and Synchronization		
<b>III</b>	<b>Distributed Fault Handling</b>	<b>09</b>	<b>CO3</b>
	Agreement Protocol: System Model, Classification, Solution to Byzantine Agreement Problem. Fault Recovery: Concepts, Classification of failures, Backward error recovery, Recovery in concurrent Systems, Consistent Check Points, Synchronous and Asynchronous check pointing and recovery. Fault tolerance: Issues, Atomic actions and committing, Commit Protocols, Non-blocking Commit protocols, Voting protocols and Dynamic Voting Protocols <b>Self-learning Topics:</b> Agreement Protocol		
<b>IV</b>	<b>Real Time Operating Systems</b>	<b>10</b>	<b>CO4</b>
	Types of Real time tasks, Modeling Timing Constraints. Task Scheduling: Types of tasks and their characteristics, Task Scheduling, Clock driven Scheduling, Hybrid Schedulers, Event driven Scheduling, EDF Scheduling, Rate Monotonic Algorithm Resource Handling: Resource Sharing, Priority Inversion, PIP, PCP, HLP. Scheduling real time tasks in distributed systems <b>Self-learning Topics:</b> Timing Constraints		
<b>V</b>	<b>Database Operating systems</b>	<b>05</b>	<b>CO5</b>
	Concurrency control: Database systems, Concurrency control model of database systems, Problem of Concurrency Control, serializability theory, Distributed Database Systems Concurrency Control Algorithms: Basic synchronization Algorithms, Lock based, Timestamp based and Optimistic Algorithms, Concurrency Control Algorithms : Data Replication <b>Self-learning Topics:</b> Concurrency control		
<b>VI</b>	<b>Case Study</b>	<b>05</b>	<b>CO6</b>



	DOS: Mach, Amoeba RTOS: UNIX as RTOS, Windows as RTOS. Mobile OS. Cloud OS <b>Self-learning Topics:</b> Case studies		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Andrew S.Tanenbaum, "Modern Systems Principles and Paradigms". PHI.
2. Pradeep K.Sinha, "Distributed Operating System-Concepts and design", PHI.
3. Andrew S.Tanenbaum, "Distributed Operating System", Pearson Education.
4. Jane W. S. Liu, "Real Time Systems", Pearson education.

## Text Books:

1. Mukesh Singhal, Niranjana G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems" MC Graw Hill education.
2. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson education

<b>Course Title: Component Based System Design</b>												
<b>Semester: I</b>			<b>Term: ODD</b>				<b>Course Code: 25MECSPEC1202</b>					
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>					
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment  
 Examination ESE: End Semester Examination

**Course Objectives:** The course is aimed

1. To gain the knowledge of current component models in terms of their design, management and related issues.
2. A detailed study of the concepts and engineering principles of software component and component-based software systems.
3. A clear understanding of use of a robust Integrated Development Environment for software development and how to navigate around this environment using the tools available.
4. Develop skills for programming in an object-oriented environment, using class components and their properties and methods to build new software products.

**Course Outcomes:**

After completion of the course, learner will be able to:

1. Understanding of component based systems, their purpose and scope.
2. Analyze Software Engineering practices related to Component Based Development.
3. Assess how the component models measure up to the goals of component based development.
4. Gain in depth knowledge of fundamental properties of components, technology and architecture and middleware.
5. Apply design Of Software Component Infrastructures and frameworks.
6. Develop and deploy large-scale component based Web applications.

Module	Contents	Hours	COs
<b>I</b>	<b>Component Definition</b>	<b>07</b>	<b>CO1</b>
	<ul style="list-style-type: none"> <li>• Definition of Software Component and its Elements.</li> <li>• Component Models and Component Services: Concepts and Principles, COTS Myths and Other Lessons Learned in Component-Based Software Development, Roles for Component-Based Development.</li> <li>• Common High-Risk Mistakes in Component-Based Software Engineering (CBSE), CBSE Success Factors: Integrating Architecture, Process, and Organization.</li> </ul> <p><b>Self-learning Topics:</b> Software Component and its Elements</p>		
<b>II</b>	<b>Software Engineering Practices</b>	<b>05</b>	<b>CO2</b>
	<ul style="list-style-type: none"> <li>• The Practice of Software Engineering.</li> <li>• From Subroutines to Subsystems: Component-Based Software Development.</li> </ul> <p><b>Self-learning Topics:</b> Software Development Components</p>		
<b>III</b>	<b>The Design of Software Component Infrastructures</b>	<b>08</b>	<b>CO3</b>
	<ul style="list-style-type: none"> <li>• Software Components and the UML.</li> <li>• Component Infrastructures: Placing Software Components in Context, Business Components.</li> <li>• Components and Connectors: Catalysis Techniques for Defining Component Infrastructures, An Open Process for Component-Based Development, Designing Models of Modularity and Integration.</li> </ul> <p><b>Self-learning Topics:</b> UML</p>		
<b>IV</b>	<b>The Management of Component-Based Software Systems</b>	<b>08</b>	<b>CO4</b>
	<ul style="list-style-type: none"> <li>• Measurement and Metrics for Software Components, The Practical Reuse of Software Components, Selecting the right COTS Software.</li> <li>• Importance of requirements, Software Component Project</li> <li>• Configuration Management and Component Libraries, The Evolution, Maintenance and Management of Component-Based Systems.</li> </ul> <p><b>Self-learning Topics:</b> Configuration Management and Component Libraries</p>		
<b>V</b>	<b>Component Technologies</b>	<b>09</b>	<b>CO5</b>
	<ul style="list-style-type: none"> <li>• Overview of the CORBA Component Model, Transactional COM+.</li> <li>• Designing Scalable Applications, The Enterprise JavaBeans Component Model, Choosing Between COM+, EJB, and CCM.</li> <li>• Software Agents as Next Generation Software Components.</li> </ul> <p><b>Self-learning Topics:</b> CORBA Component Model</p>		
<b>VI</b>	<b>Component framework and development</b>	<b>08</b>	<b>CO6</b>



	<ul style="list-style-type: none"><li>• Connectors, contexts, CLR contexts and channels.</li><li>• Black Box component framework, directory objects, cross development environment.</li><li>• Component oriented programming, component design and implementation tools, testing tools, assembly tools.</li></ul> <p><b>Self-learning Topics:</b> Black Box component framework</p>		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Addison Wilsey, "Component-Based Development: Principles and Planning for Business Systems", 2010.
2. Lau, K.-K. (Kung-Kiu), "An introduction to component-based software development", World Scientific Publishing, 2018.
3. Clemens Szyperski, "Component Software: Beyond Object-Oriented Programming", Pearson Education, 2003.
4. Don Box, Dorling Kingsley, Essential COM (2006).

Course Title: ICT for Social Cause												
Semester: I			Term: ODD			Course Code: 25MECSPEC1202						
Teaching Scheme						Evaluation Scheme						
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment  
 Examination ESE: End Semester  
 Examination

**Course Objectives:** The course is aimed

1. To appreciate various theoretical and disciplinary perspectives towards deploying ICT system for development of society.
2. To illustrate different ways by which information can be communicated.
3. To demonstrate an understanding for acquiring data securely for developing an ICT system
4. To illustrate data storage techniques and formulate knowledge from the raw data.
5. To formulate policies and strategies for ICT system.
6. To design various application using ICT.

**Course Outcomes:**

After completion of the course, learner will be able to:

1. To identify opportunities and challenges for developing ICT systems.
2. To identify and access the ways by which information can be communicated.
3. To identify methods of capturing data securely for developing an ICT system.
4. To store and analyze the data captured and generate knowledge from the raw data.
5. To devise policies and strategies for ICT system.
6. To design various application using ICT.

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction and Basics of ICT</b>	<b>05</b>	CO1
	Review of ICT history and growth, importance of ICT in societal development identifying opportunities for using ICT, learning from failures Drivers and barriers for ICT development ICT in developing countries – opportunities for developments and challenges Creating an ICT – handling text, data and media. <b>Self-learning Topics:</b>		
<b>II</b>	<b>Communication Techniques in ICT</b>	<b>10</b>	CO2
	Radio and TV Techniques, Mobile Techniques – CDMA, Mobile wireless WiMAX, Advanced wireless technologies, Bluetooth Satellite Techniques – architecture AND working principles GPS/GPRS Cloud computing –Introduction, cloud services, Cloud service providers, collaborative techniques like sharing ideas through blogs, forums, online communities etc safe transmission of data. <b>Self-learning Topics:</b>		
<b>III</b>	<b>Data acquisition in ICT</b>	<b>10</b>	CO3
	Recognition systems RFID, OMR Location recognition Data acquisition process for MEMS devices Sensors – Programming, communication with cloud. Acquiring data from internet and social media. Formation of social groups and interaction analysis Facebook, Twitter, Blogs, Forums, mailing lists etc controlling access to confidential information <b>Self-learning Topics:</b>		
<b>IV</b>	<b>Data and Knowledge Management in ICT</b>	<b>09</b>	CO4
	Data storage and management, content management system, identity management Knowledge elicitation, Knowledge representation and visualization techniques Knowledge Engineering Methodology Auditing knowledge management Data storage and disposal of data Linking knowledge management to business performance. <b>Self-learning Topics:</b>		
<b>V</b>	<b>Defining policies for administering ICT</b>	<b>06</b>	CO5
	ICT policies and e-Strategies, approach to ICT policy formulation and e-Strategy development, e-Readiness assessment, identifying priority areas and developing action plans. National Policy on ICT in India. <b>Self-learning Topics:</b>		
<b>VI</b>	<b>ICT applications</b>	<b>05</b>	CO6
	Study of ICT applications in various domains such as Agriculture, Healthcare, Education, social studies, Finance, Law, life science. <b>Self-learning Topics:</b>		
	<b>Total</b>	<b>45</b>	



## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Text Books:

1. Lechman, E. (2015). ICT Diffusion in Developing Countries: Towards a New Concept of Technological Takeoff. Germany: Springer International Publishing.
2. affordability Issues Surrounding the Use of ICT for Development and Poverty Reduction. (2018). United States: IGI Global.
3. Koh, S. C. L., Maguire, S. (2009). Information and Communication Technologies Management in Turbulent Business Environments. United Kingdom: Information Science Reference.
4. The Development Dimension ICTs for Development: Improving Policy Coherence. (2010). Ukraine: OECD Publishing.
5. Gorica, K., Kordha Tolica, E., Sevrani, K. (2015). Information Society Development Through ICT Market Strategies: Albania Versus Other Developing Countries. Germany: Springer International Publishing.
6. ICT Futures: Delivering Pervasive Real-time And Secure Services Edited By Paul Warren , John Davies, David Brown , Wiley Publication.
7. ICT Policy Formulation and e-Strategy Development Strategy Development - A Comprehensive Guidebook by Richard Labelle, Asia-Pacific Development Information Programme.

## Refrence Books:

1. BLI-224: ICT Fundamentals - [https://onlinecourses.swayam2.ac.in/nou22\\_lb08/preview](https://onlinecourses.swayam2.ac.in/nou22_lb08/preview)

<b>Course Title: Internet of Everything</b>												
<b>Semester: I</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSPEC1203</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

**Course Objectives:** The course is aimed

1. To describe the concepts of Objects in IOT, IOT Identifier, IOT Technologies.
2. To discuss and elaborate RFID architecture, RFID Tag and Reader along with the protocols used to solve the RFID issues faced in RFID applications.
3. To describe the connecting and networking nodes in a secure communication with the help of protocols such as MQTT, CoAP, and REST.
4. To explain Hadoop MapReduce and demonstrate its usage for real time batch data Analysis using Apache Oozie, Apache Spark and Apache Storm.
5. To summarize the use of ML algorithms in IoT Based application in Healthcare and Smart Transportation.
6. To elaborate and show how the analysis and the evaluation is carried out over the data received through sensors in IOE to ensure security in IOE applications.

**Course Outcomes:**

After completion of the course, learner will be able to:

1. Identify the Objects in IOT, list the IOT Identifiers and know the different technologies.
2. Explain RFID architecture, list the Components, identify RFID Tag and Reader along with the protocols used to solve the RFID issues faced in RFID applications.
3. Design applications using the communication protocols such as MQTT, CoAP, and REST.
4. Use Hadoop MapReduce for real time batch data Analysis using Apache Oozie, Apache Spark and Apache Storm.
5. Recall the ML algorithms used in IoT Based applications in Healthcare and Smart Transportation.
6. Analysis and evaluate the data received through sensors in IOE and Security in IOE applications.



Module	Contents	Hours	COs
<b>0</b>	<b>Prerequisite</b>		
	IOT Lab, Sensor Lab, Wireless Network.		
<b>I</b>	<b>Introduction to IOE</b>	<b>06</b>	CO1
	Introduction and History of IOT, Objects in IOT, IOT Identifier, IOT Technologies <b>Self-learning Topics:</b> History of IOT, Compare IOT & IOE		
<b>II</b>	<b>Radio-frequency Identification (RFID) Technology</b>	<b>08</b>	CO2
	<ul style="list-style-type: none"> <li>• Introduction to RFID and Principles of RFID</li> <li>• RFID Components and RFID Tag and Reader</li> <li>• RFID Transponder and RFID architecture</li> <li>• RFID Middleware</li> <li>• Protocols: Tree protocols, Tree splitting algorithms, Binary search</li> <li>• Algorithms</li> <li>• RFID Challenges and Applications</li> </ul> <b>Self-learning Topics:</b> Binary search Algorithms		
<b>III</b>	<b>Wireless Sensor Networks</b>	<b>07</b>	CO3
	Connecting and networking nodes, Securing communication, standards, IP Addressing Protocols - MQTT, CoAP, REST <b>Self-learning Topics:</b> Industrial WSN Standards		
<b>IV</b>	<b>Hadoop MapReduce</b>	<b>08</b>	CO4
	<ul style="list-style-type: none"> <li>• Introduction to Hadoop MapReduce, Architecture of Hadoop and</li> <li>• Hadoop Ecosystem</li> <li>• Hadoop MapReduce for Batch Data Analysis</li> <li>• Apache Oozie, Apache Spark, Apache Storm</li> <li>• Real-time Data Analysis Using Apache Storm</li> </ul> <b>Self-learning Topics:</b> Apache Hadoop Setup		
<b>V</b>	<b>IoT with ML</b>	<b>07</b>	CO5
	<ul style="list-style-type: none"> <li>• Machine Learning in IoT Based Healthcare Applications, General Architecture of H-IoT</li> <li>• Overview of Algorithms and Security of health data, Machine</li> <li>• Learning in IoT Based Smart Transportation, ML algorithms to</li> <li>• support Smart Transportation</li> </ul> <b>Self-learning Topics:</b> Deep Learning in IOT		
<b>VI</b>	<b>Security in IoE</b>	<b>06</b>	CO6



	<ul style="list-style-type: none"> <li>• Common Challenges in OT Security. How IT and OT Security Practices and Systems Vary</li> <li>• Formal Risk Analysis Structures: OCTAVE and FAIR</li> </ul> <p>Convergence of IoE and Blockchain its security challenges</p> <p><b>Self-learning Topics: Topics:</b> Trust based Recommender Systems in IoT</p>		
	<b>Total</b>	<b>45</b>	

### Evaluation and Assessment Scheme:

#### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

#### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

### Text Books:

1. Hakima Chaouchi, Internet of Things connecting objects to the web. Wiley.
2. Arshdeep Bhaga and Vijay Madiseti, Internet of Things - A Hands-on-Approach.
3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education, Cisco Press, 2017

### Refrence Books:

1. Samuel Greengard, The Internet of Things (MIT Press).
2. Hakima Chaouchi, The Internet of Things - Connecting objects to the web. Wiley Publications.
3. Herve chabanne, RFID and the Internet of Things. Wiley Publications.

### Useful Links:

1. <https://nptel.ac.in/courses/106/105/106105166/>
2. <https://nptel.ac.in/courses/108/108/108108098/>
3. <https://nptel.ac.in/courses/106/105/106105195/>
4. <https://www.coursera.org/specializations/IoT>

<b>Course Title: Web Application Security</b>												
<b>Semester: I</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSPEC1204</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination            ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. To reveal the underlying in web application.</li> <li>2. To understand the browser security principles.</li> <li>3. To understand web applications vulnerabilities.</li> <li>4. To understand web application mitigations.</li> <li>5. To identify and aid in fixing any security vulnerabilities during the web development process.</li> <li>6. To understand the security principles in developing a reliable web application.</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. To understand the security principles in developing a reliable web application</li> <li>2. Identify the various types of security issues in web browser.</li> <li>3. Identify the various types of threats in developing a web application.</li> <li>4. Identify the various types of mitigation measures of web applications.</li> <li>5. Apply the security principles in developing a reliable web application.</li> <li>6. Use industry standard tools for web application security.</li> </ol>												

Module	Contents	Hours	COs
<b>0</b>	<b>Prerequisite</b>	<b>03</b>	
	Overview of Web Applications:  Introduction history of web applications interface ad structure benefits and drawbacks of web applications Web application Vs Cloud application		
<b>I</b>	<b>Web Application Security Fundamentals</b>	<b>10</b>	CO1
	Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classifying and Prioritizing Threads  <b>Self-learning Topics:</b> Cookies, Access Control.		
<b>II</b>	<b>Browser Security Principles</b>	<b>6</b>	CO2
	Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection  <b>Self-learning Topics:</b> HTTPS, HTTP Proxies.		
<b>III</b>	<b>Web Application Vulnerabilities</b>	<b>7</b>	CO3
	Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery  <b>Self-learning Topics:</b> SSH Tunneling, Cleaning traces,Cleaning the event log Advanced phishing attacks		
<b>IV</b>	<b>Web Application Mitigations</b>	<b>10</b>	CO4
	HTTP request, HTTP response, rendering and events, html image tags, image tag security, issue, java script on error, Java script timing, port scanning , remote scripting , running remote code, frame and iframe , browser sandbox, policy goals, same origin policy, library import, domain relaxation  <b>Self-learning Topics:</b> Nikto, OWASP ZAP.		
<b>V</b>	<b>Secure Website Design</b>	<b>7</b>	CO5
	Secure website design: Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management, Sensitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines, Forms and validity, Technical implementation  <b>Self-learning Topics:</b> Wapiti, SQL Map		
<b>VI</b>	<b>Cutting Edge Web Application Security</b>	<b>06</b>	CO6
	Clickjacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security - IPv6 impact on web security  <b>Self-learning Topics:</b> <a href="https://owasp.org/www-community/Free_for_Open_Source_Application_Security_Tools">https://owasp.org/www-community/Free_for_Open_Source_Application_Security_Tools</a>		
	<b>Total</b>	<b>45</b>	



## **Evaluation and Assessment Scheme:**

### **A. Internal Assessment Examination (IAE):**

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### **B. End Semester Theory Examination (ESE):**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## **Text Books:**

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Professional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011

## **Reference Books:**

1. O'Reilly Web Security Privacy and Commerce 2nd Edition 2011
2. Professional Pen Testing for Web application, Andres andreu, wrox press
3. Carlos Serrao, Vicente Aguilera, Fabio Cerullo, "Web Application Security" Springer; 1st Edition.

<b>Course Title: Product Life Cycle Management</b>												
<b>Semester: I</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSOE101</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

**Course Objectives:** The course is aimed

1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

**Course Outcomes:**

After completion of the course, learner will be able to:

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Product Lifecycle Management (PLM)</b>	<b>11</b>	<b>CO1</b>
	<p>Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance &amp; Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications</p> <p><b>PLM Strategies:</b> Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM</p> <p><b>Self-learning Topics:</b> Product, Process, Project, Basics of Project Management</p>		
<b>II</b>	<b>Product Design</b>	<b>10</b>	<b>CO2</b>
	<p>Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process</p> <p><b>Self-learning Topics:</b> Software Engineering Paradigm, Process Models</p>		
<b>III</b>	<b>Product Data Management (PDM)</b>	<b>06</b>	<b>CO3</b>
	<p>Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation</p> <p><b>Self-learning Topics:</b> phases of product development.</p>		
<b>IV</b>	<b>Virtual Product Development Tools</b>	<b>06</b>	<b>CO4</b>
	<p>For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies</p> <p><b>Self-learning Topics:</b> Basics of CAD, CASE Tools</p>		
<b>V</b>	<b>Integration of Environmental Aspects in Product Design</b>	<b>06</b>	<b>CO5</b>
	<p>Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design.</p>		

	<b>Self-learning Topics:</b> Prototype, Iterative Approach in Product Development		
<b>VI</b>	<b>Life Cycle Assessment and Life Cycle Cost Analysis</b>	<b>06</b>	CO6
	Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis		
	<b>Self-learning Topics:</b> Cost Analysis, COCOMO Model		
	<b>Total</b>	<b>45</b>	

### Evaluation and Assessment Scheme:

#### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

#### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

### Reference Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229
3. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314
4. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

### Text Books:

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Professional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011

<b>Course Title: Reliability Engineering</b>													
<b>Semester: I</b>			<b>Term: ODD</b>				<b>Course Code: 25MECSOE102</b>						
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>	
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>								
3	-	-	3	-	-	3	20	20	60	-	-	100	
<p>IAE: Internal Assessment Examination ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. To familiarize the students with various aspects of probability theory</li> <li>2. To acquaint the students with reliability and its concepts</li> <li>3. To introduce the students to methods of estimating the system reliability of simple and complex systems</li> <li>4. To understand the various aspects of Maintainability, Availability and FMEA procedure</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand and apply the concept of Probability to engineering problems</li> <li>2. Apply various reliability concepts to calculate different reliability parameters</li> <li>3. Estimate the system reliability of simple and complex systems</li> <li>4. Carry out a Failure Mode Effect and Criticality Analysis</li> </ol>													

Module	Contents	Hours	COs
<b>I</b>	<b>Probability theory</b>	<b>08</b>	<b>CO1</b>
	<ul style="list-style-type: none"> <li><b>Probability Distributions:</b> Central tendency and Dispersion; Binomial, Normal, Poisson, Weibull, Exponential, relations between them and their significance.</li> <li><b>Measures of Dispersion:</b> Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance, Skewness and Kurtosis.</li> </ul> <p><b>Self-learning Topics:</b> Measures of Dispersion: Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance, Skewness and Kurtosis.</p>		
<b>II</b>	<b>Reliability Concepts</b>	<b>08</b>	<b>CO2</b>
	<ul style="list-style-type: none"> <li><b>Failure Data Analysis:</b> Hazard rate, failure density, Failure Rate, Mean Time to Failure (MTTF), MTBF, and Reliability Functions.</li> <li><b>Reliability Hazard Models:</b> Constant Failure Rate, Linearly increasing, Time Dependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.</li> </ul> <p><b>Self-learning Topics:</b> Reliability Hazard Models: Constant Failure Rate, Linearly increasing, Time Dependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.</p>		
<b>III</b>	<b>System Reliability</b>	<b>07</b>	<b>CO3</b>
	<p>System Configurations: Series, parallel, mixed configuration, k out of n structure, Complex systems.</p> <p><b>Self-learning Topics:</b> Complex systems.</p>		
<b>IV</b>	<b>Reliability Improvement</b>	<b>08</b>	<b>CO4</b>
	<p>Redundancy Techniques: Element redundancy, Unit redundancy, Standby redundancies. Markov analysis. System Reliability Analysis – Enumeration method, Cut-set method, Success Path method, Decomposition method.</p> <p><b>Self-learning Topics:</b> Decomposition method.</p>		
<b>V</b>	<b>Maintainability and Availability</b>	<b>07</b>	<b>CO5</b>
	<p>System downtime, Design for Maintainability: Maintenance requirements, Design methods: Fault Isolation and self-diagnostics, Parts standardization and Interchangeability, Modularization and Accessibility, Repair Vs Replacement.</p> <p>Availability – qualitative aspects.</p> <p><b>Self-learning Topics:</b> Availability – qualitative aspects.</p>		
<b>VI</b>	<b>Failure Mode, Effects and Criticality Analysis</b>	<b>07</b>	<b>CO6</b>
	<p>Failure mode effects analysis, severity/criticality analysis, FMECA examples. Fault tree construction, basic symbols, development of functional reliability block diagram, Fault tree analysis and Event tree Analysis:</p> <p><b>Self-learning Topics:</b> Fault tree analysis and Event tree Analysis</p>		
	<b>Total</b>	<b>45</b>	



## **Evaluation and Assessment Scheme:**

### **A. Internal Assessment Examination (IAE):**

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### **B. End Semester Theory Examination (ESE):**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## **Reference Books:**

1. L.S. Srinath, "Reliability Engineering", Affiliated East-West Press (P) Ltd., 1985.
2. Charles E. Ebeling, "Reliability and Maintainability Engineering", Tata McGraw Hill.
3. B.S. Dhillion, C. Singh, "Engineering Reliability", John Wiley & Sons, 1980.
4. P.D.T. Connor, "Practical Reliability Engg.", John Wiley & Sons, 1985.
5. K.C. Kapur, L.R. Lamberson, "Reliability in Engineering Design", John Wiley & Sons.
6. Murray R. Spiegel, "Probability and Statistics", Tata McGraw-Hill Publishing Co. Ltd.

<b>Course Title: Management Information System</b>													
<b>Semester: I</b>			<b>Term: ODD</b>				<b>Course Code: 25MECSOE103</b>						
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>	
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>								
3	-	-	3	-	-	3	20	20	60	-	-	100	
<p>IAE: Internal Assessment Examination ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. The course is blend of Management and Technical field.</li> <li>2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built</li> <li>3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage</li> <li>4. Identify the basic steps in systems development</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Explain how information systems Transform Business</li> <li>2. Identify the impact information systems have on an organization</li> <li>3. Describe IT infrastructure and its components and its current trends</li> <li>4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making</li> <li>5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses</li> </ol>													

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Information Systems (IS)</b>	<b>07</b>	<b>CO1</b>
	Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS  <b>Self-learning Topics:</b> Organizational Strategy, Competitive Advantages and IS		
<b>II</b>	<b>Data and Knowledge Management</b>	<b>08</b>	<b>CO2</b>
	Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results  <b>Self-learning Topics:</b> Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results		
<b>III</b>	<b>Ethical issues and Privacy</b>	<b>08</b>	<b>CO3</b>
	Information Security. Threat to IS, and Security Controls  <b>Self-learning Topics:</b> Threat to IS, and Security Controls		
<b>IV</b>	<b>Social Computing (SC)</b>	<b>07</b>	<b>CO4</b>
	Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C. Mobile commerce.  <b>Self-learning Topics:</b> E-business and E-commerce – B2B B2C. Mobile commerce.		
<b>V</b>	<b>Maintainability and Availability</b>	<b>07</b>	<b>CO5</b>
	Computer Networks Wired and Wireless technology, Pervasive computing, Cloud computing model  <b>Self-learning Topics:</b> Cloud computing model.		
<b>VI</b>	<b>Information System within Organization</b>	<b>08</b>	<b>CO6</b>
	Transaction Processing Systems, Functional Area Information System, ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System development life cycle models.  <b>Self-learning Topics:</b> Acquiring Information Systems and Applications: Various System development life cycle models.		
	<b>Total</b>	<b>45</b>	

### Evaluation and Assessment Scheme:

#### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

#### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.



## **Reference Books:**

1. Kelly Rainer, Brad Prince, Management Information Systems, Wiley
2. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10<sup>th</sup> Ed., Prentice Hall, 2007.
3. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

<b>Course Title: Design of Experiments</b>													
<b>Semester: I</b>			<b>Term: ODD</b>				<b>Course Code: 25MECSOE104</b>						
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>	
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>								
3	-	-	3	-	-	3	20	20	60	-	-	100	
<p>IAE: Internal Assessment Examination            ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. To understand the issues and principles of Design of Experiments (DOE)</li> <li>2. To list the guidelines for designing experiments</li> <li>3. To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Plan data collection, to turn data into information and to make decisions that lead to appropriate action</li> <li>2. Apply the methods taught to real life situations</li> <li>3. Plan, analyze, and interpret the results of experiments</li> </ol>													

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction</b>	<b>07</b>	<b>CO1</b>
	<ul style="list-style-type: none"> <li>• Strategy of Experimentation</li> <li>• Typical Applications of Experimental Design</li> <li>• Guidelines for Designing Experiments</li> <li>• Response Surface Methodology</li> </ul> <p><b>Self-learning Topics:</b> Response Surface Methodology</p>		
<b>II</b>	<b>Fitting Regression Models</b>	<b>08</b>	<b>CO2</b>
	<ul style="list-style-type: none"> <li>• Linear Regression Models</li> <li>• Estimation of the Parameters in Linear Regression Models</li> <li>• Hypothesis Testing in Multiple Regression</li> <li>• Confidence Intervals in Multiple Regression</li> <li>• Prediction of new response observation</li> <li>• Regression model diagnostics</li> <li>• Testing for lack of fit</li> </ul> <p><b>Self-learning Topics:</b> Testing for lack of fit</p>		
<b>III</b>	<b>Two-Level Factorial Designs</b>	<b>08</b>	<b>CO3</b>
	<ul style="list-style-type: none"> <li>• The <math>2^2</math> Design</li> <li>• The <math>2^3</math> Design</li> <li>• The General <math>2^k</math> Design</li> <li>• A Single Replicate of the <math>2^k</math> Design</li> <li>• The Addition of Center Points to the <math>2^k</math> Design,</li> <li>• Blocking in the <math>2^k</math> Factorial Design</li> <li>• Split-Plot Designs</li> </ul> <p><b>Self-learning Topics:</b> Split-Plot Designs</p>		
<b>IV</b>	<b>Two-Level Fractional Factorial Designs</b>	<b>08</b>	<b>CO4</b>
	<ul style="list-style-type: none"> <li>• The One-Half Fraction of the <math>2^k</math> Design</li> <li>• The One-Quarter Fraction of the <math>2^k</math> Design</li> <li>• The General <math>2^{k-p}</math> Fractional Factorial Design</li> <li>• Resolution III Designs</li> <li>• Resolution IV and V Designs</li> <li>• Fractional Factorial Split-Plot Designs</li> </ul> <p><b>Self-learning Topics:</b> Fractional Factorial Split-Plot Designs</p>		
<b>V</b>	<b>Response Surface Methods and Designs</b>	<b>07</b>	<b>CO5</b>
	<ul style="list-style-type: none"> <li>• Introduction to Response Surface Methodology</li> <li>• The Method of Steepest Ascent</li> <li>• Analysis of a Second-Order Response Surface</li> <li>• Experimental Designs for Fitting Response Surfaces</li> </ul> <p><b>Self-learning Topics:</b> Experimental Designs for Fitting Response Surfaces</p>		
<b>VI</b>	<b>Taguchi Approach</b>	<b>07</b>	<b>CO6</b>



	<ul style="list-style-type: none"> <li>• Crossed Array Designs and Signal-to-Noise Ratios</li> <li>• Analysis Methods</li> <li>• Robust design examples</li> </ul> <p><b>Self-learning Topics:</b> Robust design examples</p>		
	<b>Total</b>	<b>45</b>	

### Evaluation and Assessment Scheme:

#### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

#### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

### Reference Books:

1. Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3<sup>rd</sup> edition, John Wiley & Sons, New York, 2001
2. D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
3. George E P Box, J Stuart Hunter, William G Hunter, Statics for Experimenters: Design, Innovation and Discovery, 2<sup>nd</sup> Ed. Wiley
4. W J Dimond, Peactical Experiment Designs for Engineers and Scintists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
5. Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T.Voss



<b>Course Title: Operations Research</b>												
<b>Semester: I</b>			<b>Term: ODD</b>				<b>Course Code: 25MECSOE105</b>					
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>					
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination  ESE: End Semester Examination</p> <p><b>Course Objectives:</b> The course is aimed</p> <ol style="list-style-type: none"> <li>1. Formulate a real-world problem as a mathematical programming model.</li> <li>2. Understand the mathematical tools that are needed to solve optimization problems.</li> <li>3. Use mathematical software to solve the proposed models.</li> </ol> <p><b>Course Outcomes:</b></p> <p>After completion of the course, learner will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.</li> <li>2. Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.</li> <li>3. Solve specialized linear programming problems like the transportation and assignment problems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems.</li> <li>4. Understand the applications of integer programming and a queuing model and compute important performance measures</li> </ol>												

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Operations Research</b>	<b>14</b>	<b>CO1</b>
	<p>Introduction, Structure of the Mathematical Model, Limitations of Operations Research</p> <ul style="list-style-type: none"> <li>• <b>Linear Programming:</b> Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method Penalty Cost Method or Big M-method, Two Phase Method, Revised simplex method</li> <li>• <b>Duality,</b> Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis</li> <li>• <b>Transportation Problem:</b> Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel’s approximation method. Optimality test: the stepping stone method and MODI method</li> <li>• <b>Assignment Problem:</b> Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem, Travelling Salesman Problem</li> <li>• <b>Integer Programming Problem:</b> Introduction, Types of Integer Programming Problems, Gomory’s cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.</li> </ul> <p><b>Self-learning Topics: Integer Programming Problem:</b> Introduction, Types of Integer Programming Problems, Gomory’s cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.</p>		
<b>II</b>	<b>Queuing models</b>	<b>07</b>	<b>CO2</b>
	<p>queuing systems and structures, single server and multi-server models, Poisson input, exponential service, constant rate service, finite and infinite population</p> <p><b>Self-learning Topics:</b> Finite and infinite population</p>		
<b>III</b>	<b>Simulation</b>	<b>06</b>	<b>CO3</b>
	<p>Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation,</p>		

	Advantages of Simulation, Limitations of Simulation <b>Self-learning Topics:</b> Limitations of Simulation		
<b>IV</b>	<b>Dynamic programming</b>	<b>06</b>	CO4
	Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems. <b>Self-learning Topics:</b> Cargo loading and Reliability problems.		
<b>V</b>	<b>Game Theory</b>	<b>06</b>	CO5
	Competitive games, rectangular game, saddle point, minimax (maximum) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games. <b>Self-learning Topics:</b> Rectangular games without saddle point – mixed strategy for 2 X 2 games.		
<b>VI</b>	<b>Inventory Models</b>	<b>06</b>	CO6
	Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model <b>Self-learning Topics:</b> Probabilistic EOQ Model,		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002.
2. Ravindran, A, Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2009
3. Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2002.
4. Operations Research, S. D. Sharma, KedarNath Ram Nath-Meerut
5. Operations Research
6. , KantiSwarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons



<b>Course Title: Cyber Security and Laws</b>													
<b>Semester: I</b>			<b>Term: ODD</b>				<b>Course Code: 25MECSOE106</b>						
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>				<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>OR/PR/ Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>								
3	--	--	3	--	-	3	20	20	60	-	-	100	
<p>IAE: Internal Assessment Examination  ESE: End Semester Examination</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To understand and identify different types cybercrime and cyber law</li> <li>2. To recognized Indian IT Act 2008 and its latest amendments</li> <li>3. To learn various types of security standards compliances</li> </ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the concept of cybercrime and its effect on outside world</li> <li>2. Gain knowledge of various cyber offenses and cybercrimes.</li> <li>3. Illustrate different tools and methods used in cyber line to prevent against various cybercrimes.</li> <li>4. Interpret and apply IT law in various legal issues</li> <li>5. Distinguish different aspects of cyber law</li> <li>6. Apply Information Security Standards compliance during software design and development</li> </ol>													



# St. John College of Engineering and Management

Autonomous Institute

(A Christian Religious Minority Institution)

Approved by AICTE and DTE, Affiliated to University of Mumbai / MSBTE

DTE Code : 3218 AICTE Permanent ID : 1-4790201



NAAC Accredited with Grade 'A+', Three Programs NBA Accredited

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Cybercrime:</b>	<b>07</b>	<b>CO1</b>
	Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000.  <b>Self-learning topics:</b> A global Perspective on cybercrimes.		
<b>II</b>	<b>Cyber offenses &amp; Cybercrime:</b>	<b>08</b>	<b>CO2</b>
	How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues.  <b>Self-learning topics:</b> Organizational Security Policies and Measures in Mobile Computing Era, Laptops		
<b>III</b>	<b>Tools and Methods Used in Cybercrime:</b>	<b>08</b>	<b>CO3</b>
	Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing.  <b>Self-learning topics:</b> Identity Theft (ID Theft)		
<b>IV</b>	<b>The Concept of Cyberspace:</b>	<b>08</b>	<b>CO4</b>
	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, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking.  <b>Self-learning topics:</b> The Need for an Indian Cyber Law		
<b>V</b>	<b>Indian IT Act.</b>	<b>07</b>	<b>CO5</b>
	Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000. <b>Self-learning topics:</b> IT Act. 2008 and its Amendments		
<b>VI</b>	<b>Information Security Standard compliances:</b>	<b>07</b>	<b>CO6</b>
	SOX, GLBA, HIPAA, ISO, FISMA, NERC, <b>Self-learning topics:</b> PCI.		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will



have a duration of one hour.

**B. End Semester Theory Examination (ESE):**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

**Reference Books:-**

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, Information Systems Security, Wiley India, New Delhi
6. Kenneth J. Knapp, Cyber Security & Global Information Assurance Information Science Publishing.
7. William Stallings, Cryptography and Network Security, Pearson Publication
8. Websites for more information is available on : The Information Technology ACT, 2008- TIFR :  
<https://www.tifrh.res.in>
9. Website for more information, A Compliance Primer for IT professional:  
<https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538>



<b>Course Title: Disaster Management and Mitigation Measures</b>												
<b>Semester: I</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSOE107</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>OR/PR/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	--	--	3	--	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination  ESE: End Semester Examination  CA: Continuous Assessment</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>To understand physics and various types of disaster occurring around the world</li> <li>To identify extent and damaging capacity of a disaster</li> <li>To study and understand the means of losses and methods to overcome /minimize it.</li> <li>To understand role of individual and various organization during and after disaster</li> <li>To understand application of GIS in the field of disaster management</li> <li>To understand the emergency government response structures before, during and after disaster</li> </ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> <li>Gain knowledge of what is disaster, hazards &amp; its importance to study in human life.</li> <li>Get to know natural as well as manmade disaster and their extent and possible effects on the economy.</li> <li>Plan of national importance structures based upon the previous history.</li> <li>Get acquainted with government policies, acts and various organizational structure associated with an emergency.</li> <li>Illustrate various financial relief measures to understand roles of various NGO's.</li> <li>Get to know the simple dos and don'ts in such extreme events and act accordingly.</li> </ol>												

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction</b>	<b>06</b>	<b>CO1</b>
	Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. <b>Self-learning topics:</b> Introduction to global warming and climate change.		
<b>II</b>	<b>Natural Disaster and Manmade disasters:</b>	<b>09</b>	<b>CO2</b>
	<ul style="list-style-type: none"> <li>Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion</li> <li>Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization</li> </ul> <b>Self-learning topics:</b> Urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.		
<b>III</b>	<b>Disaster Management, Policy and Administration</b>	<b>07</b>	<b>CO3</b>
	<ul style="list-style-type: none"> <li>Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management.</li> <li>Policy and administration: Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time.</li> </ul> <b>Self-learning topics:</b> Study of flowchart showing the entire process.		
<b>IV</b>	<b>Institutional Framework for Disaster Management in India:</b>	<b>07</b>	<b>CO4</b>
	Importance of public awareness, Preparation and execution of emergency management program. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations. <b>Self-learning topics:</b> Use of Internet and softwares for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.		
<b>V</b>	<b>Financing Relief Measures:</b>	<b>09</b>	<b>CO5</b>
	Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. <b>Self-learning topics:</b> International relief aid agencies and their role in extreme events.		
<b>VI</b>	<b>Preventive and Mitigation Measures:</b>	<b>07</b>	<b>CO6</b>

	<ul style="list-style-type: none"> <li>• Pre-disaster, during disaster and post-disaster measures in some events in general</li> <li>• Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication</li> <li>• Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans.</li> </ul> <p><b>Self-learning topics:</b> Do's and don'ts in case of disasters and effective implementation of relief aids.</p>		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:-

1. 'Disaster Management' by Harsh K. Gupta, Universities Press Publications.
2. 'Disaster Management: An Appraisal of Institutional Mechanisms in India' by O.S. Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. 'Introduction to International Disaster Management' by Damon Copolla, Butterworth Heinemann Elsevier Publications.
4. 'Disaster Management Handbook' by Jack Pinkowski, CRC Press Taylor and Francis group.
5. 'Disaster management & rehabilitation' by Rajdeep Dasgupta, Mittal Publications, New Delhi.
6. 'Natural Hazards and Disaster Management, Vulnerability and Mitigation – R B Singh, Rawat Publications
7. Concepts and Techniques of GIS –C.P.Lo Albert, K.W. Yongg – Prentice Hall (India) Publications.



<b>Course Title: Energy Audit and Management</b>												
<b>Semester: I</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSOE108</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>OR/PR/ Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	--	--	3	--	-	3	20	20	60	-	-	100
IAE: Internal Assessment Examination ESE: End Semester Examination												
<b>Course Objectives:</b>												
<ol style="list-style-type: none"><li>1. To understand the importance energy security for sustainable development and the fundamentals of energy conservation.</li><li>2. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management</li><li>3. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.</li></ol>												
<b>Course Outcomes:</b>												
At the end of the course students will be able to:												
<ol style="list-style-type: none"><li>1. To identify and describe present state of energy security and its importance.</li><li>2. To identify and describe the basic principles and methodologies adopted in energy audit of an utility.</li><li>3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.</li><li>4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities</li><li>5. To analyse the data collected during performance evaluation and recommend energy saving measures</li><li>6. To gain knowledge of energy conservation in buildings to understand its impact on society.</li></ol>												

Module	Contents	Hours	COs
<b>I</b>	<b>Energy Scenario:</b>	<b>06</b>	<b>CO1</b>
	Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms.  <b>Self-learning topics:</b> Material and Energy balance.		
<b>II</b>	<b>Energy Audit Principles:</b>	<b>08</b>	<b>CO2</b>
	Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements. Elements of monitoring& targeting; Energy audit Instruments; Data and information-analysis. <b>Financial analysis techniques:</b> Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR)  <b>Self-learning topics:</b> Fuel and energy substitution		
<b>III</b>	<b>Energy Management and Energy Conservation in Electrical System:</b>	<b>10</b>	<b>CO3</b>
	Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances. <b>Energy efficiency measures in lighting system, Lighting control:</b> Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.  <b>Self-learning topics:</b> Star ratings.		
<b>IV</b>	<b>Energy Management and Energy Conservation in Thermal Systems:</b>	<b>10</b>	<b>CO4</b>
	Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.  <b>Self-learning topics:</b> Use of insulation- types and application		
<b>V</b>	<b>Energy Performance Assessment:</b>	<b>06</b>	<b>CO5</b>
	On site Performance evaluation techniques, Case studies based on: Motors and pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.		

	<b>Self-learning topics:</b> Case studies based on variable speed drive.		
<b>VI</b>	<b>Energy conservation in Buildings:</b>	<b>05</b>	<b>CO6</b>
	Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources.  <b>Self-learning topics:</b> GRIHA- Green Rating for Integrated Habitat Assessment.		
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:-

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B.Smith, Pergamon Press
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press
8. [www.energymanagertraining.com](http://www.energymanagertraining.com)
9. [www.bee-india.nic.in](http://www.bee-india.nic.in)



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DTE Code : 3218 AICTE Permanent ID : 1-4790201



**NAAC Accredited with Grade 'A+', Three Programs NBA Accredited**

Course Title: Development Engineering												
Semester: I			Term: ODD				Course Code: 25MECSOE109					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination  ESE: End Semester Examination</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>To understand the characteristics of rural Society and the Scope, Nature and Constraints of rural Development.</li> <li>To study Implications of 73rd CAA on Planning, Development and Governance of Rural Areas</li> <li>An exploration of human values, which go into making a 'good' human being, a 'good' professional, a 'good' society and a 'good life' in the context of work life and the personal life of modern Indian professionals</li> <li>To understand the Nature and Type of Human Values relevant to Planning Institutions</li> </ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> <li>Apply knowledge for Rural Development.</li> <li>Apply knowledge for Management Issues.</li> <li>Apply knowledge for Initiatives and Strategies</li> <li>Develop acumen for higher education and research.</li> <li>Master the art of working in group of different nature.</li> <li>Develop confidence to take up rural project activities independently</li> </ol>												

Module	Contents	Hours	COs
I	<p>Introduction to Rural Development Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development Roots of Rural Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development.</p> <p><b>Self-learning topics:</b> Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services.</p>	08	CO1
II	<p>Post-Independence rural Development Balwant Rai Mehta Committee - three tier system of rural local Government; Need and scope for people's participation and Panchayati Raj.</p> <p><b>Self-learning topics:</b> Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development</p>	07	CO2
III	<p>Rural Development Initiatives in Five Year Plans Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring organizations and agencies; Urban and rural interface - integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning.</p> <p><b>Self-learning topics:</b> Need for decentralized planning; Sustainable rural development.</p>	08	CO3
IV	<p>Post 73rd Amendment Scenario 73rd Constitution Amendment Act, including - XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning; Gram Sabha - revitalized Panchayati Raj; Institutionalization; resource mapping, resource mobilization including social mobilization; Information</p> <p><b>Self-learning topics:</b> Technology and rural planning; Need for further amendments.</p>	06	CO4
V	<p>Values and Science and Technology Material development and its values; the challenge of science and technology; Values in planning profession, research and education.</p> <p>Types of Values Psychological values — integrated personality; mental health; Societal values — the modern search for a good society; justice, democracy, rule of law, values in the Indian constitution;</p>	10	CO5

	<p>Aesthetic values — perception and enjoyment of beauty; Moral and ethical values; nature of moral judgment; Spiritual values; different concepts; secular spirituality; Relative and absolute values.</p> <p><b>Self-learning topics:</b> Human values— humanism and human values; human rights; human values as freedom, creativity, love and wisdom.</p>		
<b>VI</b>	<p>Ethics Canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility; Work ethics.</p> <p><b>Self-learning topics:</b> Professional ethics; Ethics in planning profession, research and education</p>	<b>06</b>	<b>CO6</b>
	<b>Total</b>	<b>45</b>	

## Evaluation and Assessment Scheme:

### A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination (ESE):

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:-

1. ITPI, Village Planning and Rural Development, ITPI, New Delhi
2. Thooyavan, K.R. Human Settlements: A 2005 MA Publication, Chennai
3. GoI, Constitution (73rd GoI, New Delhi Amendment) Act, GoI, New Delhi
4. Planning Commission, Five Year Plans, Planning Commission
5. Planning Commission, Manual of Integrated District Planning, 2006, Planning Commission New Delhi
6. Planning Guide to Beginners
7. Weaver, R.C., The Urban Complex, Doubleday.
8. Farmer, W.P. et al, Ethics in Planning, American Planning Association, Washington.
9. How, E., Normative Ethics in Planning, Journal of Planning Literature, Vol.5, No.2, pp. 123-150.
10. Watson, V., Conflicting Rationalities: -- Implications for Planning Theory and Ethics, Planning Theory and Practice, Vol. 4, No.4, pp.395 – 407

Course Title: Computational Laboratory-I												
Semester: I			Term: ODD			Course Code: 25MECSPCL101						
Teaching Scheme						Evaluation Scheme						
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA/TW	Oral/Pract/Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	2	-	-	1	1	-	-	-	25	25	50

Module	Contents	Hours	COs
I	<p><b>Algorithm &amp; Complexity</b></p> <ul style="list-style-type: none"> <li>The practicals in Algorithm &amp; Complexity should go beyond undergraduate level. That means not just coding standard algorithms, but also: <ul style="list-style-type: none"> <li>Complexity proofs (Big-O, Big-Ω, Big-Θ).</li> <li>Comparative evaluation using experiments.</li> <li>Research-oriented case studies (NP-complete problems, approximation, real datasets).</li> <li>Implementation with large inputs / real data (not just toy examples).</li> </ul> </li> </ul> <p><b>Module 1: Foundations</b></p> <ul style="list-style-type: none"> <li>Complexity Verification: Iterative vs. Recursive Fibonacci, Matrix Sum.</li> <li>Sorting Analysis: Merge, Quick, Heap Sort; pivot strategies in Quick Sort.</li> </ul> <p><b>Module 2: Advanced Design Paradigms</b></p> <ul style="list-style-type: none"> <li>Divide &amp; Conquer: Strassen's Matrix Multiplication vs. Naive <math>O(n^3)</math>.</li> <li>Greedy: MST via Kruskal's &amp; Prim's (sparse vs. dense graphs).</li> <li>Dynamic Programming: 0/1 Knapsack, Matrix Chain Multiplication, LCS.</li> </ul> <p><b>Module 3: Graph &amp; Network Algorithms</b></p> <ul style="list-style-type: none"> <li>Shortest Path: Dijkstra, Bellman-Ford, Floyd-Warshall.</li> <li>Traversals: DFS, BFS, with topological sort &amp; cycle detection.</li> </ul> <p><b>Module 4: Complexity Theory &amp; NP-Completeness</b></p> <ul style="list-style-type: none"> <li>NP Problems: Subset Sum / TSP (brute force vs. approximation).</li> <li>Reductions: 3-SAT → Clique demonstration, NP-complete proof report.</li> </ul> <p><b>Module 5: Research / Mini Project</b></p> <ul style="list-style-type: none"> <li>Case Study: Apply graph/DP/greedy algorithms on real dataset.</li> <li>Analyze complexity, experimental results, and trade-offs.</li> </ul>	06	CO1,2,3
II	<p><b>Advance Computer Network and Design</b></p> <p>the subject <b>Advanced Computer Networks &amp; Design</b> should focus not just on basic networking, but on <b>protocol deep-dives, performance</b></p>	06	CO4,5,6

	<p><b>modeling, design simulations, and security aspects.</b> The practicals should therefore combine <b>theory + simulation tools (NS2/NS3, Cisco Packet Tracer, GNS3, Wireshark, Mininet, etc.)</b>.</p> <p><b>Module 1: Network Protocol Analysis</b></p> <ul style="list-style-type: none"> <li>• Wireshark: Capture &amp; analyze TCP, UDP, ICMP (headers, flags, handshake).</li> <li>• TCP vs. UDP: Simulate file transfer &amp; streaming, compare throughput, latency, loss.</li> </ul> <p><b>Module 2: Routing &amp; Switching Design</b></p> <ul style="list-style-type: none"> <li>• Routing: RIP, OSPF, EIGRP, BGP in Packet Tracer/GNS3, study routing tables.</li> <li>• Switching: VLAN &amp; Inter-VLAN setup for scalable networks.</li> </ul> <p><b>Module 3: Advanced Network Simulation</b></p> <ul style="list-style-type: none"> <li>• Congestion Control: Simulate TCP Tahoe, Reno, NewReno, Vegas in NS2/NS3.</li> <li>• QoS: Priority &amp; fair queuing, analyze VoIP vs. FTP traffic.</li> <li>• Wireless: Wi-Fi simulation in NS3/Mininet-WiFi, study mobility &amp; density impact.</li> </ul> <p><b>Module 4: Security &amp; Fault Tolerance</b></p> <ul style="list-style-type: none"> <li>• Firewall/IDS: Configure iptables/Snort, detect simulated attacks.</li> <li>• VPN: Setup IPsec/SSL VPN, verify encryption via Wireshark.</li> <li>• Fault Tolerance: Configure HSRP/VRRP, test failover recovery.</li> </ul> <p><b>Module 5: Research / Mini Project</b></p> <ul style="list-style-type: none"> <li>• SDN: Mininet + OpenFlow, implement flow-based traffic engineering.</li> <li>• Case Study: Network optimization using real datasets (e.g., CAIDA traces).</li> </ul>		
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<b>Course Title: Skill Based Lab-I</b>												
<b>Semester: II</b>			<b>Term: ODD</b>				<b>Course Code: 25MECSPCL101</b>					
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>					
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
-	-	4	-	-	2	2	-	-	-	50	50	100

<b>Module</b>	<b>Contents</b>	<b>Hours</b>	<b>COs</b>
I	<b>Activities</b>		
	Skill Based Lab- I shall include activity / case study / project based learning like Mini project in engineering domains, related to the specialization or interdisciplinary domains, Product Design Application Software Development, Idea proposal and validation Lab work/Case Study can also be conducted based on DLOC chosen by the student		CO1-6



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**NAAC Accredited with Grade 'A+', Three Programs NBA Accredited**

# Master of Technology In Computer Engineering

## Semester – II

SJCEM : R - 25

**Effective from Academic Year 2025-26**

## Program Structure for Master of Technology in Computer Engineering (With Effect from 2024-2025)

### Semester II

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
25MECSPCC201	PCC	Cloud Computing and Services	3	-	-	3	-	-	3
25MECSPCC202	PCC	Exploratory Data Analytics and Visualization	3	-	-	3	-	-	3
25MECSPEC2X	PEC	Department Level Optional Course-3	3	-	-	3	-	-	3
25MECSPEC2X	PEC	Department Level Optional Course-4	3	-	-	3	-	-	3
25MECSOEX	OE	Institute Level Optional Course-II	3	-	-	3	-	-	3
25MECSPCL201	-	Computational Laboratory-II	-	-	2	-	-	1	1
25MECSVSE201	VSE	Skill Based Lab-II	-	-	4	-	-	2	2
		<b>Total</b>	<b>15</b>	<b>-</b>	<b>6</b>	<b>15</b>	<b>-</b>	<b>3</b>	<b>18</b>

Course Code	Vertical	Course Name	Evaluation Scheme					Total
			IAE 1	IAE 2	ESE	CA	OR/PR	
25MECSPCC201	PCC	Cloud Computing and Services	20	20	60	-	-	100
25MECSPCC202	PCC	Exploratory Data Analytics and Visualization	20	20	60	-	-	100
25MECSPEC2X	PEC	Department Level Optional Course-3	20	20	60	-	-	100
25MECSPEC2X	PEC	Department Level Optional Course-4	20	20	60	-	-	100
25MECSOEX	OE	Institute Level Optional Course-II	20	20	60	-	-	100
25MECSPCL201	-	Computational Laboratory-II	-	-	-	25	25	50
25MECSVSE201	VSE	Skill Based Lab-II	-	-	-	50	50	100
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>300</b>	<b>75</b>	<b>75</b>	<b>650</b>



## Elective Subjects

<b>Course Code</b>	<b>Department Level Optional Course-3</b>	<b>Course Code</b>	<b>Institute Level Optional Course</b>
25MECSPEC2101	Ethical Hacking & Digital Forensic	25MECSOE201	Project Management
25MECSPEC2102	Data Storage & Retrieval	25MECSOE202	Finance Management
25MECSPEC2103	Advance Soft Computing	25MECSOE203	Entrepreneurship Development and Management
25MECSPEC2104	Semantic Web & Social Network Analysis	25MECSOE204	Human Resource Management
	<b>Department Level Optional Course-4</b>	25MECSOE205	Professional Ethics and CSR
25MECSPEC2201	Blockchain Technology & Applications	25MECSOE206	Research Methodology
25MECSPEC2202	Storage Area Network	25MECSOE207	IPR and Patenting
25MECSPEC2203	Design Thinking	25MECSOE208	Digital Business Management
25MECSPEC2204	Metaverse	25MECSOE209	Environmental Management



<b>Course Title: Cloud Computing and Services</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>				<b>Course Code: 25MECSPCC201</b>					
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>					
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

### Course Objectives:

1. To learn the perspective of cloud computing and virtualization
2. To understand the idea behind mobile cloud computing
3. To determine the meaning of mobile offloading
4. To assess the concept of green cloud computing
5. To explore the resource allocation techniques and various business models
6. To analyse various cloud and mobile computing environments for real world application

### Course Outcomes:

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

1. Understand the concepts behind cloud computing and virtualization.
2. Apply the knowledge of mobile cloud computing to various applications
3. Determine the various techniques of loading in cloud computing applications.
4. Design applications to make the systems energy efficient.
5. Select the required cloud computing resources and develop a business model
6. Apply various techniques to develop various high ended mobile cloud computing applications.



Module	Contents	Hours	COs
I	<b>Introduction to Cloud Computing and Virtualization</b>	<b>07</b>	
	Virtualization: Need for virtualization, Features and types of virtualization, Hypervisors and its types. Cloud Computing: Introduction to Cloud Computing, Layers and Types of Clouds, Features of Cloud computing system, Cloud Infrastructure Management, Infrastructure as a Service, Platform as a Service, software as a service, Challenges and Risks. <b>Self-learning Topics:</b> Secondary services.		CO1
II	<b>Mobile Cloud Computing</b>	<b>07</b>	
	Mobile cloud computing: Need for Mobile cloud computing system, Definition, Architecture, Challenges, Characteristics and Benefits of Mobile cloud computing, Mobile cloud computing service framework Mobile cloud solutions, Mobile cloud service models, Mobile Cloud computation, Mobile Cloud storage, Mobile Cloud security and privacy, Mobile as a service consumer, Mobile as a service provider, Mobile as service broker. <b>Self-learning Topics:</b> Mobile Cloud Computing context awareness		CO2
III	<b>Offloading in Mobile Cloud Computing</b>	<b>07</b>	
	Definition of offloading, composition, migration Introduction to offloading , Offloading Decision, Types of Offloading, Topologies of Offloading, Offloading in Cloud Computing and in Mobile Cloud Computing: Similarities and Differences, Adaptive Computation Offloading from Mobile Devices, Cloud Path Selection for Offloading, Mobile Data Offloading Using Opportunistic Communication, Three-Tier Architecture of Mobile Cloud Computing, Requirements of Data Offloading, Performance Analysis of Offloading Techniques Multi-Cloud Offloading in Mobile Cloud computing environment. <b>Self-learning Topics:</b> Mobile cloud computing offloading models		CO3
IV	<b>Green Mobile Cloud Computing</b>	<b>07</b>	
	Introduction, Requirements and issues, Devices used, Computational offloading, Resource management, Service provisioning, Green location sensing. <b>Self-learning Topics:</b> Energy saving.		CO4
V	<b>Resource allocation and business model for mobile cloud computing</b>	<b>07</b>	
	Resource allocation in mobile cloud computing: Simple, dynamic and adaptive resource allocation models. Challenges and issues in resource allocation, Techniques in mobile cloud computing. Mobile cloud computing business models: Advantages, issues and applications. <b>Self-learning Topics:</b> Business Models for social mobile cloud.		CO5



VI	<b>Applications of Mobile cloud computing</b>	<b>09</b>	
	Mobile cloud media computing applications: Location identification, Human Tracking, Mobile learning applications, Cloud streaming applications, Vehicle monitoring and Biometric applications. Tips for creating cloud mobile applications.  <b>Self-learning Topics:</b> Context aware mobile computing system		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Barrie Sosinsky, Cloud computing Bible
2. Dr Kumar Saurabh, Cloud computing

## Text Books:

1. Rajkumar Buyya , James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms
2. Kailesh Jayaswal, Jagannath Kallakurchi, Donald J Houde, Cloud computing
3. Dijiang Huang and Huijun Wu, Mobile cloud computing: foundation and service model
4. Debashis De, Mobile computing architecture, algorithm and application



## Course Title: Exploratory Data Analytics and Visualization

Semester: II

Term: EVEN

Course Code: 25MECSPCC202

Teaching Scheme

Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA/TW	Oral/Pract/Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

### Course Objectives:

1. To understand the foundations of the Data Science process, methods and techniques
2. To represent and organize knowledge about large heterogeneous data collections
3. To use mathematical models and tools for large-scale data analysis and reasoning
4. To work and evaluate Data at Scale

### Course Outcomes:

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

1. Appreciate the science of statistics and the scope of its potential applications
2. Summarize and present data in meaningful ways
3. Select the appropriate statistical analysis depending on the research question at hand
4. Understand and verify the underlying assumptions of a particular analysis
5. Effectively and clearly communicate results from analyses performed to others

Module	Contents	Hours	COs
I	<b>Introduction to Data Science</b>	<b>10</b>	
	<ul style="list-style-type: none"> <li>Data science process: Defining goal, retrieving data, preprocessing data, exploratory data analysis, model building and data visualization, Ethical issues in data science.</li> <li>Probability: review of probability theory, normal distribution, sampling</li> <li>Simple Linear Regression, F-test and t-test for Simple Linear Regression, Residual Plots, Outliers and Influence Points, Multiple linear regression.</li> </ul> <p><b>Self-learning Topics:</b> F-test and t-tests for Multiple Linear Regression.</p>		CO1
II	<b>Predictive and Descriptive Models</b>	<b>10</b>	
	<ul style="list-style-type: none"> <li>Descriptive Modeling: Principal components analysis (PCA), singular value decomposition (SVD), probabilistic PCA, applying PCA to new data, PCA for data interpretation., EM algorithm for PCA, Independent Component Analysis (ICA), Maximum likelihood estimation using EM.</li> <li>Predictive Modeling: Predictive modeling process, supervised and unsupervised learning, parametric and nonparametric models, business intelligence, challenges in using predictive analytics</li> <li>Introduction to time series analysis and time series mining, Introduction to spatio-temporal data, spatio-temporal model, fast dynamic time warping</li> </ul> <p><b>Self-learning Topics:</b> Supervise and Unsupervised Learning</p>		CO2
III	<b>Evaluation and Methodology of Data Science</b>	<b>04</b>	
	<ul style="list-style-type: none"> <li>Experimental setups, training, tuning, test data, holdout method, cross- validation, bootstrap method</li> <li>Measuring performance of a model: Accuracy, ROC curves, precision- recall curves, loss functions for regression</li> <li>Interpretation of results: Confidence interval for accuracy, hypothesis tests for comparing models, algorithms</li> </ul> <p><b>Self-learning Topics:</b> Data science methodology</p>		CO3
IV	<b>Data Communication and Information Visualization</b>	<b>07</b>	
	<ul style="list-style-type: none"> <li>Data Communication: cost Function, how to Minimize cost function, coefficients of determination.</li> <li>Information visualization: effective information visualization, visual Encodings, perception of visual cues, data scales, visualizing time series data, data journalism, dashboards</li> </ul> <p><b>Self-learning Topics:</b> understanding data communication</p>		CO4

V	<b>Analysis of Variance (ANOVA)</b> <ul style="list-style-type: none"> <li>One-Way Analysis of Variance, F-test for ANOVA, Evaluating Group Differences, Type I and Type II Errors</li> <li>Issues with Multiple Comparisons, Assumptions of Analysis of Variance, Relationship between One-Way Analysis of Variance and Regression, One-Way Analysis of Covariance, Two-Way Analysis of Variance and Covariance</li> </ul> <b>Self-learning Topics:</b>	07	CO5
VI	<b>Analysis for proportions</b> <ul style="list-style-type: none"> <li>One-Sample Tests for Proportions, Significance Tests for a Proportion, Confidence Intervals for a Proportion</li> <li>Two-Sample Tests for Proportions, Confidence Intervals for Differences in Proportions, Significance Tests for Differences in Proportions, Effect Measures, Logistic Regression, Multiple Logistic Regression, Area under the ROC Curve</li> </ul> <b>Self-learning Topics:</b> Understanding Proportions	07	CO6
<b>Total</b>		<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

- Davy Cielen, Meysman, Mohamed Ali, "Introducing Data Science", Dreamtech Press
- Kevin P. Murphy, "Machine Learning a Probabilistic Perspective", The MIT Press
- Dean Abbott, "Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst", Wiley, 2014
- Noel Cressie, Christopher K. Wikle, "Statistics for Spatio-Temporal Data, Wiley
- Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley
- Rachel Schutt and Cathy O'Neil, "Doing Data Science", O'Reilly Media
- Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly Media
- Teetor, P. (2011). R cookbook. Sebastopol, CA: O'Reilly. ISBN 9780596809157
- Chang, W. (2013). R graphics cookbook. Sebastopol, CA: O'Reilly. ISBN 9781449316952
- Andy Field, Jeremy Miles and Zoe Field. (2012) Discovering Statistics Using R. Publisher: SAGE Publications Ltd. ISBN-13: 978-1446200469



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## Useful Links:

1. Data sets for Machine Learning algorithms: <https://www.kaggle.com/datasets>
2. <https://towardsdatascience.com/machine-learning/home>
3. [https://onlinecourses.nptel.ac.in/noc21\\_cs85/preview](https://onlinecourses.nptel.ac.in/noc21_cs85/preview)
4. <https://www.openintro.org/stat/>



<b>Course Title: Ethical Hacking and Digital Forensics</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSPEC2101</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination  ESE: End Semester Examination</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To understand underlying principles and many of the techniques associated with the digital forensic practices.</li> <li>2. To explore practical knowledge about ethical hacking Methodology</li> <li>3. To develop an excellent understanding of current cyber security issues and ways that user, administrator and programmer errors can lead to exploitable in securities.</li> </ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.</li> <li>2. Acquire knowledge of various digital forensic tools and ethical hacking.</li> <li>3. Interpret security issues in ICT world, and apply digital forensic tools for security and investigations.</li> <li>4. Achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system, mobile, email etc.</li> <li>5. Generate legal evidences and supporting investigation reports.</li> </ol>												

Module	Contents	Hours	COs
I	<b>Ethical Hacking Methodology</b>	<b>07</b>	
	Introduction, Steps of Ethical Hacking: Planning, Reconnaissance, Scanning, Exploitation, post exploitation and result reporting. Ethical Hacking Tool: Metasploit <b>Self-learning Topics:</b> Hacking Methodology		CO1
II	<b>Introduction to Digital Forensics</b>	<b>07</b>	
	The Need for Digital Forensics, Types of Digital Forensics, Introduction to Incident Response Methodology, Incident handling steps, Ethics in Digital Forensics. <b>Self-learning Topics:</b> Incident Response Methodology etc		CO2
III	<b>Data Collection</b>	<b>11</b>	
	Live Data Collection from Windows and Unix Systems, Tools for Forensic Duplication, Collecting Network-based Evidence, Evidence Handling - Chain of Custody. Data Collection Forensic Tools : Forensics Toolkit/ WinHex <b>Self-learning Topics:</b> Case Study on Company Data collection procedure		CO3
IV	<b>Data Analysis</b>	<b>10</b>	
	Data Analysis, Investigating Windows, Unix Systems, Analysing Network Traffic, Investigating Routers, Email forensics Data Analysis Tools : Nmap/Wireshark/Helix3pro <b>Self-learning Topics:</b> Case Study on Data Analysis		CO4
V	<b>Mobile Device Forensics</b>	<b>06</b>	
	Crime and mobile phones, evidences, forensic procedures, files present in SIM cards, device data, external memory dump, and evidences in memory card, operator's networks. <b>Self-learning Topics:</b> Case study on Mobile Data		CO5
VI	<b>Forensic Investigation Reporting</b>	<b>04</b>	
	Investigative Report Template, Layout of an Investigative Report, Guidelines for Writing a Report <b>Self-learning Topics:</b> Report Writing Techniques		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.



## **B. End Semester Theory Examination:**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## **Reference Books:**

1. Peter Stephenson, "Investigating Computer Crime: A Handbook for Corporate Investigations", Sept 1999.
2. Debra Littlejohn Shinder and Ed Tittel, "Scene of the Cybercrime: Computer Forensics Handbook", Syngress Publishing, Inc.
3. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition, 2001
4. Nina Godbole, "Information Systems Security", Wiley India, New Delhi
5. William Stallings, "Cryptography and Network Security", Pearson Publication

## **Text Books:**

1. Kevin Mandia, Chris Prosis, "Incident Response and computer forensics", Tata McGraw Hill, 2006.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing, Second Edition: Ethical Hacking and Penetration Testing Made Easy", 2nd Edition, Syngress.
3. Investigation Procedures and Response, EC-Council Press

<b>Course Title: Data Storage &amp; Retrieval</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSPEC2102</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination  
ESE: End Semester Examination

**Course Objectives:**

1. Understand need of storage network with its architecture, features, components, topology, benefits and limitations.
2. Study the impact of downtime in terms of losses and business continuity.
3. Understand the basic terminologies and components in information retrieval systems.
4. Compare and contrast Information Retrieval models.

**Course Outcomes:**

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

1. Evaluate storage architecture, ISS, SAN, NAS and IP SAN.
2. Design the storage infrastructure for business continuity.
3. Implement and evaluate various Information Retrieval Models.

<b>Module</b>	<b>Contents</b>	<b>Hours</b>	<b>COs</b>
<b>I</b>	<b>Introduction to Data Storage</b>	<b>05</b>	
	Need for storage network, Evolution of storage technology and architecture, Key Challenges in managing information, Information lifecycle, Disk drive performance, Fundamental laws governing disk performance. <b>Self-learning Topics:</b> Fundamental laws governing etc		CO1
<b>II</b>	<b>Storage System Environment</b>	<b>09</b>	
	<ul style="list-style-type: none"> <li>• Basic Software for Storage Networking: Software for SANs, Shared access data managers,</li> <li>• Volumes (RAID): Resilience, performance and flexibility, File systems and application performance.</li> <li>• Intelligent Storage System: Storage Virtualization: Form of Virtualization, storage virtualization configurations and challenges, Types of storage virtualization.</li> <li>• Content-Addressed Storage: Architecture, Object storage and Retrieval in CAS.</li> </ul>		CO2



	<b>Self-learning Topics:</b>		
III	<b>Storage Networking Technologies</b>	<b>10</b>	
	<ul style="list-style-type: none"> <li>Storage Area Networks: Fibre Channel, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies.</li> <li>Network-Attached Storage: General-Purpose Servers vs. NAS Devices, Benefits of NAS, NAS File I/O, Components of NAS, NAS Implementations, NAS File-Sharing Protocols, NAS I/O Operations, Factors Affecting NAS Performance and Availability. IP SAN: iSCSI, FCIP.</li> </ul>		CO3
IV	<b>Business Continuity and Enterprise backup</b>	<b>07</b>	
	<ul style="list-style-type: none"> <li>Introduction to Business Continuity: Information availability, BC planning lifecycle, Failure Analysis, Business impact analysis.</li> <li>Enterprise backup software for SAN: Backup management, Enterprise data protection, Backup architecture, Backup policies, Minimizing impact of backup, Lan-free and serverless backup.</li> </ul>		CO4
V	<b>Information Retrieval</b>	<b>07</b>	
	Introduction to Information Retrieval(IR), Objectives and Components of IR system, Taxonomy of IR models, Information Retrieval process, Documents and Query forms		CO5
VI	<b>Retrieval Models</b>	<b>07</b>	
	Query structure, The matching process, Text analysis		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Ulf Troppens, Wolfgang Muller-Friedt, Rainer Wolafka, "Storage Networks Explained" Wiley Publication
2. Spalding, Robert. Storage Networks: The Complete Reference. Tata McGraw-Hill Education, 2003
3. Manning, Christopher D., Prabhakar Raghavan, and Hinrich Schütze. Introduction to information retrieval. Vol. 1, no. 1. Cambridge: Cambridge university press, 2008.



# St. John College of Engineering and Management

**Autonomous Institute**

(A Christian Religious Minority Institution)

Approved by AICTE and DTE, Affiliated to University of Mumbai / MSBTE

DTE Code : 3218 AICTE Permanent ID : 1-4790201



**NAAC Accredited with Grade 'A+', Three Programs NBA Accredited**

## **Text Books:**

1. G. Somasundaram, Alok Shrivastava, “Information Storage and Management”, EMC Education services”, Wiley Publication, Edition 2009
2. Richard Barker, Paul Massiglia, “Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs”, Wiley India
3. Robert R. Korfhage, “Information Storage and Retrieval”, Wiley Publication



<b>Course Title: Advanced Soft Computing</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSPEC2103</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination  
ESE: End Semester Examination

**Course Objectives:**

1. To familiarize various soft computing techniques
2. To relate various soft computing techniques in practical scenario.
3. To understand hybrid approach for application development.

**Course Outcomes:**

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

1. To demonstrate various soft computing techniques.
2. To apply and analyze different soft computing techniques for solving practical applications.
3. To design an intelligent system for social and technical problems.

Module	Contents	Hours	COs
I	<b>Introduction</b>	<b>03</b>	
	Differentiate Hard and Soft Computing, Soft Computing Constituents, Neuro Fuzzy and Soft Computing Characteristics <b>Self-learning Topics:</b> Soft Computing Constituents		CO1
II	<b>Fuzzy Logic &amp; Rough Set Theory</b>	<b>10</b>	
	Fuzzy Relations and Fuzzy Rules, Generalized Modens Ponens, Defuzzification and its Types Fuzzy Inference Systems, Design of Fuzzy Controller, Introduction to Rough Sets <b>Self-learning Topics:</b> Types Fuzzy Inference Systems		CO2
III	<b>Supervised Network</b>	<b>09</b>	
	Error Back Propagation Training Algorithm, Radial Basis Function <b>Self-learning Topics:</b> Radial Basis Function etc		CO3
IV	<b>Unsupervised Network</b>	<b>10</b>	
	Kohonen Self Organizing Maps, Basic Learning Vector Quantization, Basic Adaptive Resonance Theory <b>Self-learning Topics:</b> Vector Quantization etc.		CO4
V	<b>Hybrid Systems and Introduction to Deep Learning</b>	<b>08</b>	
	Fuzzy-Neural Systems, Neuro-Genetic Systems Fuzzy-Genetic Systems, Deep Learning: Definition & background, historical context of deep learning, Three classes of deep learning network. <b>Self-learning Topics:</b> Three classes of deep learning network etc		CO5
VI	<b>Applications and Case Study</b>	<b>05</b>	
	Automobile Fuel Efficiency using ANFIS Color Receipe prediction using CANFIS <b>Self-learning Topics:</b> In detail CANFIS		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.



## Reference Books:

1. Fakhreddine O. Karry, Clarence De Silva, "Soft Computing and Intelligent systems Design Theory, Tools and Applications" Pearson 2009.
2. Li Deng and Dong Yu 'Deep Learning Methods and Applications'.

## Text Books:

1. J.S.R.Jang "Neuro-Fuzzy and Soft Computing" PHI 2003.
2. S. Rajasekaran and G.A. Vijaylakshmi Pai. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.
3. Satish Kumar "Neural Networks A Classroom Approach" Tata McGrawHill.
4. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.
5. Samir Roy, Udit Chakraborty "Introduction to Soft Computing" Pearson Education India.
6. Jacek.M.Zurada "Introduction to Artificial Neural Sytems" Jaico Publishing House.
7. Timothy J.Ross "Fuzzy Logic With Engineering Applications" Wiley.



<b>Course Title: Semantic Web &amp; Social Network Analysis</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSPEC2104</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination  
ESE: End Semester Examination

**Course Objectives:**

1. To understand the basics of Semantic Web Technologies
2. To Learn knowledge representation for Semantic Web
3. To understand the importance of Social Network Analysis
4. To understand and use semantic web technologies for social network analysis

**Course Outcomes:**

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

1. Understand the Semantic Web and Social Networks
2. Understand Electronic sources for network analysis and different ontology languages.
3. Model and aggregate social network data.
4. Design and Analyze social network using semantic web technologies.



Module	Contents	Hours	COs
I	<b>Introduction Semantic Web and Social Networks:</b>	<b>05</b>	
	The Semantic Web- Limitations of the current Web, The semantic Web Technologies, A Layered Approach, The emergence of the social web. Social Network Analysis- What is network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis <b>Self-learning Topics:</b> Key concepts and measures in network analysis etc		CO1
II	<b>Semantics and Knowledge Representation on the Semantic Web</b>	<b>09</b>	
	Electronic sources for network analysis- Electronic discussion networks, Blogs and online communities Structured Web Documents-XML, Describing web Resources-RDF, RDF Schema, Querying Knowledge Representation on the Semantic Web-SPARQL <b>Self-learning Topics:</b> Resources-RDF etc		CO2
III	<b>Modeling and aggregating social network data:</b>	<b>10</b>	
	Ontologies and their role in the Semantic Web, Ontology languages for the Semantic Web-RDFS, OWL. State-of-the- art in network data representation, Ontology Engineering, Semantic Web Knowledge Management Architecture, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data		CO3
IV	<b>Developing social- semantic applications</b>	<b>07</b>	
	Building Semantic Web applications with social network features, Flink: the social networks of the Semantic Web community, open academia: distributed, semantic-based publication management		CO4
V	<b>Extracting and Mining Communities in social network and social network analysis-</b>	<b>07</b>	
	Extracting evolution of Web Community from series of web archive – Detecting communities in social Networks- Definition of community – Evaluating communities – methods for community detection and mining –Semantic based social network analysis.		CO5
VI	<b>Applications of community mining algorithms , Visualization-</b>	<b>07</b>	
	Applications of community mining algorithms-Influence and Homophily, Recommendation, Behavior Analytics, Visualization- Graph theory Centrality – Clustering- Node Edge Diagrams –Matrix Representation –,Benefits of semantic social networks for communities		CO6
	<b>Total</b>	<b>45</b>	



## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking Techniques and applications”, First Edition Springer, 2011.
2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Retrieval and Access: Techniques for Improved user Modelling”, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.
5. Charu C. Aggarwal, “Social Network Data Analytics”, Springer; 2011.
6. Borko Furht, “Handbook of Social Network Technologies and Applications”, 1<sup>st</sup> Edition, Springer, 2010.
7. Toby Segaran,colin Evans and Jamie Taylor “Programming Semantic Web”, O’Reilly.
8. Berners Lee, Godel and Turing “Thinking on the Web “,Wiley inter science, 2008.
9. Vladimir Geroimenko, Chaomei Chen “Visualizing the Semantic Web”, Springer 2006.

## Text Books:

1. Grigoris Antoniou and Frank van Harmelen “Semantic Web Primer”second edition
2. Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.
3. Reza Zafarani,Mohammad Ali Abbasi,Huan Liu “Social Media Mining: Introduction”,Cambridge University press.



<b>Course Title: Blockchain Technology and Applications</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSPEC2201</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination  
ESE: End Semester Examination

**Course Objectives:**

1. To get acquainted with the concept of Distributed ledger system and Blockchain.
2. To learn the concepts of consensus and mining in Blockchain through the Bitcoin network.
3. To understand Ethereum and develop-deploy smart contracts using different tools and frameworks.
4. To understand permissioned Blockchain and explore Hyperledger Fabric.
5. To understand different types of crypto assets.
6. To apply Blockchain for different domains IOT, AI and Cyber Security.

**Course Outcomes:**

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

1. Describe the basic concept of Blockchain and Distributed Ledger Technology.
2. Interpret the knowledge of the Bitcoin network, nodes, keys, wallets and transactions.
3. Implement smart contracts in Ethereum using different development frameworks.
4. Develop applications in permissioned Hyperledger Fabric network.
5. Interpret different Crypto assets and Crypto currencies
6. Analyze the use of Blockchain with AI, IoT and Cyber Security using case studies.

Module	Contents	Hours	COs
I	<b>Introduction to DLT and Blockchain</b>	<b>06</b>	
	<p>Fundamental concepts of Distributed systems, Distributed Ledger Technologies (DLTs) Introduction, Types of Blockchains            Blockchain: Origin, Phases, Components            Block in a Blockchain: Structure of a Block, Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the Blockchain, Merkle Tree.  <b>Self-learning Topics:</b> Linking Blocks in the Blockchain, Merkle Tree etc.</p>		CO1
II	<b>Consensus and Mining</b>	<b>09</b>	
	<p>What is Bitcoin and the history of Bitcoin, Bitcoin Transactions, Bitcoin Concepts: keys, addresses and wallets, Bitcoin Transactions, validation of transactions, PoW consensus            Bitcoin Network: Peer-to-Peer Network Architecture, Node Types and Roles, Incentive based Engineering, The Extended Bitcoin Network, Bitcoin Relay Networks, Network Discovery, Full Nodes, Exchanging “Inventory”, Simplified Payment Verification (SPV) Nodes, SPV Nodes and Privacy, Transaction Pools, Blockchain Forks  <b>Self-learning Topics:</b> Peer-to-Peer Network Architecture etc.</p>		CO2
III	<b>Permissionless Blockchain: Ethereum</b>	<b>10</b>	
	<p>Components, Architecture of Ethereum, Miner and mining node, Ethereum virtual machine, Ether, Gas, Transactions, Accounts, Patricia Merkle Tree, Swarm, Whisper and IPFS, Ethash, End to end transaction in Ethereum            Smart Contracts: Smart Contract programming using solidity, Metamask (Ethereum Wallet), Setting up development environment, Use cases of Smart Contract, Smart Contracts: Opportunities and Risk.            Smart Contract Deployment: Introduction to Truffle, Use of Remix and test networks for deployment            Other Permissionless Blockchain platforms Introduction: IOTA, Hashgraph, EOS, etc.  <b>Self-learning Topics:</b> Opportunities and Risk etc</p>		CO3
IV	<b>Permissioned Blockchain : Hyperledger Fabric</b>	<b>08</b>	
	<p>Introduction to Framework, Tools and Architecture of Hyperledger Fabric <u>Blockchain</u>            Components: Certificate Authority, Nodes, Chain codes, Channels, Consensus: Solo, Kafka, RAFT Designing Hyperledger Blockchain            Other Permissioned Blockchain platforms Introduction: CORDA, Quoram, etc.  <b>Self-learning Topics:</b> Certificate Authority etc</p>		CO4
V	<b>Crypto assets and Cryptocurrencies</b>	<b>06</b>	

	Fungible and Non fungible tokens, ERC20 and ERC721 standards, comparison between ERC20 & ERC721, ICO, STO, Different Crypto currencies <b>Self-learning Topics:</b> ERC20 & ERC721 etc		CO5
VI	<b>Blockchain Applications &amp; Research Areas</b>	<b>06</b>	
	Blockchain in IoT, AI, Cyber Security Research Areas: Interoperability, Privacy, Performance, Oracles, Security of smart contracts and platforms  <b>Self-learning Topics:</b> Blockchain in IoT etc.		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Mastering Blockchain, Imran Bashir, Packt Publishing
2. Mastering Bitcoin Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media
3. Blockchain Technology: Concepts and Applications, Kumar Saurabh and Ashutosh Saxena, Wiley.
3. The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, Antony Lewis.for Ethereum and Blockchain, Ritesh Modi, Packt publication.
4. Mastering Bitcoin Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media

## Text Books:

1. "Mastering Bitcoin, PROGRAMMING THE OPEN BLOCKCHAIN", 2nd Edition by Andreas M. Antonopoulos, June 2017, Publisher(s): O'Reilly Media, Inc. ISBN: 9781491954386.
2. Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly.
3. Blockchain Technology, Chandramouli Subramanian, Asha A George, Abhillash K. A and Meena Karthikeyan, Universities press.
4. Hyperledger Fabric In-Depth: Learn, Build and Deploy Blockchain Applications Using Hyperledger Fabric, Ashwani Kumar, BPB publications
5. Solidity Programming Essentials: A beginner's Guide to Build Smart Contracts for Ethereum and Blockchain, Ritesh Modi, Packt publication
6. Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond, Chris Burniske & Jack Tatar



<b>Course Title: Storage Area Network</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSPEC2202</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination  ESE: End Semester Examination</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. Understand and analyze the basics of storage network, storage technologies and various storage architectures.</li> <li>2. Define and understand virtualization with respect to storage network</li> <li>3. Understand SAN Management and its various aspects.</li> <li>4. Describe disaster recovery for storage network and understand strategies, parameters and Quality of Service for Business Continuity in storage infrastructure.</li> <li>5. Understand and analyze security aspects for storage area network.</li> <li>6. Be aware of the applications and Recent Developments in Ad Hoc Networks</li> </ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> <li>1. Explain storage technologies and storage architectures.</li> <li>2. Describe and apply virtualization in storage network.</li> <li>3. Apply SAN Management with its various parameters.</li> <li>4. Understand and apply disaster recovery and Business Continuity in storage network.</li> <li>5. Understand and apply storage security and its importance.</li> </ol>												

Module	Contents	Hours	COs
I	<b>Need for Storage Network</b>	<b>10</b>	
	Basics of Storage Network: - Intelligent Storage Systems (ISS), Data protection (RAID implementation methods). RAID arrays, RAID technologies, RAID levels, RAID impact on disk performance & RAID comparison, SCSI, SAN: FC SAN FC Protocol Stack, IP Storage, Infiniband, Virtual Interfaces, Comparison of NAS, FC SAN and iSCSI SAN. <b>Self-learning Topics:</b> RAID etc		CO1
II	<b>Storage Virtualization</b>	<b>07</b>	
	Definition, Storage virtualization on block and file level, Storage virtualization on various levels of Storage network, Symmetric and Asymmetric Virtualization. Basics of Software Defined Storage and its types <b>Self-learning Topics:</b> Basics of Software Defined Storage etc.		CO2
III	<b>Managing SAN</b>	<b>06</b>	
	Storage Management tasks, What Gets Managed in SAN? Zoning, Virtualization: Allocating Capacity rather than Disk, SAN Management and Quality of online storage device: Storage capacity, Data availability and I/O performance, SAN Management and Asset Utilization <b>Self-learning Topics:</b> Quality of online storage device etc.		CO3
IV	<b>Business Continuity</b>	<b>08</b>	
	<ul style="list-style-type: none"> <li>• <b>Strategies of Business Continuity:</b> High availability, Disaster Recovery, Continuous business operation</li> <li>• <b>Parameters of Business Continuity:</b> Availability, characteristics of Availability (MTBF, MTTR and MTTF), characteristics of failure (RTO and RPO), Network Recovery Objective (NRO)</li> <li>• <b>Quality of Service for Business Continuity:</b> Service level Agreements (SLAs), High availability versus disaster recovery, The Seven-Tier Model, Tier 0 to Tier 7</li> </ul> <b>Self-learning Topics:</b> Service level Agreements		CO4
V	<b>Storage Security</b>	<b>08</b>	
	<ul style="list-style-type: none"> <li>• <b>Overview of Storage Security:</b> Define storage security, Storage security framework: Security attributes (Confidentiality, Integrity, Availability, Accountability)</li> <li>• <b>Security Elements:</b> Assets (Information, Hardware, Software, Network Infrastructure), Threats, Vulnerabilities</li> </ul>		CO5

	<ul style="list-style-type: none"> <li>• <b>Security Controls:</b> Technical (implemented in hardware, software and firmware), Non-Technical: Administrative (Policies, Standards),</li> <li>• FC SAN security, Basic SAN Security Mechanisms, Securing Switch Ports</li> </ul> <p><b>Self-learning Topics:</b> SAN Security Mechanisms etc.</p>		
VI	<b>Designing Storage Area Network</b>	<b>06</b>	
	A case study to design a storage area network for an organization considering the following guidelines: SAN Implementation, SAN Management, SAN Virtualization, SAN Disaster Recovery and Security <b>Self-learning Topics:</b> SAN Implementation etc.		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Vaishali D. Khairnar and Nilima M. Dongre, "Storage Network Management and Retrieval", Wiley
2. Robert Spalding, "Storage Networks: The Complete Reference", McGraw Hill Education
3. W. Curtis Preston, "Using SANs and NAS", O'Reilly

## Text Books:

1. Ulf Troppens, Rainer Erkens, Wolfgang Muller-Friedt, Rainer Wolafka, Nils Haustein, "Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, Infiniband and FCoE", Second Edition, Wiley
2. Richard Barker and Paul Massiglia, "Storage Area Network Essentials A Complete Guide to Understanding and Implementing SANs", Wiley.
3. EMC Education Services, "Information Storage and Management," Second Edition, Wiley
4. Martin Hosken, "VMware Software-Defined Storage: A Design Guide to the Policy-Driven, Software- Defined Storage Era"



<b>Course Title: Design Thinking</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSPEC2203</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

### Course Objectives:

1. To stress the importance of good design.
2. To recognize the latest and future issues and challenges in innovation.
3. To expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and innovation using design thinking principles.
4. To develop an advanced innovation and growth mindset form of problem identification and reframing, and insight generation.
5. To provide a social and thinking space for the recognition of innovation challenges and the design of creative solutions.
6. To propose a concrete, feasible, viable and relevant innovation project/challenge with Implementation

### Course Outcomes:

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

1. Understand good features of designs.
2. Understand importance of innovation in day to day life
3. Illustrate and analyze user needs and formulate design and innovation using design thinking principles.
4. Interpret and evaluate the data collected during the process of problem identification and reframing, and insight generation.
5. Evaluate designs based on theoretical frameworks and methodological approaches.
6. Design innovative applications that are usable, effective and efficient for intended users

Module	Contents	Hours	COs
I	<b>Introduction to design</b>	<b>06</b>	
	Good and Poor Design, What is Interaction Design, The User Experience, The Process Of Interaction Design, Interaction Design and the User Experience, Necessity of UI/UX, <b>Self-learning Topics:</b> In detail about UI/UX etc.		CO1
II	<b>Design Thinking Background</b>	<b>06</b>	
	Definition of design thinking, business uses of design thinking, variety of approaches within the design thinking discipline, design thinking mindset <b>Self-learning Topics:</b> Design thinking discipline etc		CO2
III	<b>Design Thinking Approach</b>	<b>09</b>	
	Fundamental Concepts: Empathy, ethnography, divergent thinking convergent thinking, visual thinking, assumption testing, prototyping, and validation within design Thinking, Design Thinking Resources Human resource, preferred space prepared, materials commonly used, dynamic between design thinking teams and the organization Design Thinking Processes, Design thinking approaches, Double Diamond approach, d.School 5-Stage approach, Growth approach, role of project management within design thinking <b>Self-learning Topics:</b> Design Thinking Resources etc.		CO3
IV	<b>Design Thinking in Practice</b>	<b>08</b>	
	<ul style="list-style-type: none"> <li>Process Stages of Designing for Growth</li> <li>Design Thinking Tools and Methods need to use tools and methods, visualization, journey mapping, value chain analysis, mind mapping, brainstorming, concept development assumption testing, rapid prototyping customer co-creation, learning launch.</li> </ul> <b>Self-learning Topics:</b> Brainstorming etc		CO4
V	<b>UX Evaluation, The Interaction Cycle and the Use Action Framework</b>	<b>08</b>	
	UX Goals, Metrics and Targets, UX Evaluation Techniques.- Formative vs summative ,Analysis, The interaction cycle, The user action framework adding a structured knowledge base to the interaction cycle, Interaction cycle and user action framework content categories, Role of affordances within the UAF, Practical value of the UAF. <b>Self-learning Topics:</b> UX Evaluation etc		CO5
VI	<b>Design Thinking Application</b>	<b>08</b>	
	This section explores practical case study related to product development in a design thinking effort. Any domain is preferable. <b>Self-learning Topics:</b> Design thinking effort		CO6



		<b>Total</b>	<b>45</b>	
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## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Karmic Design Thinking by Prof. Bala Ramadurai, available at Amazon (paperback), Amazon(e- book), Flipkart, Pothe, halfpricebooks.in.
2. Design: Creation of Artifacts in Society by Prof. Karl Ulrich, U. Penn
3. Change by Design by Tim Brown.
4. The UX Book, by Rex Hartson and Pardha S Pyla
5. Donald A. Norman, "The design of everyday things", Basic books.
6. Jeff Johnson, "Designing with the mind in mind", Morgan Kaufmann Publication.

## Text Books:

1. "Designing for growth: A design thinking tool kit for managers", by Jeanne Liedtka and Tim Ogilvie., 2011, ISBN 978-0-231-15838-1
2. "The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems", by Michael Lewrick, Patrick Link, Larry Leifer., 2018, ISBN 978-1- 119-46747-2
3. "Presumptive design: Design provocations for innovation", by Leo Frishberg and Charles Lambdin., 2016, ISBN: 978-0-12-803086-8
4. "Systems thinking: Managing chaos and complexity: A platform for designing business architecture.", "Chapter Seven: Design Thinking", by Jamshid Gharajedaghi, 2011, ISBN 978-0- 12-385915-0
5. Interaction Design, by J. Preece, Y. Rogers and H. Sharp. ISBN 0-471-49278-7.
6. Human Computer Interaction, by Alan Dix, Janet Finlay, Gregory D Abowd, Russell Beale

## Useful Links:

1. <https://nptel.ac.in/courses/110106124>
2. [https://onlinecourses.nptel.ac.in/noc22\\_mg32/preview](https://onlinecourses.nptel.ac.in/noc22_mg32/preview)
3. [https://onlinecourses.nptel.ac.in/noc21\\_ar05/preview](https://onlinecourses.nptel.ac.in/noc21_ar05/preview)
4. <https://nptel.ac.in/courses/124/107/124107008/>
5. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ar10/>
6. <https://nptel.ac.in/courses/107/103/107103083/>
7. <https://www.youtube.com/watch?v=6C2Ye1makdY&list=PLW-zSkCnZ-gD5TDfs1eL5EnH2mQ0f9g6B>
8. <https://xd.adobe.com/ideas/process/>



## Course Title: Metaverse

**Semester: II**

**Term: EVEN**

**Course Code: 25MECSPEC2204**

### Teaching Scheme

### Evaluation Scheme

**Contact Hrs.**

**Credit Allotted**

**Total Credit**

**IAE 1**

**IAE 2**

**ESE**

**CA/TW**

**Oral/Pract/  
Tut.**

**Total**

**Th**

**Tu**

**Pr**

**Th**

**Tu**

**Pr**

3

-

-

3

-

-

3

20

20

60

-

-

100

IAE: Internal Assessment Examination

ESE: End Semester Examination

### Course Objectives:

1. To study the concepts of Metaverse.
2. To study Metaverse and Web 3.0, Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), NFT in Blockchain.
3. To study the Metaverse technologies and protocols.
4. To study and identify the required infrastructure for Metaverse.
5. To study various case studies of Metaverse.
6. To study of Metaverse Immersive technology and Interfaces.

### Course Outcomes:

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

1. Understand the concepts of Metaverse.
2. Understand and study Metaverse and Web 3.0, Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), NFT in Blockchain.
3. Understand the Metaverse technologies and protocols.
4. Identify the required infrastructure for Metaverse.
5. Understand different case studies of Metaverse.
6. Understand Metaverse Immersive technology and Interfaces

Module	Contents	Hours	COs
I	<b>Introduction</b>	<b>06</b>	
	What is the Metaverse? Evaluation of Technology: Web, AR VR, 3D spaces, Immersive learning , Blockchain , Decentralised commerce <b>Self-learning Topics:</b> Blockchain etc.		CO1
II	<b>Fundamental Concepts of AR, VR, MR and Blockchain</b>	<b>09</b>	
	Building block technology of metaverse , How Gaming + Web 3.0 + Blockchain are Changing the Internet: Future of Internet: How Metaverse is different from Internet, Potential of Metaverse characteristics that characterise metaverse The Different Shapes of the Metaverse: Games, NFTs (assets), Blockchain Protocols, Cryptocurrencies, etc <b>Self-learning Topics:</b> The Different Shapes		CO2
III	<b>Metaverse Technologies and Protocols</b>	<b>07</b>	
	Metaverse technologies, principles, affordances and challenges Blockchain Protocols and Platforms Involved in the Metaverse Metaverse-Related Tokens Blockchain NFT need for metaverse: working principle of blockchain, NFT based virtual assets in metaverse, case study How NFTs are Unlocking the Metaverse Potential working of ERC721 NFT <b>Self-learning Topics:</b> Blockchain NFT		CO3
IV	<b>Metaverse Infrastructure</b>	<b>07</b>	
	Access the metaverse, necessary hardware Understanding Decentraland , native token MANA, creating own Avatar. Using metamask to access Decentraland, owning land to have direct access of metaverse. <b>Self-learning Topics:</b> creating own Avatar		CO4
V	<b>Case studies of Metaverse</b>	<b>08</b>	
	Various usecase of metaverse Industries Disrupted by the Metaverse: Fashion, Marketing, Brands, Finance, Gaming, Architecture, Virtual Shows/Concerts, Art Galleries and Museums Virtual Business and market, Investing In the Metaverse and Profit Asset Classes Inside the Metaverse Metaverse Land Ownership - Property Investment <b>Self-learning Topics:</b> Art Galleries and Museums Virtual Business		CO4
VI	<b>Metaverse Immersive technology and Interfaces</b>	<b>08</b>	
	3d Reconstruction, AI technology to analyses 3D Scan Virtual Reality (VR) and Augmented Reality (AR), Mixed Reality (MR) and Extended Reality (XR), Metaverse vs VR what is difference, IoT to bridge gap between physical world and internet Metaverse Interfaces: Personal Computer, Mobile Phone, AR Glasses, VR Goggles, Neuralink <b>Self-learning Topics:</b> Metaverse Interfaces etc		CO5



		<b>Total</b>	<b>45</b>	
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## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Mystakidis, Stylianos, "Metaverse", Journal=Encyclopedia,2022, <https://www.mdpi.com/2673-8392/2/1/31>
2. All One Needs to Know about Metaverse: A Complete Survey on Technological Singularity, Virtual Ecosystem, and Research Agenda, Technical Report · October 2021



<b>Course Title: Project Management</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>				<b>Course Code: 25MECSOE201</b>					
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>					
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination  
ESE: End Semester Examination

**Course Objectives:**

1. To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

**Course Outcomes:**

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

1. Apply selection criteria and select an appropriate project from different options.
2. Write work break down structure for a project and develop a schedule based on it.
3. Identify opportunities and threats to the project and decide an approach to deal with them strategically.
4. Use Earned value technique and determine & predict status of the project.
5. Capture lessons learned during project phases and document them for future reference

Module	Contents	Hours	COs
I	<b>Project Management Foundation</b>	<b>06</b>	
	Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI) <b>Self-learning Topics:</b> stage gate process		CO1
II	<b>Initiating Projects</b>	<b>07</b>	
	How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics. <b>Self-learning Topics:</b> Non-numeric models		CO2
III	<b>Project Planning and Scheduling</b>	<b>09</b>	
	Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart, Introduction to Project Management Information System (PMIS). <b>Self-learning Topics:</b> PERT		CO3
IV	<b>Planning Projects</b>	<b>07</b>	
	Crashing project time, Resource loading and levelling, Goldratt's critical chain, Project Stakeholders and Communication plan Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks <b>Self-learning Topics:</b> Probability and impact matrix		CO4
V	<b>Executing Projects</b>	<b>09</b>	
	Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, Team management, communication and project meetings Monitoring and Controlling Projects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep, Project audit Project Contracting Project procurement management, contracting and outsourcing, <b>Self-learning Topics:</b> Using milestones for measurement		CO5



VI	<b>Project Leadership and Ethics</b>	<b>07</b>	
	Introduction to project leadership, ethics in projects, Multicultural and virtual projects Closing the Project: Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study <b>Self-learning Topics:</b> Process of project termination		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 7<sup>th</sup> Edition, Wiley India
2. A Guide to the Project Management Body of Knowledge (PMBOK<sup>®</sup> Guide), 5<sup>th</sup> Ed, Project Management Institute PA, USA
3. Project Management, Gido Clements, Cengage Learning
4. Project Management, Gopalan, Wiley India
5. Project Management, Dennis Lock, 9<sup>th</sup> Edition, Gower Publishing England



<b>Course Title: Finance Management</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSOE202</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
IAE: Internal Assessment Examination ESE: End Semester Examination												
<b>Course Objectives:</b>												
<ol style="list-style-type: none"><li>1. Overview of Indian financial system, instruments and market</li><li>2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management</li><li>3. Knowledge about sources of finance, capital structure, dividend policy</li></ol>												
<b>Course Outcomes:</b>												
At the end of the course students will be able to:												
<ol style="list-style-type: none"><li>1. Understand Indian finance system and corporate finance</li><li>2. Take investment, finance as well as dividend decisions</li></ol>												

Module	Contents	Hours	COs
I	<b>Overview of Indian Financial System</b>	<b>07</b>	
	<p>Characteristics, Components and Functions of Financial System.</p> <p>Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills.</p> <p>Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market</p> <p>Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges</p> <p><b>Self-learning Topics:</b> Characteristics and Classification</p>		CO1
II	<b>Concepts of Returns and Risks</b>	<b>07</b>	
	<p>Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.</p> <p>Time Value of Money: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.</p> <p><b>Self-learning Topics:</b> Ordinary Annuity</p>		CO2
III	<b>Overview of Corporate Finance</b>	<b>10</b>	
	<p>Objectives of Corporate Finance; Functions of Corporate Finance— Investment Decision, Financing Decision, and Dividend Decision.</p> <p>Financial Ratio Analysis: Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.</p> <p><b>Self-learning Topics:</b> Cash Flow Statement</p>		CO3
IV	<b>Capital Budgeting</b>	<b>10</b>	
	<p>Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)</p> <p>Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables;</p>		CO4

	and Management of Cash and Marketable Securities. <b>Self-learning Topics:</b> Estimation of Working Capital Requirements		
V	<b>Sources of Finance</b> Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance Capital Structure: Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure <b>Self-learning Topics:</b> Net Operating Income Approach	<b>06</b>	CO5
VI	<b>Dividend Policy</b> Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches—Gordon's Approach, Walter's Approach, and Modigliani- Miller Approach <b>Self-learning Topics:</b> Gordon's Approach in detail	<b>05</b>	CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Fundamentals of Financial Management, 13<sup>th</sup> Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10<sup>th</sup> Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3. Indian Financial System, 9<sup>th</sup> Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11<sup>th</sup> Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.



## Course Title: Entrepreneurship Development and Management

Semester: II

Term: EVEN

Course Code: 25MECSOE203

Teaching Scheme

Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA/TW	Oral/Pract/Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

### Course Objectives:

1. To acquaint with entrepreneurship and management of business
2. Understand Indian environment for entrepreneurship
3. Idea of EDP, MSME

### Course Outcomes:

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

1. Understand the concept of business plan and ownerships
2. Interpret key regulations and legal aspects of entrepreneurship in India
3. Understand government policies for entrepreneurs

Module	Contents	Hours	COs
I	<b>Overview Of Entrepreneurship</b>	<b>05</b>	
	Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship <b>Self-learning Topics:</b> Capital Markets in Entrepreneurial Development		CO1
II	<b>Business Plans And Importance Of Capital To Entrepreneurship</b>	<b>10</b>	
	Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur. Entrepreneurship And Business Development: Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations <b>Self-learning Topics:</b> Entrepreneurship And Business Development		CO2
III	<b>Women's Entrepreneurship Development</b>	<b>06</b>	
	Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises <b>Self-learning Topics:</b> Women's Entrepreneurship Development		CO3
IV	<b>Indian Environment for Entrepreneurship</b>	<b>09</b>	
	key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc <b>Self-learning Topics:</b> Role of State governments in terms of infrastructure developments		CO4
V	<b>Effective Management of Business</b>	<b>09</b>	
	Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing <b>Self-learning Topics:</b> technology innovation etc		CO5
VI	<b>Achieving Success In The Small Business</b>	<b>6</b>	
	Stages of the small business life cycle, four types of firm-level growth		CO6



	strategies, Options – harvesting or closing small business Critical Success factors of small business <b>Self-learning Topics:</b> The small Business case study		
		<b>Total</b>	<b>45</b>

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHill Company
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIM Ahmedabad
8. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann Publication Ltd.
9. Kurakto, Entrepreneurship- Principles and Practices, Thomson Publication
10. Laghu Udyog Samachar

<b>Course Title: Human Resource Management</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSOE204</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination            ESE: End Semester Examination</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To introduce the students with basic concepts, techniques and practices of the human resource management</li> <li>2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations</li> <li>3. To familiarize the students about the latest developments, trends &amp; different aspects of HRM</li> <li>4. To acquaint the student with the importance of inter-personal &amp; inter-group behavioural skills in an organizational setting required for future stable engineers, leaders and managers</li> </ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the concepts, aspects, techniques and practices of the human resource management.</li> <li>2. Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective.</li> <li>3. Gain knowledge about the latest developments and trends in HRM.</li> <li>4. Apply the knowledge of behavioural skills learnt and integrate it with in inter personal and intergroup environment emerging as future stable engineers and managers.</li> </ol>												

Module	Contents	Hours	COs
I	<b>Introduction to HR</b>	<b>06</b>	
	<ul style="list-style-type: none"> <li>Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions</li> <li>Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues</li> </ul> <p><b>Self-learning Topics:</b> Human resource planning in detail</p>		CO1
II	<b>Organizational Behaviour (OB)</b>	<b>08</b>	
	<ul style="list-style-type: none"> <li>Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues</li> <li>Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness</li> <li>Perception: Attitude and Value, Effect of perception on Individual Decision- making, Attitude and Behaviour</li> <li>Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor);</li> <li>Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team.</li> <li>Case study</li> </ul> <p><b>Self-learning Topics:</b> Theories of Motivation</p>		CO2
III	<b>Organizational Structure &amp; Design</b>	<b>07</b>	
	<ul style="list-style-type: none"> <li>Structure, size, technology, Environment of organization; Organizational Roles &amp; conflicts: Concept of roles; role dynamics; role conflicts and stress.</li> <li>Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership.</li> <li>Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.</li> </ul> <p><b>Self-learning Topics:</b> Politics at workplace etc</p>		CO3
IV	<b>Human resource Planning</b>	<b>06</b>	
	<ul style="list-style-type: none"> <li>Recruitment and Selection process, Job-enrichment, Empowerment - Job- Satisfaction, employee morale</li> <li>Performance Appraisal Systems: Traditional &amp; modern methods, Performance Counselling, Career Planning Training &amp; Development: Identification of Training Needs, Training Methods</li> </ul> <p><b>Self-learning Topics:</b> Traditional &amp; modern methods</p>		CO4

V	<b>Emerging Trends in HR</b>	<b>08</b>	
	<ul style="list-style-type: none"> <li>Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes &amp; transformation in HR. Organizational Change, Culture, Environment</li> <li>Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation</li> </ul> <p><b>Self-learning Topics:</b> Business process case study</p>		CO5
VI	<b>HR &amp; MIS</b>	<b>10</b>	
	<p>Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&amp;D, Public Transport, Hospitals, Hotels and service industries)</p> <ul style="list-style-type: none"> <li>Strategic HRM: Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals</li> <li>Labor Laws &amp; Industrial Relations: Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act</li> </ul> <p><b>Self-learning Topics:</b> HRM case study</p>		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

- Stephen Robbins, Organizational Behavior, 16<sup>th</sup> Ed, 2013
- V S P Rao, Human Resource Management, 3<sup>rd</sup> Ed, 2010, Excel publishing
- Aswathapa, Human resource management: Text & cases, 6<sup>th</sup> edition, 2011
- C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15<sup>th</sup> Ed, 2015, Himalaya Publishing, 15<sup>th</sup> edition, 2015
- P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5<sup>th</sup> Ed, 2013, Himalaya Publishing
- Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications



<b>Course Title: Professional Ethics and Corporate Social Responsibility (CSR)</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSOE205</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination ESE: End Semester Examination</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>1. To understand professional ethics in business</li><li>2. To recognized corporate social responsibility</li></ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"><li>1. Understand rights and duties of business</li><li>2. Distinguish different aspects of corporate social responsibility</li><li>3. Demonstrate professional ethics</li><li>4. Understand legal aspects of corporate social responsibility</li></ol>												

Module	Contents	Hours	COs
I	<b>Professional Ethics and Business</b>	<b>05</b>	
	The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business <b>Self-learning Topics:</b> Duties in Business in detail		CO1
II	<b>Professional Ethics in the Marketplace</b>	<b>09</b>	
	Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy Professional Ethics and the Environment: Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources <b>Self-learning Topics:</b> Public policy		CO2
III	<b>Professional Ethics of Consumer Protection</b>	<b>07</b>	
	Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy Professional Ethics of Job Discrimination: Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs. <b>Self-learning Topics:</b> Reservation of job in detail		CO3
IV	<b>Introduction to Corporate Social Responsibility</b>	<b>06</b>	
	Potential Business Benefits— Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India <b>Self-learning Topics:</b> Detail on social responsibility		CO4
V	<b>Corporate Social Responsibility</b>	<b>09</b>	
	Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India <b>Self-learning Topics:</b> case study on PPP		CO5
VI	<b>Corporate Social Responsibility in Globalizing India</b>	<b>09</b>	
	Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility— Companies Act, 2013. <b>Self-learning Topics:</b> Case study on Corporate Social Responsibility		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:



## **A. Internal Assessment Examination:**

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

## **B. End Semester Theory Examination:**

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## **Reference Books:**

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.
3. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Publisher: Pearson, New Delhi.
4. Corporate Social Responsibility in India (2015) by Bidyut Chakrabarty, Routledge, New Delhi.



<b>Course Title: Research Methodology</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSOE206</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination  
ESE: End Semester Examination

**Course Objectives:**

1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation

**Course Outcomes:**

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

1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings

Module	Contents	Hours	COs
I	<b>Introduction and Basic Research Concepts</b>	<b>09</b>	
	<ul style="list-style-type: none"> <li>• Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology</li> <li>• Need of Research in Business and Social Sciences</li> <li>• Objectives of Research</li> <li>• <b>Issues</b> and Problems in Research</li> <li>• Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical</li> </ul> <p><b>Self-learning Topics:</b> Concept behind Research</p>		CO1
II	<b>Types of Research</b>	<b>08</b>	
	<ul style="list-style-type: none"> <li>• Basic Research</li> <li>• Applied Research</li> <li>• Descriptive Research</li> <li>• Analytical Research</li> <li>• Empirical Research</li> <li>• Qualitative and Quantitative Approaches</li> </ul> <p><b>Self-learning Topics:</b> detail study of research</p>		CO2
III	<b>Research Design and Sample Design</b>	<b>08</b>	
	<ul style="list-style-type: none"> <li>• Research Design – Meaning, Types and Significance</li> <li>• Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors</li> </ul> <p><b>Self-learning Topics:</b> case study on sample Design</p>		CO3
IV	<b>Research Methodology</b>	<b>09</b>	
	<ul style="list-style-type: none"> <li>• Meaning of Research Methodology</li> <li>• Stages in Scientific Research Process:</li> <li>• Identification and Selection of Research Problem</li> <li>• Formulation of Research Problem</li> <li>• Review of Literature</li> <li>• Formulation of Hypothesis</li> <li>• Formulation of research Design</li> <li>• Sample Design</li> <li>• Data Collection</li> <li>• Data Analysis</li> <li>• Hypothesis testing and Interpretation of Data</li> <li>• Preparation of Research Report</li> </ul> <p><b>Self-learning Topics:</b> case study on Research methodology</p>		CO3
V	<b>Formulating Research Problem</b>	<b>06</b>	
	Considerations: Relevance, Interest, Data Availability, Choice of		CO4



	data, Analysis of data, Generalization and Interpretation of analysis <b>Self-learning Topics:</b>		
VI	<b>Outcome of Research</b>	<b>05</b>	
	<ul style="list-style-type: none"><li>Preparation of the report on conclusion reached</li><li>Validity Testing &amp; Ethical Issues</li><li>Suggestions and Recommendation</li></ul> <b>Self-learning Topics:</b> case study on ethical issues		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R., 1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2<sup>nd</sup>ed), Singapore, Pearson Education



<b>Course Title: IPR and Patenting</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSOE207</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
IAE: Internal Assessment Examination ESE: End Semester Examination												
<b>Course Objectives:</b>												
<ol style="list-style-type: none"><li>1. To understand intellectual property rights protection system</li><li>2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures</li><li>3. To get acquaintance with Patent search and patent filing procedure and applications</li></ol>												
<b>Course Outcomes:</b>												
At the end of the course students will be able to:												
<ol style="list-style-type: none"><li>1. understand Intellectual Property assets</li><li>2. assist individuals and organizations in capacity building</li><li>3. work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting</li></ol>												

Module	Contents	Hours	COs
I	<b>Introduction to Intellectual Property Rights (IPR)</b>	<b>06</b>	
	Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc. Importance of IPR in Modern Global Economic Environment: Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development <b>Self-learning Topics:</b> Types of trademark		CO1
II	<b>Enforcement of Intellectual Property Rights</b>	<b>08</b>	
	Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement <b>Indian Scenario of IPR:</b> Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc. <b>Self-learning Topics:</b> Indian IPR case study		CO2
III	<b>Emerging Issues in IPR</b>	<b>06</b>	
	Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc. <b>Self-learning Topics:</b> Issue related to copyright		CO3
IV	<b>Basics of Patents</b>	<b>08</b>	
	Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent <b>Self-learning Topics:</b> Detail study on types of patent		CO4
V	<b>Patent Rules</b>	<b>09</b>	
	Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.) <b>Self-learning Topics:</b> Case study on any particular patent		CO5
VI	<b>Procedure for Filing a Patent (National and International)</b>	<b>08</b>	
	Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement <b>Self-learning Topics:</b> IPR		CO6



		<b>Total</b>	<b>45</b>	
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## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5. Cornish, William Rodolph & Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7<sup>th</sup> Edition, Sweet & Maxwell
6. Lous Harns, 2012, The enforcement of Intellectual Property Rights: A Case Book, 3<sup>rd</sup> Edition, WIPO
7. Prabhuddha Ganguli, 2012, Intellectual Property Rights, 1st Edition, TMH
8. R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books
9. M Ashok Kumar and mohd Iqbal Ali, 2-11, Intellectual Property Rights, 2nd Edition, Serial
10. Kompal Bansal and Praishit Bansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BS Publications



<b>Course Title: Digital Business Management</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSOE208</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination ESE: End Semester Examination</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>1. To familiarize with digital business concept</li><li>2. To acquaint with E-commerce</li><li>3. To give insights into E-business and its strategies</li></ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"><li>1. Identify drivers of digital business</li><li>2. Illustrate various approaches and techniques for E-business and management</li><li>3. Prepare E-business plan</li></ol>												

Module	Contents	Hours	COs
I	<b>Introduction to Digital Business</b>	<b>10</b>	
	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, <b>Self-learning Topics:</b> Hadoop		CO1
II	<b>Overview of E-Commerce</b>	<b>07</b>	
	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 EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing  to promote your e-commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC <b>Self-learning Topics:</b> E-governance		CO2
III	<b>Digital Business Support services</b>	<b>07</b>	
	ERP as e –business backbone, knowledge Tope Apps, Information and referral system Application Development: Building Digital business Applications and Infrastructure <b>Self-learning Topics:</b> ERP system		CO3
IV	<b>Managing E-Business</b>	<b>07</b>	
	Managing Knowledge, Management skills for e- business, Managing Risks in e –business Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications <b>Self-learning Topics:</b> WWW roll in E-business		CO4
V	<b>E-Business Strategy</b>	<b>05</b>	
	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) <b>Self-learning Topics:</b> Case Study on E-Business		CO5



VI	<b>Materializing e-business:</b> From Idea to Realization Business plan preparation Case Studies and presentations <b>Self-learning Topics:</b> key component of E-business	<b>09</b>	CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.

## Reference Books:

1. A textbook on E-commerce, Er Arunrajan Mishra, Dr W K Sarwade, Neha Publishers & Distributors, 2011
2. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
3. Digital Business and E-Commerce Management, 6<sup>th</sup> Ed, Dave Chaffey, Pearson, August 2014
4. Introduction to E-Business-Management and Strategy, Colin Combe, ELSVIER, 2006
5. Digital Business Concepts and Strategy, Eloise Coupey, 2<sup>nd</sup> Edition, Pearson
6. Trend and Challenges in Digital Business Innovation, Vinocenzo Morabito, Springer
7. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan
8. E-Governance-Challenges and Opportunities in: Proceedings in 2<sup>nd</sup> International Conference theory and practice of Electronic Governance
9. Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5
10. Measuring Digital Economy-A new perspective- DoI:10.1787/9789264221796-enOECD Publishing



<b>Course Title: Environmental Management</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>				<b>Course Code: 25MECSOE209</b>					
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>					
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	-	3	-	-	3	20	20	60	-	-	100
<p>IAE: Internal Assessment Examination ESE: End Semester Examination</p> <p><b>Course Objectives:</b></p> <ol style="list-style-type: none"><li>1. Understand and identify environmental issues relevant to India and global concerns</li><li>2. Learn concepts of ecology</li><li>3. Familiarise environment related legislations</li></ol> <p><b>Course Outcomes:</b></p> <p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"><li>1. Understand the concept of environmental management</li><li>2. Understand ecosystem and interdependence, food chain etc</li><li>3. Understand and interpret environment related legislations</li></ol>												

Module	Contents	Hours	COs
I	<b>Introduction and Definition of Environment</b>	<b>10</b>	
	Significance of Environment Management for contemporary managers, Career opportunities, Environmental issues relevant to India, Sustainable Development, the Energy scenario <b>Self-learning Topics:</b>		CO1
II	<b>Global Environmental concerns</b>	<b>07</b>	
	Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc. <b>Self-learning Topics:</b>		CO2
III	<b>Concepts of Ecology</b>	<b>06</b>	
	Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc. <b>Self-learning Topics:</b>		CO3
IV	<b>Scope of Environment Management</b>	<b>10</b>	
	Scope of Environment Management, Role and functions of Government as a planning and regulating agency Environment Quality Management and Corporate Environmental Responsibility <b>Self-learning Topics:</b>		CO4
V	<b>Quality Environmental Management</b>	<b>07</b>	
	Total Quality Environmental Management, ISO-14000, EMS certification. <b>Self-learning Topics:</b>		CO5
VI	<b>General overview</b>	<b>05</b>	
	General overview of major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc. <b>Self-learning Topics:</b>		CO6
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### A. Internal Assessment Examination:

Assessment consists of two class tests, each 20 marks. The IAE 1 will cover any three Course Outcomes (COs) and IAE 2 will cover the remaining three Course Outcomes (COs). Each test will have a duration of one hour.

### B. End Semester Theory Examination:

End Semester exam of 60 Marks will be conducted based on entire syllabus.



## Reference Books:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
3. Environmental Management V Ramachandra and Vijay Kulkarni, TERI Press
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press Environment and Ecology, Majid Hussain, 3<sup>rd</sup> Ed. Access Publishing.2015

<b>Course Title: Computational Laboratory-II</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>			<b>Course Code: 25MECSPCL201</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
-	-	2	-	-	1	1	-	-	-	25	25	50

<b>Module</b>	<b>Contents</b>	<b>Hours</b>	<b>COs</b>
I	<b>Cloud Computing &amp; Services</b>	<b>06</b>	
	<ul style="list-style-type: none"> <li>Use Eucalyptus or open Nebula or equivalent to set up cloud, many virtual machine utilization, virtual machine migration at certain conditions, web applications on cloud.</li> <li>Demonstrate how to build ML/AL capabilities on cloud for mobile applications</li> <li>Explain how mobile offline data synchronization can be done using any cloud platform</li> </ul> <b>Self-learning Topics:</b>		CO1,2,3
II	<b>Data Analytics and Visualization</b>	<b>06</b>	
	<p>For the following Experiments, use any available data set or download it from Kaggle/UCI or other repositories and use Python to solve each problem.</p> <ul style="list-style-type: none"> <li>Data preparation using NumPy and Pandas</li> <li>Data Visualization / Exploratory Data Analysis for the selected data set using Matplotlib and Seaborn</li> <li>Data Modeling</li> <li>Implementation of Statistical Hypothesis Test using Scipy and Sci-kit learn</li> <li>Regression Analysis a. Perform Logistic Regression to find out relation between variables. b. Apply regression Model techniques to predict the data on above dataset</li> <li>Predictive data Analytics using open source tools like Rstudio, RWeka, RHadoop</li> </ul> <b>Self-learning Topics:</b>		CO4,5,6



<b>Course Title: Skill Based Lab-II</b>												
<b>Semester: II</b>			<b>Term: EVEN</b>				<b>Course Code: 25MECSVSE201</b>					
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>					
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA/TW</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
-	-	4	-	-	2	2	-	-	-	50	50	100

<b>Module</b>	<b>Contents</b>	<b>Hours</b>	<b>COs</b>
I	<b>Activities</b>		
	Skill Based Lab- I and II shall include activity / case study / project based learning like Mini project in engineering domains, related to the specialization or interdisciplinary domains, Product Design Application Software Development, Idea proposal and validation Lab work/Case Study can also be conducted based on DLOC chosen by the student		CO1-6



**St. John College of Engineering and Management**

**Autonomous Institute**

(A Christian Religious Minority Institution)

Approved by AICTE and DTE, Affiliated to University of Mumbai / MSBTE

DTE Code : 3218 AICTE Permanent ID : 1-4790201



**NAAC Accredited with Grade 'A+', Three Programs NBA Accredited**

# Master of Technology In Computer Engineering

## Semester – III

SJCEM : R - 25

**Effective from Academic Year 2025-26**

## Program Structure for Master of Technology in Computer Engineering

(With Effect from 2025-2026)

### Semester III

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
25MECSPRJ301	PRJ	Major Project: Dissertation –I	-	-	36	-	-	18	18
25MECSEEM301	EEMC	Online Credit Course- I	-	-	-	-	-	-	3
25MECSEEM302	EEMC	Online Credit Course- II	-	-	-	-	-	-	3
<b>Total</b>			-	-	<b>36</b>	-	-	<b>18</b>	<b>24</b>

Course Code	Vertical	Course Name	Evaluation Scheme					Total
			IAE 1	IAE 2	ESE	CA	OR/ PR	
25MECSPRJ301	PRJ	Major Project: Dissertation –I	-	-	-	100	-	100
25MECSEEM301	EEMC	Online Credit Course- I	-	-	-	25	-	25
25MECSEEM302	EEMC	Online Credit Course- II	-	-	-	25	-	25
<b>Total</b>			-	-	-	<b>150</b>	-	<b>150</b>



Course Title: Major Project: Dissertation –I												
Semester: III			Term: ODD				Course Code: 25MECSPRJ301					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	36	-	-	18	18	-	-	-	100	-	100
<p>IAE: Internal Assessment Examination ESE: End Semester Examination CA: Continuous Assessment</p> <p><b>Note:</b> It is mandatory to complete the Online Credit Courses (OCC) available on NPTEL / Swayam /MOOC or similar platform approved by university. The learner shall opt for one course each from OCC- I and OCC-II. These two courses shall be completed in any semester I or II or III, but not later end of the Semester III. The credits earned with OCC- I and OCC-II shall be accounted in the third semester grade-sheet. The learner shall be allowed to take up these courses from his or her institute or organization/ industry where his / her major project is carried out. The students shall complete the courses and shall qualify the exam conducted by the respective authorities/ instructor from the platform. The fees for any such courses and the corresponding examination shall be borne by the learner. University shall make a provision that credit earned with OCC-I and OCC-II shall be accounted in the third semester grade-sheet with actual names of the courses.</p>												



<b>Course Title: Online Credit Course- I</b>												
<b>Semester: III</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSEEM301</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
-	-	-	-	-	-	3	-	-	-	25	-	25
<p>IAE: Internal Assessment Examination ESE: End Semester Examination CA: Continuous Assessment</p> <p><b>Online Credit Course I:</b></p> <p>The learner shall opt for the course in the domain of Research Methodology or Research &amp; Publication Ethics or IPR. The opted course shall be of 3 credits of equivalent number of weeks with Continuous Assessment of 25 marks.</p>												



<b>Course Title: Online Credit Course- II</b>												
<b>Semester: III</b>			<b>Term: ODD</b>			<b>Course Code: 25MECSEEM302</b>						
<b>Teaching Scheme</b>						<b>Evaluation Scheme</b>						
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credit</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>Oral/Pract/ Tut.</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
-	-	-	-	-	-	3	-	-	-	25	-	25
<p>IAE: Internal Assessment Examination ESE: End Semester Examination CA: Continuous Assessment</p> <p><b>Online Credit Course II:</b></p> <p>The learner shall opt for the course recommended by Faculty Advisor/ Project Supervisor from the institute. The opted course shall be of 3 credits of equivalent number of weeks with Continuous Assessment of 25 marks.</p>												



**St. John College of Engineering and Management**

**Autonomous Institute**

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# Master of Technology In Computer Engineering

## Semester – IV

SJCEM : R - 25

**Effective from Academic Year 2025-26**



## Program Structure for Master of Technology in Computer Engineering

(With Effect from 2025-2026)

### Semester IV

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
25MECSPRJ401	PRJ	Major Project: Dissertation – II	-	-	40	-	-	20	20
		<b>Total</b>	-	-	<b>40</b>	-	-	<b>20</b>	<b>20</b>

Course Code	Vertical	Course Name	Evaluation Scheme					Total
			IAE 1	IAE 2	ESE	CA	OR/PR	
25MECSPRJ401	PRJ	Major Project: Dissertation – II	-	-	-	100	100	200
		<b>Total</b>	-	-	-	<b>100</b>	<b>100</b>	<b>200</b>



Course Title: Major Project: Dissertation –II												
Semester: IV			Term: EVEN				Course Code: 25MECSPRJ401					
Teaching Scheme						Evaluation Scheme						
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	40	-	-	20	20	-	-	-	100	100	200
<p>IAE: Internal Assessment Examination            ESE: End Semester Examination            CA: Continuous Assessment</p> <p><b>Note:</b> It is mandatory to complete the Online Credit Courses (OCC) available on NPTEL / Swayam /MOOC or similar platform approved by university. The learner shall opt for one course each from OCC- I and OCC-II. These two courses shall be completed in any semester I or II or III, but not later end of the Semester III. The credits earned with OCC- I and OCC-II shall be accounted in the third semester grade-sheet. The learner shall be allowed to take up these courses from his or her institute or organization/ industry where his / her major project is carried out. The students shall complete the courses and shall qualify the exam conducted by the respective authorities/ instructor from the platform. The fees for any such courses and the corresponding examination shall be borne by the learner. University shall make a provision that credit earned with OCC-I and OCC-II shall be accounted in the third semester grade-sheet with actual names of the courses.</p>												