



## AUTONOMY SCHEME

### SJCEM : R-24 B

Sr. No.	Heading	Particulars
1	Title of the Course	Computer Engineering
2	Eligibility for Admission	As per the Institute Examination Ordinance
3	Theory Passing Marks (IAE / ESE)	40%
4	Continuous Assessment (CA) / Oral / Practical	50%
5	To be implemented from Academic Year	With effect from Academic Year:2024-25
6	Total Credits	Maximum 172
7	Honor / Minor Courses offered	<b>Data Science</b> (Additional Credits: 18)
8	Eligibility Criteria for Honor /Minor	<ul style="list-style-type: none"><li>• Students with no backlog in semester I, II and III.</li><li>• The CGPI based on Semester I, II and III of the students must be 6.75 and above.</li><li>• For Direct Second Year (DSE) Students – No backlog in semester III and CGPI must be 6.75 and above.</li></ul>



## 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 172, 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-24 B 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
OJT	On Job Training
PRJ	Project

### 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**

# Bachelor of Technology In Computer Engineering

## Second Year

### Semester – IV

#### SJCEM: R – 24B

**Effective from Academic Year 2025-26**



## Program Structure for Second Year Computer

### Engineering (With Effect from 2025-2026)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CSPCC401B	PCC	Statistics and Probability	2	1	-	2	1	-	3
24CSPCC402B	PCC	Analysis of Algorithm	3	-	2	3	-	1	4
24CSPCC403B	PCC	Computer Networks	3	-	-	3	-	-	3
24CSPCC404B	PCC	Operating System	3	-	2	3	-	1	4
24CSAEC401B	AEC	Employability Enhancement Program -II (Communication)	-	-	2	-	-	1	1
24CSVSE401B	VSEC	Employability Enhancement Program -III (Industry Certification)	-	-	2	-	-	1	1
24MDM401XB	MDM	Multidisciplinary Minor	3	-	2	3	-	1	4
24CSOJT401B	OJT	Internship I	-	-	3	-	-	1	1
		<b>Total</b>	<b>14</b>	<b>01</b>	<b>8</b>	<b>14</b>	<b>01</b>	<b>6</b>	<b>21</b>

### Semester IV

Course Code	Vertical	Course Name	Evaluation Scheme					Total
			Theory			Practical		
			IAE 1	IAE 2	ESE	CA	OR/PR	
24CSPCC401B	PCC	Statistics and Probability	20	20	60	25	-	125
24CSPCC402B	PCC	Analysis of Algorithm	20	20	60	25	25	150
24CSPCC403B	PCC	Computer Networks	20	20	60	-	-	100
24CSPCC404B	PCC	Operating System	20	20	60	25	25	150
24CSAEC401B	AEC	Employability Enhancement Program -II (Communication)	-	-	-	25	-	25
24CSVSE401B	VSEC	Employability Enhancement Program -III (Industry Certification)	-	-	-	-	25	25
24MDM401XB	MDM	Multidisciplinary Minor	20	20	60	25	-	125
24CSOJT401B	OJT	Internship I	-	-	-	-	25	25
		<b>Total</b>	<b>100</b>	<b>100</b>	<b>300</b>	<b>125</b>	<b>100</b>	<b>725</b>



## Multidisciplinary Minor (MDM) Offered by Computer Engineering

<b>Interface and Experience Design</b>				
<b>Offered to</b>	<b>Semester</b>	<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>MECH, CIVIL, ECS, IT</b>	<b>Sem IV</b>	<b>24MDM401IEB</b>	<b>UI/UX Fundamentals</b>	<b>04</b>
	<b>Sem V</b>	<b>24MDM501IEB</b>	<b>Innovation and Product Design</b>	<b>04</b>
	<b>Sem VI</b>	<b>24MDM601IEB</b>	<b>Prototyping and Interface Development Tools</b>	<b>02</b>
	<b>Sem VII</b>	<b>24MDM701IEB</b>	<b>Human Computer Interaction</b>	<b>02</b>
		<b>24MDM702IEB</b>	<b>Project on Interface and Experience Design</b>	<b>02</b>



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# Syllabus for Second Year Computer Engineering Semester – IV

**SJCEM: R – 24B**

**(With Effect from 2025-2026)**

<b>Course Title: Statistics and Probability</b>												
<b>Semester: IV</b>			<b>Term: Even</b>				<b>Course Code: 24CSPCC401B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
2	1	-	2	1	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

**Course Objectives:** The course is aimed

1. To study the basic techniques of statistics like correlation, regression and curve fitting for data Analysis, Machine learning and AI.
2. To understand probability theory and random process that serve as an essential tool for applications of engineering sciences.
3. To acquaint students with the concepts of probability distributions.
4. To understand the various types of hypothesis tests and learn how to choose the most appropriate test based on the type of data and the research question.
5. Enhance problem-solving skills through the application of counting principles to solve a wide range of problems in mathematics, computer science, engineering, and other disciplines.
6. To learn about different types of graphs, Understand their properties and characteristics.

**Course Outcomes:**

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

1. Apply the concept of Correlation and Regression to the engineering problems in data Science, machine learning and AI.
2. Illustrate understanding of concepts of probability and expectation for getting the speed of the data and distribution of probabilities.
3. Apply the concepts of probability distribution to engineering problems.
4. Apply the most suitable hypothesis test for different types of data and research designs, such as t-tests, chi-square tests.
5. Apply counting principles, the pigeonhole principle, and recurrence relations effectively in various mathematical, computational, and real-world problem-solving contexts.
6. Develop proficiency in applying various graph algorithms, including traversal algorithms, shortest path algorithms.

Module	Contents	Hours	COs
<b>I</b>	<b>Statistical Techniques:</b>	6	CO1
	Karl Pearson's coefficient of correlation (r), Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks), Lines of regression, Fitting of first- and second-degree curves.  <b>Self-learning Topics:</b> Covariance, fitting of exponential curve.		
<b>II</b>	<b>Probability Theory:</b>	5	CO2
	Definition and basics of probability, conditional probability, Total Probability theorem and Bayes' theorem, Discrete and continuous random variable with probability distribution and probability density function, Expectation, Variance and Standard Deviation.  <b>Self-learning Topics:</b> Cumulative Distribution Function, Moment generating function, Skewness and Kurtosis of distribution (data).		
<b>III</b>	<b>Probability Distribution:</b>	4	CO3
	Probability Distribution: Binomial, Poisson and Normal distribution - problems (No derivation for mean and standard deviation)  <b>Self-learning Topics:</b> Bernoulli's Distribution, Uniform Distribution, Exponential Distribution		
<b>IV</b>	<b>Sampling Theory:</b>	5	CO4
	Introduction, Parameter and Statistics, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom. Z- test (Large Sample), Students' t-distribution (Small sample). Test the significance of mean and Difference between the means of two samples. Chi-Square Test: Test of goodness of fit and independence of attributes.  <b>Self-learning Topics:</b> Yate's Correction.		
<b>V</b>	<b>Counting</b>	5	CO5
	Basic Counting Principle-Sum Rule, Product Rule, Inclusion Exclusion Principle, Pigeonhole Principle, Recurrence relations-Linear Homogeneous and Non-Homogeneous Recurrence Relation (where $f(n) = A$ or $A \cdot n^m$ or $An+B$ ), Solving recurrence relations.  <b>Self-learning Topics:</b> Extended Pigeonhole Principle, Non-Homogeneous Recurrence Relation (where $f(n) = An^2+Bn+C$ or $A \cdot a^n$ or $(An+B)e^n$ )		
<b>VI</b>	<b>Graph Theory:</b>	5	CO6
	Introduction, Simple Graphs, Multigraphs, Isomorphic Graphs, Subgraphs, Handshaking lemma (Without proof), Complete graph, Regular, Planar graph, Walks, Trails, Path, Cycle, Connected and Disconnected Graph, Bipartite graph, Euler and Hamiltonian Graphs, Components of graph, Cut-Set, Cut-Vertex, Weighted graph, Dijkstra's Algorithm.  <b>Self-learning Topics:</b> Traversal algorithms- breadth-first search, depth-first search		
	<b>Total</b>	<b>30</b>	



## Evaluation and Assessment Scheme:

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

Assessment consists of two class tests of 20 marks each. The IAE-I will cover any three course outcomes (COs) and IAE-II will cover remaining three course outcomes (COs). Duration of each test shall be one hour.

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

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

### C. Continuous Assessment (CA):

General Instructions:

- Batchwise tutorials are to be conducted. The number of students per batch should be maximum of 25 per batch.
- Students are encouraged to write at least 6 tutorials on the entire syllabus.
- Students are encouraged to write at least 4 Assignments on the entire syllabus.

The distribution of Term work Marks will be as follows

- Tutorials: 10 Marks
- Assignments: 10 Marks
- Attendance (Theory and tutorial): 5 Marks

## Reference Books:

1. Probability, Statistics and Random Processes, T.Veerarajan, McGraw-Hill education.
2. Narsing Deo, "Graph Theory with applications to engineering and computer science", PHI Publications.

## Text Books:

1. Introductory Probability and Statistical Applications, B L Mayer, Wiley Eastern Limited, 2<sup>nd</sup> Edition.
2. Discrete and Combinatorial Mathematics-An Applied Introduction, Ralph P. Grimaldi and B V Ramana, Pearson Education, Asia, 5<sup>th</sup> Edition.

## Useful Links:

1. <https://www.coursera.org/specializations/discrete-mathematics>
2. <https://www.edx.org/learn/discrete-mathematics>

## Course Title: Analysis of Algorithms

<b>Semester: IV</b>			<b>Term: EVEN</b>				<b>Course Code: 24CSPCC402B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

### Course Objectives:

1. To provide mathematical approaches for Analysis of Algorithms
2. To understand and solve problems using various algorithmic approaches
3. To analyze algorithms using various method
4. To solve problems using various strategies
5. To analyze strategies for solving problems not solvable in polynomial time.
6. To provide mathematical approach for Analysis of Algorithms.

### Course Outcomes:

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

1. Analyze the running time and space complexity of algorithms.
2. Describe, apply and analyze the complexity of divide and conquer strategy.
3. Describe, apply and analyze the complexity of greedy strategy.
4. Describe, apply and analyze the complexity of dynamic programming strategy.
5. Explain and apply backtracking, branch and bound and string-matching techniqueto deal with some hard problems.
6. Describe the classes P, NP, and NP-Complete and be able to prove that a certain problem is NP-Complete.

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to analysis of algorithm</b>	13	CO1
	Performance analysis, Space and Time complexity, Growth of function–Big –Oh, Omega, Theta notation, Mathematical background for algorithm analysis, Analysis of selection sort , Insertion sort. <b>Recurrences:</b> -The substitution method -Recursion tree method -Master method <b>Divide and Conquer Approach:</b> General method. Analysis of Merge sort, Analysis of Quick sort , Analysis of Binary search, Finding minimum and maximum algorithm and analysis <b>Self-Learning Topics:</b> Strassen’ s matrix multiplication		
<b>II</b>	<b>Dynamic Programming Approach</b>	7	CO2
	General Method, Multistage Graphs, Single source shortest path, All pair shortest path Assembly-line scheduling , 0/1 knapsack Travelling salesman problem, longest common subsequence <b>Self-Learning Topics:</b> Principles of Dynamic Programming Approach		
<b>III</b>	<b>Greedy Method Approach</b>	7	CO3
	General Method, Single Source Shortest Path, Knapsack problem, Job Sequencing with deadlines Minimum cost spanning trees-Kruskal’s and Prim’s algorithm <b>Self-Learning Topics:</b> Optimal storage on tapes		
<b>IV</b>	<b>Backtracking and Branch-and-bound:</b>	7	CO4
	General Method, N-queen problem, Sum of subsets, Graph coloring, 15 puzzle problem, Travelling salesman problem. <b>Self-Learning Topics:</b> Optimization in Backtracking, Constraint Propagation		
<b>V</b>	<b>String Matching Algorithms:</b>	6	CO5
	The naïve string matching Algorithms ,The Rabin Karp algorithm String matching with finite automata, The knuth-Morris-Pratt algorithm <b>Self-Learning Topics:</b> Boyer-Moore Algorithm		
<b>VI</b>	<b>Non-deterministic polynomial algorithms:</b>	5	CO6
	Polynomial time, Polynomial time verification, NP Completeness and reducibility, NP Completeness proofs, Vertex Cover Problems , Clique Problems <b>Self-Learning Topics:</b> Importance of NP Problems		
	<b>Total</b>	<b>45</b>	

Exp. No.	Experiment List	COs
1	Implementation of Selection Sort and Insertion Sort.	CO1
2	Implementation of Merge sort and Quick sort.	CO1
3	Implementation of All pair shortest path	CO2
4	Implementation of Longest common subsequence	CO2
5	Implementation of Fractional Knapsack problem	CO3
6	Implementation of Job sequencing with deadlines	CO3
7	Implementation of N-queen problem	CO4, CO6
8	Implementation of Graph Coloring	CO4, CO6
9	Implementation of the naïve string-matching Algorithms	CO5
10	Implementation of the Rabin Karp algorithm	CO5, CO6

## Evaluation Scheme and Assessment:

### 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom



8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

#### **D. Oral & Practical Exam**

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.

#### **Reference Books:**

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition.
2. S. K. Basu, "Design Methods and Analysis of Algorithm", PHI.
3. John Kleinberg, Eva Tardos, "Algorithm Design", Pearson.
4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication.

#### **Text Books:**

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, "Introduction to algorithms", 2nd edition, PHI publication 2005.
2. Ellis Horowitz, Sartaj Sahni, S. Rajasekaran. "Fundamentals of computer algorithms" University Press

#### **Useful Links:**

1. <https://leetcode.com/explore/interview/card/leetcode-interview-crash-course-data-structures-and-algorithms/703/arraystrings/>
2. <https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/>
3. <https://visualgo.net/en>



## Course Title: Computer Networks

<b>Semester: IV</b>		<b>Term: Even</b>			<b>Course Code: 24CSPCC403B</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</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

CA: Continuous Assessment

**Course Objectives:** The course aims

1. To introduce concepts and fundamentals of data communication and computer networks.
2. To explore the inter-working of various layers of OSI.
3. To explore the issues and challenges of protocols design while delving into TCP/IP protocol suite.
4. To assess the strengths and weaknesses of various routing algorithms.
5. To understand various transport layer and application layer protocols.
6. To understand various application layer protocols.

**Course Outcomes:**

At the end of the course students will be able:

1. Demonstrate the concepts of data communication and compare ISO–OSI model with TCP/IP model.
2. Explore different concepts and design issues at physical layer.
3. Explore different design issues at data link layer.
4. Design the network using IP addressing and sub netting / supernetting schemes.
5. Analyze transport layer protocols and congestion control algorithms.
6. Explore protocols at application layer

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Networking</b>	5	CO1
	<p>Introduction to computer network, network application, network software and hardware components (interconnection networking devices), network topology, protocol hierarchies, design issues for the layers, connection-oriented and connectionless services.</p> <p>Reference models: Layer details of OSI, TCP/IP models. Communication Between layers.</p> <p><b>Self-learning Topics:</b> Real-world applications of each network topology.</p>		
<b>II</b>	<b>Physical Layer</b>	4	CO2
	<p>Introduction to communication: Electromagnetic spectrum Guided transmission media: Twisted pair, coaxial, fiber optics. Unguided transmission media: Radio waves, micro waves, infrared</p> <p><b>Self-learning Topics:</b> Factors affecting the performance of guided and unguided transmission media</p>		
<b>III</b>	<b>Data Link Layer</b>	9	CO3
	<p>DLL design issues (services, framing, error control, flow control), error detection and correction (Hamming code, CRC, checksum), Elementary data link protocols, Stop and Wait, Sliding Window (Go Back N and Selective Repeat), Medium access control sublayer: Channel allocation problem, multiple access protocol (ALOHA, Carrier Sense Multiple Access (CSMA/CD) &amp; (CSMA/CA))</p> <p><b>Self-learning Topics:</b> CSMA/CD, and CSMA/CA protocols in wireless networks.</p>		
<b>IV</b>	<b>Network Layer</b>	13	CO4
	<p>Network layer design issues, Communication primitives: unicast, multicast, broadcast. IPv4 addressing (classfull and classless), subnetting, supernetting design problems, IPv4 protocol, network address translation (NAT), IPv6 Routing algorithms: Shortest path (Dijkstra's), link state routing, distance vector routing Protocols - ARP, RARP, ICMP, IGMP</p> <p>Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, token &amp; leaky bucket algorithms</p> <p><b>Self-learning Topics:</b> Importance of IPv6 Protocol</p>		
<b>V</b>	<b>Transport Layer</b>	7	CO5
	<p>Transport service: Transport service primitives, Berkeley sockets, connection management (handshake), UDP, TCP, TCP state transition, TCP timers TCP flow control (sliding window), TCP congestion control: Slow start algorithm</p> <p><b>Self-learning Topics:</b> Role of TCP timers in ensuring reliable data transmission</p>		

Module	Contents	Hours	COs
VI	<b>Application Layer</b>	7	CO6
	DNS: Name Space, Resource Record, and Types of Name Server. HTTP, SMTP, Telnet, FTP, and DHCP  <b>Self-learning Topics:</b> Various application layer protocols like SSH, TFTP, NFS, SNMP		
	<b>Total</b>	<b>45</b>	

## Evaluation Scheme and Assessment:

### 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. A. S. Tanenbaum, Computer Networks, 4<sup>th</sup> Edition, Pearson Education
2. B. A. Forouzan, Data Communications and Networking, 5<sup>th</sup> Edition, TMH
3. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, 6<sup>th</sup> Edition, Addison Wesley

## Text Books:

1. S. Keshav, An Engineering Approach to Computer Networking, Pearson
2. Natalia Olifer & Victor Olifer, Computer Networks: Principles, Technologies & Protocols for Network Design, Wiley India, 2011.
3. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Second Edition, The Morgan Kaufmann Series in Networking.

## Useful Links:

1. <https://www.netacad.com/courses/networking/networking-essentials>
2. <https://www.coursera.org/learn/computer-networking>
3. <https://nptel.ac.in/courses/106/105/106105081>
4. <https://www.edx.org/course/introduction-to-networking>



## Course Title: Operating System

<b>Semester: IV</b>			<b>Term: EVEN</b>			<b>Course Code: 24CSPCC404B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment, TW: Term Work

### Course Objectives:

1. Understand the fundamental concepts, functions, and structures of modern operating systems.
2. Analyze the mechanisms for process management, scheduling, synchronization, and deadlock handling.
3. Apply various memory management and file system techniques to optimize system performance.
4. Develop and evaluate solutions for system-level problems using appropriate OS algorithms and programming constructs.

### Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Explain the structure, services, and functionalities of operating systems.
2. Demonstrate process creation, scheduling, and inter-process communication mechanisms.
3. Analyze process synchronization and concurrency control using semaphores, mutexes, and monitors.
4. Evaluate deadlock prevention, avoidance, and recovery strategies using system models and algorithms.
5. Implement and compare memory management and page replacement algorithms for efficient memory utilization.
6. Evaluate and analyze file management and disk scheduling techniques to determine their efficiency and performance trade-offs.

Module	Contents	Hours	COs
1	<b>Module 1 Overview of Operating Systems</b>	4	CO1
	Objectives, functions, and services of OS; Evolution and types; System structures – monolithic, microkernel, layered, modular; System calls and their types.  <b>Self-Learning Topics:</b> Case Study: Linux vs Windows OS Architecture		
2	<b>Module 2: Process Management</b>	8	CO2
	Concept of a Process, Process States, Process Description, Process Control Block, Operations on Processes. Threads: Definition and Types, Concept of Multithreading, Scheduling: Types of Scheduling: Preemptive and Non-preemptive, Scheduling algorithms and their performance evaluation: FCFS, SJF, SRTF, Priority based, Round Robin  <b>Self-Learning Topics:</b> Linux Process Management Internals		
3	<b>Module 3: Process Synchronization and Concurrency</b>	8	CO3
	Concurrency: Principles of Concurrency, Inter-Process Communication, Process/Thread Synchronization. Mutual Exclusion: Requirements, Hardware and Software Support, Semaphores and Mutex, Monitors, Classical synchronization problems: Producer and Consumer problem, Readers/Writers Problem  <b>Self-Learning Topics:</b> Synchronization in Multicore and Distributed Systems		
4	<b>Module 4: Deadlock</b>	8	CO4
	Principles of deadlock, Conditions for deadlock, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance: Banker's Algorithm for Single & Multiple Resources, Deadlock Detection and Recovery. Dining Philosophers Problem.  <b>Self-Learning Topics:</b> Modeling Deadlocks using Simulation Tools		
5	<b>Module 5: Memory Management</b>	9	CO5
	Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Next Fit, Relocation, Paging, Segmentation. Virtual Memory: Demand Paging, Structure of Page Tables, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Thrashing  <b>Self-Learning Topics:</b> Memory Management in Linux Kernel		

Module	Contents	Hours	COs
<b>6</b>	<b>Module 6: File System and I/O Management</b>	<b>8</b>	<b>CO6</b>
	File Management: Overview, File Organization and Access, Secondary Storage Management: File Allocation Methods Input /Output Management I/O Management and Disk Scheduling: I/O Devices, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK.  <b>Self-Learning Topics:</b> File Systems in Linux (EXT4) and Windows (NTFS), SSD-based Disk Scheduling Concepts		
	<b>Total</b>	<b>45</b>	

### List of Experiments:

Sr. No.	Title of Experiment	COs Mapped
1	Explore the internal commands of linux and Write shell scripts to do the following: a. Display top 10 processes in descending order b. Display processes with highest memory usage. c. Display current logged in user and logname. d. Display current shell, home directory, operating system type, current path setting, current working directory. e. Display OS version, release number, kernel version. f. Illustrate the use of sort, grep, awk, etc.	CO1
2	Implement system calls for file manipulation (open, read, write, lseek, close)	CO1
3	Write shell scripts for automation tasks (e.g., displaying system info, sorting files, user management)	CO2
4	Implement CPU Scheduling Algorithms – FCFS, SJF, SRTF, Priority, Round Robin	CO2
5	Implement <b>Inter-Process Communication (IPC)</b> using pipes or message queues	CO2
6	Implement <b>Synchronization Problems</b> using Semaphores or Mutex (Producer–Consumer / Reader–Writer)	CO3
7	Simulation of <b>Dining Philosophers Problem</b> using threads and semaphores	CO3
8	Implement <b>Deadlock Avoidance</b> using <b>Banker’s Algorithm</b>	CO4
9	Implement <b>Memory Allocation Algorithms</b> – Best Fit, First Fit, Worst Fit	CO5
10	Implement <b>Page Replacement Algorithms</b> – FIFO, LRU, Optimal	CO5
11	Implement <b>File Allocation Techniques</b> – Sequential, Indexed, Linked	CO6
12	Implement Disk Scheduling Algorithms - FCFS, SSTF, SCAN, CSCAN, LOOK	CO6

## 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted



## Reference Books:

1. A Tanenbaum, "Operating System Design and Implementation", 3 rd Edition, Pearson, January 2015.
2. Phillip A. Laplante, Seppo J. Ovaska, "Real Time Systems Design and Analysis", 4th Edition, Wiley-IEEE Press, Dec 2011.
3. Naresh Chauhan, "Principles of Operating Systems", 1 st Edition, Oxford University Press, 2014

## Text Books:

1. Abraham Silberschatz, Greg Gagne, Peter Baer Galvin, "Operating System Concepts", 8th Edition, Wiley,2018.
2. Tanenbaum, "Modern Operating System", 4 th Edition, Pearson Education, 2014
3. William Stallings, "Operating Systems: Internal and Design Principles", 8 th Edition, Pearson, 2014.
4. Randal. K. Michael, "Mastering Shell Scripting", 2 nd Edition, Wiley Publication, 2008.

## Useful Links:

1. <https://nptel.ac.in/courses/106105214>
2. [https://onlinecourses.nptel.ac.in/noc25\\_cs94/preview](https://onlinecourses.nptel.ac.in/noc25_cs94/preview) [onlinecourses.nptel.ac.in](https://onlinecourses.nptel.ac.in)
3. <https://www.cse.iitb.ac.in/~mythili/os/>



<b>Course Title: Employability Enhancement Program -II (Communication)</b>												
<b>Semester: IV</b>			<b>Term: Even</b>				<b>Course Code: 24CSAEC401B</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</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
<p><b>Course Objectives:</b></p> <ol style="list-style-type: none"> <li>1. To understand the importance of active listening in effective communication.</li> <li>2. To cultivate effective inter-personal skills and employment skills for organizational development.</li> </ol> <p><b>Course Outcomes:</b></p> <p>After successful completion of the course, learner will be able to ...</p> <ol style="list-style-type: none"> <li>1. Understand the importance of active listening and social etiquette for effective communication.</li> <li>2. Enhance written communication, official and technical skills</li> <li>3. Strengthen their personal and professional relationship in career building.</li> <li>4. Ace their employability Skills through personal SWOT, Group Discussion and Resume Writing</li> </ol>												

Module	Contents	Hours	COs
<b>I</b>	<b>Listening &amp; Social Skills</b>	06	CO1
	Importance of Listening, Difference between hearing & listening, Types of Listening, Barriers of Listening, Listening (Audios/Videos), Etiquette-Social Etiquette, Dining Etiquette, Telephonic Etiquette, Email Etiquette, Reading Comprehension Skills		
<b>II</b>	<b>Proposal &amp; Report Writing</b>	08	CO2
	Letter Writing: Permission Letter, Leave Letter, Apology Letter, Meetings – Notice, Agenda & Minutes, Introduction to Proposal Writing, Parts of a Proposal, Types of Proposal: Research, Business, What is Technical paper writing in IEEE? Types of Paper Writing: Journal, Conference Paper, Writing a Review Paper		
<b>III</b>	<b>Interpersonal Skills</b>	08	CO3
	Presentation Skills: Power Point, Demo Presentation, Managerial Skills: Time Management, Goal Setting, Decision Making, Conflict Resolution, Team Building, Leadership, Emotional Intelligence, Critical Thinking, Assertiveness, Negotiation		
<b>IV</b>	<b>Employability Skills</b>	08	CO4
	SWOT Analysis: Personal & Organizational, Verbal Aptitude Test, Group Discussion Skills: Types of GD, Do's and Don'ts, Tips for cracking a GD, Resume Writing, Interview Techniques		
	<b>Total</b>	30	

## List of Experiments:

Tutorial No.	List of Experiments / Tutorials	COs
1	Listening Activity	CO1
2	Comprehending Unseen Passages	CO1
3	Writing Email Etiquette/Do's & Don'ts of Email Writing	CO1
4	Meeting and Documentation- Notice, Agenda & Minutes	CO2
5	Letter Writing- Permission, Leave & Apology	CO2
6	PPT Presentation on any Technical Topic (Group Activity)	CO2/3
7	Case Study Based GD-1	CO3
8	Case Study -2	CO3
9	SWOT Analysis: Personal	CO4
10	Resume Writing	CO 4



## Evaluation and Assessment Scheme:

### A. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.

### Reference Books:

- 1) M Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill, 2008
- 2) Gadyalji Vaishali K, Communication Skills, Nandu Publications, 2010
- 3) Rai Urmila & Rai S.M, Business Communication, Himalaya Publishing House, 2007
- 4) Rai Urmila & Rai S.M, Business Communication, Himalaya Publishing House, 2008
- 5) Raman Meenakshi & Sharma Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2015
- 6) Raman Meenakshi & Singh Prakash, Business Communication, Oxford University Press, 2008
- 7) Luthans Fred, Organizational Behavior An Evidence-Based Approach, McGraw Hill Education Private Limited, 2013
- 8) Locker O Kitty & Kaczmarek Kyo Stephen, Business Communication Building Critical Skills, McGraw Hill Education Private Limited, 2007
- 9) Chaturvedi P D & Chaturvedi Mukesh, Business Communication Concepts, Cases and Applications, Pearson Education, 2008



## Useful links for CCES-I:

<https://youtu.be/TTARLuquJeE>

<https://youtu.be/jPj0Z2lb8jg>

<https://youtu.be/2nEvKZ4SG2c>

## PD & Social Etiquette

<https://youtu.be/wPorhmnMDdc>

<https://youtu.be/n6F5icYGnSg>

## 7Cs of Effective Communication

<https://youtu.be/XuGCDRNIU-M>

## Letter Writing

<https://youtu.be/ci47OQLFjao>

<https://youtu.be/uj6rIM62Bqk>

## Motivational Speech

<https://youtu.be/xrEq-1UujOo>

[https://youtu.be/W7BW9gv\\_OkU](https://youtu.be/W7BW9gv_OkU)

## Reading Comprehension

<https://youtu.be/3yYjYvdcCw8>

## Public Speaking Tips

<https://youtu.be/UNGLa--HOXQ>

## BARRIERS TO COMMUNICATION

[https://youtu.be/k9KK\\_0zr3LU](https://youtu.be/k9KK_0zr3LU)



## Course Title: Employability Enhancement Program -III (Industry Certification)

<b>Semester: IV</b>			<b>Term: Even</b>				<b>Course Code: 24CSVSE401B</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</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

### Introduction

As global competition intensifies, industries seek candidates who are not only skilled but also adaptable and ready to meet the demands of an evolving workforce. To bridge the gap between academic learning and industry expectations, SJCEM has introduced certification courses aimed at preparing students for impactful internships. These courses provide students with essential knowledge and skills, empowering them to excel in professional environments and increase their employability.

**Objectives:** The objectives of this course are to

1. Develop Professional Skills
2. Enhance Technical Competency
3. Cultivate Problem-Solving Abilities
4. Promote Ethical and Professional Conduct
5. Familiarize with Industry Standards and Expectations
6. Prepare for a Transition from Classroom to Workplace

**Outcomes:** After completion of this course, students will be able to

1. Communicate and Collaborate Effectively
2. Acquire Job-Ready Technical Skills
3. Enhanced Critical Thinking and Problem-Solving
4. Understand Ethical and Professional Standards
5. Use Industry Tools and Standards
6. Industry Integration effectively

### Certification GUIDELINES:

The general procedure for organizing certification courses is as follows:

#### 1. Identification of Industry Partners

Industries have been identified to provide in-house certification courses in various domains. Students are regularly informed and encouraged to pursue these certification courses.

#### 2. Selection of Certification Domain

Students can choose two domains of their interest for the certification course and express their willingness to pursue the certification.

Following combination of domains are offered in the even semesters:

	Domain 1	Domain 2
Track 1	SQL	.NET
Track 2	CCNA	AI-IBM
Track 3	Cyber Security	AI-IBM
Track 4	Creo	Solid Works
Track 5	Data Science	Prompt Engineering and AI
Track 6	MernStack	Flutter
Track 7	AR-VR	Game Development
Track 8	Drone	Data Analytics
Track 9	IELTS/GRE	Certificate in Social Science
Track 10	Robotic	IoT
Track 11	Blockchain Basics	Blockchain Intelligence
Track 12	AWS	MernStack

### 3. Allocation of Tracks

Each track can accommodate a maximum of 60 students or as per the availability of maximum seats. Allocation will be based on a first-come first-served basis. However, the institute reserves the right to reassign tracks as per the requirement.

### 4. Course Duration

Students have to complete the certification course, which has a minimum duration of 30 hours.

### 5. Oral & Practical Exam

Based on the entire syllabus, oral (20 marks) & practical/implementation (30 marks) examination will be conducted. Grades will be assigned as per the examination rules.

**Note:** A minimum of 90% attendance is required to award the certificate. If a student fails to meet this requirement, the student needs to re-register for the course internally or externally until successfully completed.



## Course Title: Internship I

<b>Semester: IV</b>			<b>Term: Even</b>			<b>Course Code: 24CSOJT401B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
-	-	-	-	-	-	1	-	-	-	-	25	25

### Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program helps fresh pass-outs in gaining professional know-how and benefits corporate sectors. The internship also enhances the student's employability skills passing out from Technical Institutions.

### Objectives:

1. Integration of workshop with workplace in physical and/or hybrid model.
2. Developing research aptitude in emerging technologies
3. Enhance entrepreneurial capabilities and professional competency
4. Development of decision-making and teamwork skills
5. Cultivate a sense of Social Imagery and Citizenship Responsibility

**Outcomes:** After completion of this course, students will be able to

1. Apply practical skills effectively in physical and hybrid workplace settings.
2. Conduct and communicate research on emerging technologies.
3. Demonstrate creative problem-solving and an entrepreneurial mindset.
4. Meet industry standards with strong communication and technical skills.
5. Collaborate effectively and make informed decisions within teams.

### INTERNSHIP GUIDELINES:

- The students should apply for internships of their choice with the permission of the Institute.
- The internship duration ranges from 4 to 6 weeks and is scheduled during the summer vacation period for students
- Industry will confirm the training slots and the number of seats allocated for internships via confirmation letter/ email.
- Students on joining Training at the concerned Industry / Organization, submit the Joining Report/Letters / Email.
- Students undergo industrial training at the concerned Industry / Organization.
- Training and placement team will visit the industry and evaluate(s) the performance of students regularly and evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers.
- Students will submit training report after completion of internship.
- Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.



- It will be evaluated on the basis of the following criteria:
  - Regularity in maintenance of the diary.
  - Project/Case study/Completion of assigned task by industry undertaken during the internship
  - Employer feedback
- Training Certificate to be obtained from industry followed by the presentation in the department.



**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**

# Bachelor of Technology In Computer Engineering

Second Year  
Semester – VI  
SJCEM: R – 24B

**Effective from Academic Year 2025-26**



**Scheme of Third Year (Semester VI)  
Computer Engineering (With Effect from 2025-26)**

**Semester VI**

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CSPCC601B	PCC	Cloud Computing	3	-	2	3	-	1	4
24CSPCC602B	PCC	UI/UX Design Fundamentals	3	-	2	3	-	1	4
24CSPEC601XB	PEC	Professional Elective III	3	-	2	3	-	1	4
24CSPEC602XB	PEC	Professional Elective IV	3	-	2	3	-	1	4
24OE601XB	OE	Open Elective II	3	-	-	3	-	-	3
24CSVSE601B	VSEC	Employability Enhancement Program-III (Industry Certification)	-	-	-	-	-	1	1
24CSOJT601B	OJT	Internship - II	-	-	-	-	-	1	1
<b>Total</b>			<b>15</b>	<b>0</b>	<b>8</b>	<b>15</b>	<b>0</b>	<b>6</b>	<b>21</b>

Course Code	Vertical	Course Name	Evaluation Scheme					Total
			Theory			Practical		
			IAE 1	IAE 2	ESE	CA	OR/PR	
24CSPCC601B	PCC	Agile Development and Devops	20	20	60	25	-	125
24CSPCC602B	PCC	UI/UX Design Fundamentals	20	20	60	25	25	150
24CSPEC601XB	PEC	Professional Elective III	20	20	60	25	-	125
24CSPEC602XB	PEC	Professional Elective IV	20	20	60	25	-	125
24OE601XB	OE	Open Elective II	20	20	60	-	-	100
24CSVSE601B	VSEC	Employability Enhancement Program-III (Industry Certification)	-	-	-	-	50	50
24CSOJT601B	OJT	Internship - II	-	-	-	-	50	50
<b>Total</b>			<b>100</b>	<b>100</b>	<b>300</b>	<b>100</b>	<b>125</b>	<b>725</b>



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

# Syllabus for Third Year Computer Engineering Semester – VI

**SJCEM: R – 24B  
(With Effect from 2025-2026)**



## Course Title: Cloud Computing

Semester: VI

Term: EVEN

Course Code: 24CSPCC601B

### Teaching Scheme

### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	-	125

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment, TW: Term Work

### Course Objectives:

- To study fundamental concepts of cloud computing
- To learn various data storage methods on cloud
- To understand the implementation of Virtualization in Cloud Computing
- To learn the application and security on cloud computing
- To study risk management in cloud computing
- To understand the advanced technologies in cloud computing

### Course Outcomes:

Understand the different Cloud Computing environment

Use appropriate data storage technique on Cloud, based on Cloud application

Analyze virtualization technology and install virtualization software

Develop and deploy applications on Cloud

Apply security in cloud applications

Use advance techniques in Cloud Computing



Module	Contents	Hours	COs
1	<b>Introduction to Cloud Computing</b>	7	CO1
	Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage. Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models.  <b>Self-Learning Topics:</b> Application of Cloud Computing		
2	<b>Data Storage and Cloud Computing</b>	7	CO2
	Data Storage: Introduction to Enterprise Data Storage, Direct Attached Storage, Storage Area Network, Network Attached Storage, Data Storage Management, File System, Cloud Data Stores, Using Grids for Data Storage. Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing. Cloud Storage from LANs to WANs: Cloud Characteristics, Distributed Data Storage.  <b>Self-Learning Topics:</b> Application of Datastorage		
3	<b>Virtualization in Cloud Computing</b>	9	CO3
	Introduction: Definition of Virtualization, Adopting Virtualization, Types of Virtualizations, Virtualization Architecture and Software, Virtual Clustering, Virtualization Application, Pitfalls of Virtualization. Grid, Cloud and Virtualization: Virtualization in Grid, Virtualization in Cloud, Virtualization and Cloud Security. Virtualization and Cloud Computing: Anatomy of Cloud Infrastructure, Virtual infrastructures, CPU Virtualization, Network and Storage Virtualization.  <b>Self-Learning Topics:</b> Study of VMware		
4	<b>Cloud Platform and Cloud Application</b>	10	CO4
	<b>Amazon Web Services (AWS):</b> Amazon Web Services and Components, Amazon Simple DB, Elastic Cloud Computing (EC2), Amazon Storage System, Amazon Database services (Dynamo DB),  <b>Self-Learning Topics:</b> Overview of OpenStack architecture		
5	<b>Advance Techniques in Cloud Computing</b>	7	CO5
	Future Trends in cloud Computing, Mobile Cloud, Automatic Cloud Computing: Distributed Cloud Computing Vs Edge Computing, Containers, Docker, and Kubernetes,  <b>Self-Learning:</b> Introduction to DevOps. IOT and Cloud		
6	<b>Security in Cloud</b>	5	CO6
	Risk Management, Enterprise-Wide Risk Management, Types of Risks in Cloud Computing. Data Security in Cloud: Security Issues, Challenges, advantages, Disadvantages, Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud, Secure Cloud Software Requirements, Secure  <b>Self-Learning</b> Cloud Software Testing.		
	<b>Total</b>	<b>45</b>	



## List of Experiments:

Sr. No.	Title of Experiment	COs Mapped
1	To learn basic Linux commands for file and directory navigation. <b>Commands Used:</b> pwd, ls, cd, mkdir, rmdir, cp, mv, rm	CO1
2	To perform operations on files and directories. <b>Commands Used:</b> cat, touch, echo, more, less, head, tail	CO1
3	To modify file permissions and ownership.	CO1, CO5
4	To install and manage software packages. <b>Commands Used:</b> apt update, apt install, apt remove, yum install	CO1, CO4
5	To monitor running processes and system usage. <b>Commands Used:</b> ps, top, htop, df -h, free -m	CO1, CO3
6	To create and manage users and groups. <b>Commands Used:</b> adduser, passwd, groupadd, usermod, deluser	CO1, CO5
7	Create an AWS Free Tier Account	CO4
8	Explore AWS Management Console Dashboard	CO4
9	Case study on Amazon EC2 to learn about Amazon EC2, Amazon Elastic Compute Cloud is a central part of Amazon.com's cloud computing platform, Amazon Web Services. How EC2 allows users to rent virtual computers on which to run their own computer applications.	CO1, CO4
10	Case study on Microsoft Azure to learn about Microsoft Azure is a cloud computing platform and infrastructure, created by Microsoft, for building, deploying and managing applications and services through a global network of Microsoft-managed datacenters. How it works, different services provided by it	CO1, CO4, CO6
11	Implementation of Virtualization in Cloud Computing to Learn Virtualization Basics, Benefits of Virtualization in Cloud using Open Source Operating System. Use <b>VirtualBox</b> or <b>VMware</b> to create 2-3 VMs on your system. Run different OSs (Ubuntu + Fedora + Windows). <b>Goal:</b> Understand how virtualization divides hardware resources.	CO1, CO3

## 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:

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### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

**List of Teacher Assessment Examination (TAE):**



1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.

## Reference Books:

1. James Bond, "The Enterprise Cloud", O'Reilly Media, Inc. ISBN: 9781491907627
2. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more", Wiley Publications, ISBN: 978-0-470-97389-9
3. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.
4. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications", Cambridge University Press, ISBN: 9780511778476
5. Tim Mather, Subra K, Shahid L., "Cloud Security and Privacy", Oreilly, ISBN-13 978-81- 8404-815-5
6. Dr. Kumar Saurabh, "Cloud Computing, 4ed: Architecting Next-Gen Transformation Paradigms", Wiley publication, ISBN: 9788126570966
7. Rishabh Sharma, "Cloud Computing: Fundamentals, Industry Approach and Trends", Wiley publication, ISBN:

## Text Books:

1. A. Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning and Implementation", Pearson, ISBN: 978-81-317-7651-3
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education, ISBN-13:978-1-25-902995-0

## Useful Links:

### e-Books :

1. <https://sjceodisha.in/wp-content/uploads/2019/09/CLOUD-COMPUTING-Principles-and-Paradigms.pdf>
2. <https://studytm.files.wordpress.com/2014/03/hand-book-of-cloud-computing.pdf>
3. <https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf>
4. <https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.500-291r2.pdf>



## MOOCs Courses link:

1. Cloud Computing, [https://onlinecourses.nptel.ac.in/noc21\\_cs14/preview?](https://onlinecourses.nptel.ac.in/noc21_cs14/preview?)
2. Cloud Computing and Distributed System:  
[https://onlinecourses.nptel.ac.in/noc21\\_cs15/preview?](https://onlinecourses.nptel.ac.in/noc21_cs15/preview?)
3. <https://www.digimat.in/nptel/courses/video/106105167/L01.html>
4. <https://www.digimat.in/nptel/courses/video/106105167/L03.html>
5. <https://www.digimat.in/nptel/courses/video/106105167/L20.html>



## Course Title: UI/UX Design Fundamentals

Semester: VI

Term: EVEN

Course Code: 24CSPCC602B

### Teaching Scheme

### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	-	125

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment, TW: Term Work

### Course Objectives:

1. To introduce principles and methodologies of User Interface (UI) and User Experience (UX) design for computer systems and applications.
2. To enable students to design intuitive, accessible, and responsive interfaces for web, mobile, and software platforms.
3. To provide hands-on exposure to wireframing, prototyping, and usability testing using industry-standard tools.
4. To develop analytical skills for evaluating usability, accessibility, aesthetics, and interaction quality in software applications.

### Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Explain core principles, conventions, and processes involved in UI/UX design.
2. Apply layout principles, grids, and visual hierarchy to create efficient software interfaces.
3. Use typography, color theory, and accessibility standards to improve design quality.
4. Conduct user research, design personas, storyboards, and user flows for software systems.
5. Use design and prototyping tools (Figma, Adobe XD, Illustrator, Pencil Project) to develop interactive interfaces.
6. Discuss and analyze advanced UI/UX trends including motion design, AR/VR, voice, and AI-driven interfaces



Module	Contents	Hours	COs
<b>1</b>	<b>Introduction to UI/UX and User-Centered Design</b>	<b>8</b>	<b>CO1</b>
	<p>Definition and distinction between User Interface (UI) and User Experience (UX). Human-centered design (HCD) approach and design thinking process. The Elements of User Experience model (Garrett): Strategy, Scope, Structure, Skeleton, and Surface. Roles in the design process: UX designer, UI designer, researcher, developer. Understanding users: goals, needs, and mental models. Evolution of interface design: from command-line to graphical and responsive interfaces. Examples from software, web, and mobile applications.</p> <p><b>Self-Learning Topics:</b> Dark Mode and its usability impact.</p>		
<b>2</b>	<b>Principles of User Interface Design</b>	<b>8</b>	<b>CO2</b>
	<p>Fundamental UI design principles: Consistency, Visibility, Feedback, Affordance, Simplicity, and Tolerance.</p> <p>The design process for screen-based interfaces (Galitz).</p> <p>Structure of graphical user interfaces: menus, dialog boxes, controls, icons, toolbars, and forms. Formal and active elements of interface design.</p> <p>Layout strategies and grid-based composition.</p> <p>Designing for interaction: direct manipulation, feedback, response time.</p> <p>Error prevention and recovery in interface design.</p> <p>Case studies from operating systems and productivity software</p> <p><b>Self-Learning Topics:</b> Cooper's Goal-Directed Design process.</p>		
<b>3</b>	<b>Visual Design—Typography, Color, and Aesthetics</b>	<b>7</b>	<b>CO3</b>
	<p>Principles of visual communication in UI, Typography for screens: typeface selection, readability, hierarchy, alignment. Text organization: headlines, labels, and body text. Designing with color: harmonies, contrasts, psychological associations, Color models (RGB, HSL, CMYK) and guidelines for digital media. Legibility and accessibility: contrast ratios and WCAG guidelines. Integration of typography and color in interface composition.</p> <p><b>Self-Learning Topics:</b> Typography in developer tools</p>		
<b>4</b>	<b>UX Design Process and Evaluation</b>	<b>10</b>	<b>CO4</b>
	<p>Foundations of UX design: phases and deliverables, User research: contextual inquiry, observation, surveys, interviews, Personas and scenarios: definition, development, and use, Information architecture: sitemaps, user flows, and task analysis, Wireframing and storyboarding (low-fidelity), Prototyping techniques (paper to digital), Usability testing: goals, methods, metrics, and iterative design. Heuristic evaluation (Nielsen's 10 heuristics), Accessibility evaluation and inclusive design principles.</p> <p><b>Self-Learning Topics:</b> UX in mobile apps</p>		
<b>5</b>	<b>Design Tools and Interactive Prototyping</b>	<b>6</b>	<b>CO5</b>
	<p>Overview of modern design and prototyping tools: Figma, Adobe XD, Illustrator, Pencil Project. Creating wireframes, mockups, and prototypes, Interaction design in tools: linking, transitions, and micro-interactions, Responsive and adaptive design principles. Preparing assets and developer</p>		



Module	Contents	Hours	COs
	handoff documentation, Usability review using prototypes. <b>Self-Learning Topics:</b> Libraries in Figma		
<b>6</b>	<b>Advance Topics in UI/UX</b>	<b>6</b>	<b>CO6</b>
	Motion and Micro-interactions: Enhancing feedback and engagement. AR/VR Interface Design: Immersive user experiences. Voice User Interfaces (VUIs): Alexa, Siri, Google Assistant design guidelines. Design Systems and Component Libraries: Consistency and scalability. Emerging Trends: AI-driven UX, gesture-based interactions, accessibility automation. <b>Self-Learning Topics:</b> usability of voice assistants (Alexa, Google Assistant).		
	<b>Total</b>	<b>45</b>	

## List of Experiments:

Sr. No.	Title of Experiment	COs Mapped
1	Case study analysis of UI elements in apps like Zomato, Swiggy, IRCTC, Smart City app	CO1
2	Create a logo and branding style guide for a software product	CO2
3	Design a simple profile/login interface with form validation layout	CO2
4	Develop custom icons for a productivity or educational app	CO2, CO3
5	Apply typography and color theory to a learning management system interface	CO3
6	Evaluate good vs bad UI in existing websites (IRCTC, Govt portals, SCADA dashboards)	CO3, CO4
7	Create personas and wireframes for a college ERP or e-learning platform	CO4
8	Design a feedback form UI using icons and color cues for emotional feedback	CO4
9	Prototype an interactive mobile app (chat, delivery, or booking) using Figma	CO5
10	Analyze and present an advanced UI/UX trend (e.g., AR/VR, VUI, motion design)	CO6



## 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.



## Reference Books:

1. Rex Hartson, Pardha Pyla – The UX Book: Process and Guidelines for Ensuring a Quality User Experience, Elsevier.
2. Alan Cooper – About Face: The Essentials of Interaction Design, Wiley.
3. Don Norman – The Design of Everyday Things, Basic Books.

## Text Books:

1. Russ Unger, Carolyn Chandler – A Project Guide to UX Design, New Riders, 2012.
2. Jesse James Garrett – The Elements of User Experience, Pearson, 2011.
3. Wilbert O. Galitz – The Essential Guide to User Interface Design, Wiley, 2007.

## Useful Links:

1. Design & Implementation of Human-Computer Interfaces – NPTEL
2. User-centric Computing for Human-Computer Interaction – NPTEL
3. The Complete UX / UI Design Fundamentals Course – Udemy
4. UI/UX Design Fundamentals for Beginners – Udemy
5. Fundamentals of Interaction Design – Rochester Institute of Technology (edX)
6. LinkedIn Learning – “Foundations of UX: Prototyping”



## Course Title: Deep Learning

<b>Semester: VI</b>		<b>Term: EVEN</b>				<b>Course Code: 24CSPCC6011B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
2	-	2	2	-	1	3	20	20	60	25	-	125

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment, TW: Term Work

Prerequisite: Basic mathematics and Statistical concepts, Linear algebra, Machine Learning

### Course Objectives:

1. To learn the fundamentals of Neural Network.
2. To gain an in-depth understanding of training Deep Neural Networks.
3. To Gain insights into regularization techniques to prevent overfitting and enhance model generalization.
4. To Study the principles of auto encoders and their role in unsupervised learning, along with applications.
5. To CNNs for image processing and RNNs for sequence data, and explore architectures like LeNet, AlexNet, LSTM, and GRU.
6. To investigate the latest advancements in deep learning, such as GANs, and their applications in areas like image generation and Deep Fakes.

### Course Outcomes:

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

1. Demonstrate an understanding of neural network structures and their learning mechanisms, including perceptrons and multilayer networks.
2. Apply various optimization techniques and loss functions to effectively train deep neural networks.
3. Implement regularization techniques to handle overfitting and improve model performance in real world scenarios.
4. Develop and apply auto encoders for unsupervised learning tasks, including dimensionality reduction and data compression.
5. Design and implement CNN and RNN architectures for image and sequence data tasks, respectively, using modern deep learning frameworks.
6. Analyze the architecture and functioning of GANs, and explore their application in generating synthetic data such as images.



Module	Contents	Hours	COs
1	<b>Fundamentals of Neural Network</b>	5	CO1
	Biological neuron, Mc-Culloch Pitts Neuron, Perceptron, Perceptron Learning, Delta learning, Multilayer Perceptron: Linearly separable, linearly non-separable classes. Deep Networks: Fundamentals, Brief History, Three Classes of Deep Learning Basic Terminologies of Deep Learning  <b>Self-Learning Topics:</b> Hebbian Learning Theory, XOR Problem and its solution using Multilayer Perceptron (MLP)		
2	<b>Training, Optimization and Regularization of Deep Neural Network</b>	11	CO2
	<b>Training Feedforward DNN</b> Multi Layered Feed Forward Neural Network, Learning Factors, Activation functions: Tanh, Logistic, Linear, Softmax, ReLU, Leaky ReLU, Loss functions: Squared Error loss, Cross Entropy, Choosing output function and loss function . <b>Optimization</b> Learning with backpropagation, Learning Parameters: Gradient Descent (GD), Stochastic and Mini Batch GD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, Adam, RMSProp. <b>Regularization</b> Overview of Overfitting, Types of biases, Bias Variance Tradeoff Regularization Methods: L1, L2 regularization, Parameter sharing, Dropout, Weight Decay, Batch normalization, Early stopping, Data Augmentation, Adding noise to input and output  <b>Self-Learning Topics:</b> Advanced Optimizers: Nadam, AMSGrad Transfer Learning: Concept and Application		
3	<b>Autoencoders: Unsupervised Learning</b>	7	CO3
	Introduction, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoders. Denoising Autoencoders, Sparse Autoencoders, Contractive Autoencoders . Application of Autoencoders: Image Compression.  <b>Self-Learning Topics:</b> Variational Autoencoders (VAEs), Applications of Autoencoders in Anomaly Detection		
4	<b>Convolutional Neural Networks (CNN): Supervised Learning</b>	8	CO4
	Convolution operation, Padding, Stride, Relation between input, output and filter size, CNN architecture: Convolution layer, Pooling Layer, Weight Sharing in CNN, Fully Connected NN vs CNN, Variants of basic Convolution function Modern Deep Learning Architectures: LeNET: Architecture, AlexNET: Architecture <b>Self-Learning Topics:</b> Residual Networks (ResNet) and Skip		

Module	Contents	Hours	COs
	Connections, DenseNet: Densely Connected Convolutional Networks		
5	<p><b>Recurrent Neural Networks (RNN)</b>            Sequence Learning Problem, Unfolding Computational Graphs, Recurrent Neural Network, Bidirectional RNN, Backpropagation Through Time (BTT), Vanishing and Exploding Gradients, Truncated BTT. Long Short Term Memory: Selective Read, Selective write, Selective Forget, Gated Recurrent Unit</p> <p><b>Self-Learning Topics:</b> Applications of RNNs in Natural Language Processing (NLP), Attention Mechanisms in Sequence Models</p>	9	CO5
6	<p><b>Recent Trends and Applications</b>            Generative Adversarial Network (GAN): Architecture            Applications: Image Generation, DeepFake</p> <p><b>Self-Learning Topics:</b> Variational Autoencoders vs. GANs: A Comparative Study, Applications of GANs in Medical Imaging</p>	5	CO6
	<b>Total</b>	<b>45</b>	

### List of Experiments:

Sr. No.	Title of Experiment	COs Mapped
1	To explore python libraries for deep learning e.g. Theano, TensorFlow etc.	CO1
2	Implement Mc-Culloch Pitts model for binary logic functions	CO1
3	Apply any of the following learning algorithms to learn the parameters of the supervised single layer feed forward neural network. a. Stochastic Gradient Descent b. Mini Batch Gradient Descent c. Momentum GD d. Nestorev GD e. Adagrad GD f. Adam Learning GD	CO2
4	Implement a backpropagation algorithm to train a DNN with at least 2 hidden layers.	CO2
5	Design the architecture and implement the autoencoder model for Image Compression.	CO3
6	Design the architecture and implement the autoencoder model for Image denoising	CO3
7	Design and implement a CNN model for digit recognition application.	CO4
8	Design and implement a CNN model for image classification	CO4
9	Design and implement LSTM for Sentiment Analysis.	CO5
10	Generating faces using a pre-trained GAN in Python/TensorFlow.	CO6

### 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.

## C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.

### Reference Books:

1. Buduma, N. and Locascio, N., —Fundamentals of deep learning: Designing next-generation machine in- telligence algorithms" 2017. O'Reilly Media, Inc."
2. François Chollet. —Deep learning with Python —(Vol. 361). 2018 New York: Manning.
3. Douwe Osinga. —Deep Learning Cookbook, O'REILLY, SPD Publishers, Delhi.
4. Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc
5. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India

### Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. —Deep Learning, MIT Press Ltd, 2016
2. Li Deng and Dong Yu, —Deep Learning Methods and Applications, Publishers Inc.
3. Satish Kumar "Neural Networks A Classroom Approach" Tata McGraw-Hill.
4. JM Zurada —Introduction to Artificial Neural Systems, Jaico Publishing House
5. M. J. Kochenderfer, Tim A. Wheeler. —Algorithms for Optimization, MIT Press.

### Useful Links:



# St. John College of Engineering and Management

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1. <https://deeplearning.cs.cmu.edu/S21/index.html>
2. <http://www.cse.iitm.ac.in/~miteshk/CS6910.html>
3. <https://nptel.ac.in/courses/106/106/106106184/>
4. <https://www.deeplearningbook.org>



## Course Title: Data mining & Business Intelligence

Semester: VI

Term: EVEN

Course Code: 24CSPEC6012B

### Teaching Scheme

### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	-	125

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment, TW: Term Work

### Course Objectives:

1. To introduce the concept of data warehouse data Mining as an important tool for enterprise data management and as a cutting-edge technology for building competitive advantage
2. To enable students to effectively identify sources of data and process it for data mining
3. To make students well versed in all data mining algorithms, methods of evaluation.
4. To Enable students to understand and apply Business Intelligence concepts, tools, and analytics for data-driven decision-making.

### Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Demonstrate an understanding of the importance of data warehousing and data mining and the principles of business intelligence
2. Organize and prepare the data needed for data mining using preprocessing techniques
3. Apply classification, clustering, and association rule mining techniques to analyze datasets and discover meaningful patterns.
4. Explain BI fundamentals, KPIs, and balanced scorecards.
5. Implement and analyze enterprise BI solutions and decision support systems.
6. Implement BI tools and advanced analytics to solve enterprise problems



Module	Contents	Hours	COs
1	<b>Data Warehouse (DWH) Fundamentals with Introduction to Data Mining</b>	4	CO1
	DWH characteristics, Dimensional modeling: Star, Snowflakes, OLAP operation, OLTP vs OLAP. Introduction to Data Mining, KDD Process, Kind of patterns to be mined, Technologies used, Data Mining applications.  <b>Self-Learning Topics:</b> Data Marts, Major issues in Data Mining		
2	<b>Data Exploration and Data Preprocessing</b>	8	CO2
	Types of Attributes, Statistical Description of Data, Measuring Data Similarity and Dissimilarity. Why Preprocessing? Data Cleaning, Data Integration, Data Reduction: Attribute Subset Selection, Histograms, Clustering, Sampling, Data Cube aggregation, Data transformation and Data Discretization: Normalization, Binning, Histogram Analysis  <b>Self-Learning Topics:</b> Data Visualization, Concept hierarchy generation		
3	<b>Classification, Clustering, Association</b>	12	CO3
	Classification methods: Decision Tree Induction: Attribute Selection Measures, Tree pruning. Bayesian Classification: Naïve Bayes Classifier. Clustering :Partition Methods( K-Means, K- Medoids), Hierarchical Methods(Agglomerative, Divisive). Market Basket Analysis, Frequent Item Sets, Closed Item Sets and Association Rule, Frequent Pattern Mining, Apriori Algorithm, Association Rule Generation  <b>Self-Learning Topics:</b> Real-world applications of association rule mining in retail, e-commerce, and healthcare.		
4	<b>Business Intelligence Fundamentals</b>	07	CO4
	Introduction to BI – Definition, Need & Scope, BI vs. Data Mining vs. Data Analytics, BI for Enterprise Decision Making, BI System Architecture (Components & Layers), Data Governance & Data Quality Management, Business Performance Management (BPM) – Concepts, KPIs, Metrics, CSFs, Balanced Scorecards – Strategic Alignment  <b>Self-Learning Topics</b> Case studies on KPIs in different industries (Retail, Banking, Healthcare), Trends in Business Performance Management (BPM)		
5	<b>Decision Support &amp; Enterprise BI Deployment</b>	07	CO5



Module	Contents	Hours	COs
	Decision Support Systems (DSS) – Types & Components, BI Project Lifecycle & BI Strategy Implementation, Enterprise BI Solutions: CRM Analytics, SCM Analytics, HR & Finance Analytics, Metadata and Master Data Management (MDM), BI Security, Privacy & Governance Compliance, Change Management & User Adoption, ROI Analysis for BI Solutions  <b>Self-Learning Topics</b> BI Security, Privacy, and Governance frameworks in enterprises		
<b>6</b>	<b>BI Tools, Advanced Analytics &amp; Trends</b>	<b>07</b>	<b>CO6</b>
	ETL Tools for BI – Introduction & Workflow, Cloud BI – Architecture & Case Studies, Real-time BI, Mobile BI, Self-service BI and Collaborative BI, Big Data BI and Hadoop-based BI solutions, Predictive Analytics in BI – Forecasting, What-if analysis Emerging Trends & Applications: AI-driven BI, Conversational BI,  <b>Self-Learning Topics</b> - Data Stories, Industry Case Studies – Retail, Banking, Healthcare, E-Commerce		
	<b>Total</b>	<b>45</b>	

### List of Experiments:

Sr. No.	Title of Experiment	COs Mapped
1	Design dimensional modelling : Design Star and Snowflake Schema	CO1
2	Implement using tools or languages like JAVA/ python/R a) Data Exploration b) Data preprocessing	CO2
3	Implement and evaluate using languages like JAVA/ python/R Classification Algorithms	CO3
4	Implement and evaluate using languages like JAVA/ python/R Clustering Algorithms	CO3
5	Implement and evaluate using languages like JAVA/ python/R Frequent Pattern Mining Algorithms	CO3
6	Understand KPIs, Metrics, and Critical Success Factors (CSFs) in a business scenario.	CO4
7	Design a strategic balanced scorecard for a given business scenario.	CO4
8	To design and implement an ETL pipeline for data integration.	CO5
9	To perform forecasting and what-if analysis using BI tools.	CO5
10	Simulate decision-making using a DSS framework for a business scenario.	CO5
11	Explore real-time BI and cloud-based analytics.	CO6



Sr. No.	Title of Experiment	COs Mapped
12	To implement a BI solution for a real-world enterprise scenario.	CO6

## 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 the entire syllabus.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.



## Reference Books:

1. Michael Berry and Gordon Linoff “Data Mining Techniques”, 2nd Edition Wiley Publications.
2. Michael Berry and Gordon Linoff “Mastering Data Mining- Art & science of CRM”, Wiley Student Edition.
3. Vikram Pudi & Radha Krishna, “Data Mining”, Oxford Higher Education.
4. Rick Sherman, “Business Intelligence Guidebook: From Data Integration to Analytics”, 2nd Edition, Morgan Kaufmann
5. Galit Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, 2nd Edition, Wiley India
6. Cindi Howson, “Successful Business Intelligence: Unlock the Value of BI & Big Data”, 2nd Edition, McGraw-Hill

## Text Books:

1. Han, Kamber, "Data Mining Concepts and Techniques", Morgan Kaufmann 3rd Edition.
2. P. N. Tan, M. Steinbach, Vipin Kumar, “Introduction to Data Mining”, Pearson Education.
3. Paulraj Ponniah “Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals” Wiley Publications
4. Business Intelligence: Data Mining and Optimization for Decision Making by Carlo Vercellis, Wiley India Publications.
5. G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, 2nd Edition, Wiley India
6. Jyotiranjana Hota, “Data Mining and Business Intelligence: Data-driven Strategy for Business Transformation”, 1st Edition, Wiley India
7. Galit Shmueli, N.R. Patel, P.C. Bruce, “Business Intelligence: Data Mining and Optimization for Decision Making”, 1st Edition, Wiley India

## Useful Links:

1. Data Mining [https://onlinecourses.nptel.ac.in/noc21\\_cs06/preview](https://onlinecourses.nptel.ac.in/noc21_cs06/preview)
2. <https://www.coursera.org/specializations/data-mining>
3. [https://onlinecourses.nptel.ac.in/noc20\\_cs12/preview](https://onlinecourses.nptel.ac.in/noc20_cs12/preview)



### Course Title: Information and Cyber Security

Semester: VI

Term: EVEN

Course Code: 24CSPEC6021B

#### Teaching Scheme

#### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	-	125

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment, TW: Term Work

#### Course Objectives:

1. To understand the fundamental concepts of information security, including security goals, policies, and risk management frameworks.
2. To analyze various types of cyber threats, vulnerabilities, and attacks in diverse environments such as social networks, cloud computing, IoT, and mobile platforms.
3. To apply access control models, security standards, compliance frameworks, and cyber laws for safeguarding organizational information assets.
4. To demonstrate skills in incident response, digital forensics, disaster recovery, and the design of security strategies for emerging technologies like cloud and IoT.

#### Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Understand the fundamentals of information security, security policies, and risk management frameworks.
2. Analyze cyber threats, vulnerabilities, and attacks across different environments (social, cloud, IoT, mobile).
3. Apply access control models, security standards, and compliance frameworks to protect information assets.
4. Examine cyber laws, ethics, and data privacy regulations in the context of organizational security.
5. Understand the fundamentals of digital forensics and the basic concepts of business continuity and disaster recovery.
6. Design and evaluate security strategies for emerging technologies like cloud, IoT, and mobile ecosystems.



Module	Contents	Hours	COs
1	<b>Introduction to Information Security</b>	8	CO1
	Information Security overview: definition, importance, principles (CIA + AAA). Security governance: policies, procedures, standards, and guidelines. Risk management: risk assessment, risk analysis methods (qualitative vs quantitative). Security frameworks: ISO 27001, NIST, COBIT overview.  <b>Self-Learning Topics:</b> Case Study on Cyberattack Incident and Mitigation Strategies		
2	<b>Threats, Vulnerabilities, and Attacks</b>	8	CO2
	Classification of threats: internal vs external, human vs technical. Social engineering, phishing, identity theft, insider threats. Security in web and mobile environments (overview only, not cryptographic). Vulnerability assessment & penetration testing process.  <b>Self-Learning Topics:</b> Study recent real-world cyber-attacks (Equifax, SolarWinds, etc.).		
3	<b>Access Control, Authentication &amp; Security Models</b>	7	CO3
	Access control principles, models: DAC, MAC, RBAC, ABAC. Identity and Access Management (IAM): roles, provisioning, SSO, MFA. Security standards and best practices (ISO/IEC 27002). Physical security controls and environment protection.  <b>Self-Learning Topics :</b> Zero Trust Architecture overview.		
4	<b>Cyber Laws, Ethics &amp; Compliance</b>	8	CO4
	Cyber laws in India: IT Act 2000 & Amendments, data privacy laws (DPDP Act 2023). Global privacy frameworks: GDPR, HIPAA, PCI-DSS overview. Ethical hacking principles and responsible disclosure.  <b>Self-Learning Topics :</b> Case study – Legal implications of a cybercrime incident.		
5	<b>Fundamentals of Forensics &amp; Business Continuity</b>	8	CO5
	Introduction to digital forensics – objectives, process, and scope, Forensic principles, types of digital forensics, Legal, ethical and privacy issues in forensics. Business Continuity and Disaster Recovery (BC/DR) : Concepts of business continuity and disaster recovery. Risk assessment and impact analysis, BC/DR plans, backup strategies, redundancy, and failover mechanisms.  <b>Self-Learning Topics :</b> Role of digital forensics in identifying cyberattacks,		
6	<b>Security for Emerging Technologies</b>	6	CO6



Module	Contents	Hours	COs
	Cloud security: shared responsibility model, threats, CSA framework. IoT security: architecture, vulnerabilities, secure design. Mobile security: Android/iOS attack surfaces, app hardening. AI & Big Data security challenges (overview).  <b>Self-Learning Topics:</b> Explore real-world IoT security breach cases		
	<b>Total</b>	<b>45</b>	

## List of Experiments:

Sr. No.	Title of Experiment	COs Mapped
1	Study and documentation of an Information Security Policy and its key elements (confidentiality, access, backup).	CO1
2	Perform Risk Assessment of a given case (small organization or college lab) using a risk matrix	CO1
3	Threat modeling for a simple system using STRIDE methodology.	CO2
4	Demonstrate phishing simulation or detection using online tools (e.g., GoPhish or email header analysis).	CO2
5	Perform vulnerability scanning using tools like OpenVAS/Nessus (safe environment).	CO2
6	Configure Access Control policies and permissions on Linux/Windows systems.	CO3
7	Configure and demonstrate Multi-Factor Authentication (MFA) using open-source tools or cloud accounts.	CO3
8	Analyze and summarize the IT Act 2000 or DPDP Act 2023 key sections relevant to cyber security	CO4
9	Study and compare data protection standards – GDPR vs HIPAA vs DPDP Act (tabular report).	CO4
10	Case study on digital forensic investigation of a cybercrime incident.	CO5
11	Performing a basic data backup and restore operation.	CO5
12	Case study on Business Continuity Plan.	CO5
13	Demonstrate Cloud Security setup (access controls on AWS/Azure free tier).	CO6
14	Evaluate security in an IoT device or network using simulation tools (e.g., IoT Security Framework).	CO6
15	Mini-project / Case Study on recent cyberattack and presentation.	CO1-CO6

## 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:**

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

## **C. Continuous Assessment (CA):**

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

### **List of Teacher Assessment Examination (TAE):**

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.

## **Reference Books:**

1. Nina Godbole and Sunit Belapure, "Information Systems Security: Security Management, Metrics, Frameworks and Best Practices", Wiley India, Revised Edition.
2. William Stallings, "Effective Cybersecurity: A Guide to Using Best Practices and Standards", Pearson Education, Latest Edition.
3. P. W. Singer and Allan Friedman, "Cybersecurity and Cyberwar: What Everyone Needs to Know", Oxford University Press, Latest Edition.
4. Raef Meeuwisse, "Cybersecurity for Beginners", CreateSpace / Independently Published, Latest Edition.
5. Chuck Easttom, "Computer Security Fundamentals", Pearson Education, Fourth Edition.



## Text Books:

1. Brian Craig, “Cyber Law: The Law of the Internet and Information Technology”, Pearson Education, Latest Edition.
2. Nina D. Zivkovic, “Cyber Forensics: From Data to Digital Evidence”, CRC Press, Latest Edition.
3. ISO/IEC, “27001 & 27002 Standards: Information Security Management Systems (ISMS) and Controls”, International Organization for Standardization, Latest Edition.
4. SO/IEC, “27001 & 27002 Standards: Information Security Management Systems (ISMS) and Controls”, International Organization for Standardization, Latest Edition.

## Useful Links:

1. [https://onlinecourses.swayam2.ac.in/cec25\\_cs05/preview](https://onlinecourses.swayam2.ac.in/cec25_cs05/preview)
2. <https://nptel.ac.in/courses/106106248>
3. <https://nptel.ac.in/courses/106105162>
4. <https://nptel.ac.in/courses/106105031>



## Course Title: Computer Vision

Semester: VI

Term: EVEN

Course Code:24CSPEC6022B

### Teaching Scheme

### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	-	125

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

### Course Objectives:

1. To understand the fundamental concepts of Computer Vision and digital image processing.
2. To introduce the processes involved in image enhancement and restoration.
3. To gain understanding of color image processing and morphology.
4. To impart knowledge of image segmentation and object reorganization techniques

### Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Understand the fundamentals of Computer Vision.
2. Implement the concept of Computer Vision in its applications.
3. Apply image enhancement techniques for smoothening and sharpening of images.
4. Compare different image segmentation and restoration techniques.
5. Demonstrate smoothening and sharpening techniques for color images.
6. Explain morphological, feature extraction, pattern classification techniques for object recognition.

Module	Contents	Hours	COs
1	<b>Introduction</b>	6	CO1
	What is Computer vision? A brief history. Image Formation: Photometric image formation. The digital camera.  <b>Self-Learning Topics:</b> Image processing: Point operators, Linear filtering.		
2	<b>Image Processing:</b>	8	CO2
	More neighborhood operators. Fourier transforms. Pyramids and wavelets.  <b>Self-Learning Topics:</b> Geometric Transformations.		
3	<b>Image Restoration and Reconstruction:</b>	9	CO3
	A model of Image degradation/restoration process. Restoration in the presence of noise only. Periodic noise reduction by frequency domain filtering. Image Segmentation: Fundamentals, Point, Line and edge detection, thresholding (Foundation & Basic global thresholding only).  <b>Self-Learning Topics:</b> Segmentation by region growing & region splitting & merging.		
4	<b>Color Image Processing:</b>	8	CO4
	Color fundamentals, color models. Pseudo-color image processing. Full color image processing. Color transformations. Color image smoothing and sharpening. Using color in image segmentation.  <b>Self-Learning Topics:</b> Noise in color images.		
5	<b>Morphological Image Processing:</b>	8	CO5
	Preliminaries. Erosion and Dilation. Opening and closing. Hit-or-miss transform. Some basic morphological algorithms. Feature Extraction: Background. Boundary.  <b>Self-Learning Topics:</b> Preprocessing (Boundary following & Chain codes only).		
6	<b>Image pattern Classification:</b>	6	CO6
	Background, Patterns and classes.  <b>Self-Learning Topics:</b> Pattern classification by prototype matching (Minimum distance classifier only).		
	<b>Total</b>	45	

## List of Experiments:

Sr. No.	Title of Experiment	COs Mapped
1	Study of Computer Vision Applications	CO1
2	Implementation of Neighborhood Operators for Image Smoothing and Sharpening	CO2
3	Edge Detection using Gradient-Based Neighborhood Operators	CO2
4	Simulation of Image Degradation and Restoration Process	CO3
5	Implementation of Image Restoration in the Presence of Noise Only	CO3
6	Study of Color Fundamentals and Different Color Models (RGB, HSV, CMY, YCbCr)	CO4
7	Conversion between Various Color Models using OpenCV/MATLAB	CO4
8	Study of Basic Morphological Image Processing Operations	CO5
9	Implementation of Erosion and Dilation on Binary Images	CO5
10	Study of Image Background and Foreground Separation Techniques	CO6

## 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:

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

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review



9. Quiz

10. Mind Mapping

11. Any Other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.

### Reference Books:

1. David Forsyth and Jean Ponce, Computer Vision: A Modern Approach, 2nd Edition, Pearson, 2015.
2. Reinhard Klette, Concise Computer Vision - An Introduction into Theory and Algorithms, Springer, 2014.

### Text Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications (Texts in Computer Science), 2nd Edition, 2022, Springer.
2. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Pearson, 4th edition, 2019.

### Useful Links:

1. Virtual labs: <https://cse19-iiith.vlabs.ac.in/>
2. [https://onlinecourses.nptel.ac.in/noc21\\_ee78/preview](https://onlinecourses.nptel.ac.in/noc21_ee78/preview)
3. Introduction to Machine Vision: <https://www.youtube.com/watch?v=tY2gczObpfU>
4. [https://coral.ise.lehigh.edu/optml/files/2019/10/OptML\\_CV\\_tutorial\\_1\\_compressed.pdf](https://coral.ise.lehigh.edu/optml/files/2019/10/OptML_CV_tutorial_1_compressed.pdf)



## Course Title: : Organizational Behaviour

Semester: VI

Term: Even

Course Code: 24OE6011B

### Teaching Scheme

### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

### Course Objectives:

1. To introduce the fundamentals and scope of Organisational Behaviour and its importance in business.
2. To analyse individual differences and behavioural aspects such as motivation, personality, and perception.
3. To evaluate the influence of group behaviour, leadership, conflict, and stress on organisational effectiveness.
4. To apply concepts of organisational culture, change, and development for effective management.

### Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Explain the foundations, concepts, and models of organisational behaviour and their relevance to management practice.
2. Apply theories of motivation, learning, perception, and personality to analyse individual behaviour at the workplace.
3. Analyse group dynamics, teamwork, and decision-making processes to improve group effectiveness.
4. Apply leadership theories and conflict management techniques to real organisational situations.
5. Evaluate causes of stress, coping strategies, and approaches to organisational change and development.
6. Interpret the role of organisational culture and climate in shaping employee behaviour and organisational performance.



Module	Content	Hours	COs
1	<b>Module 1: Introduction to OB</b> Nature, scope, and importance of OB, Contributing disciplines (Psychology, Sociology, Anthropology, Political Science), Models of OB (Autocratic, Custodial, Supportive, Collegial, System), Hawthorne studies and key behavioural foundations, Challenges and opportunities in OB	8	CO1
2	<b>Module 2: Individual Behaviour in Organizations</b> Personality: determinants, traits, and types, Perception: process, factors, and errors, Attitudes, values, and beliefs, Motivation: content and process theories (Maslow, Herzberg, McGregor), Learning: classical, operant, social learning theories, Motivation-performance link, incentives (financial & non-financial)	8	CO 2
3	<b>Module 3: Group Behaviour &amp; Teamwork</b> Groups vs. Teams: features and importance, Stages of group development (Tuckman), Group norms, cohesiveness, and effectiveness, Team roles, building, and decision-making, Inter-group relations and conflicts	7	CO 3
4	<b>Module 4: Leadership &amp; Conflict Management</b> Leadership: meaning, traits, and characteristics, Theories of leadership: Trait, Behavioural, Contingency (Fiedler, Path-Goal), Leadership styles and modern perspectives, Conflict: nature, levels, and types, Conflict management approaches and negotiation	7	CO 4
5	<b>Module 5: Stress &amp; Organisational Change</b> Stress: meaning, causes, and consequences, Stress management: individual & organisational strategies, Organisational change: nature, resistance, and strategies, Planned change and steps, Organisational Development: objectives, interventions	8	CO 5
6	<b>Module 6: Organisational Culture &amp; Climate</b> Concept, importance, and elements of culture, Managing organisational culture and sub-cultures, Organisational climate: factors and measurement, Relationship of culture & climate with effectiveness, Contemporary issues: ethics, work-life balance, globalisation	7	CO 6
<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. Luthans, F. (2017). *Organisational Behavior-An evidence based approach*. (12th ed.). McGraw-Hill Education.
2. Pareek, U. (2014). *Understanding Organisational Behavior*. Delhi, India: Oxford University Press.
3. Robbins, S. T., & Judge, T. A. (2019). *Essentials of Organizational Behaviour*. (14<sup>th</sup> ed.). London, United Kingdom: Pearson.
4. Singh, A. K., & Singh, B. P. (2007). *Organisational Behavior*. Delhi, India: Excel Books Pvt. Ltd.
5. Singh, K. (2015). *Organisational Behavior: Texts & Cases*. (3rd ed.). India: Pearson.

## Text Books:

1. Greenberg, J. (2015). *Behavior in Organizations*. (10th ed.). Delhi, India: Pearson Education India.
2. Hersey, P. K., Blanchard, D., & Johnson, D. (2013). *Management of Organizational Behavior*. Pearson.

## Useful Links:

1. [https://onlinecourses.nptel.ac.in/noc25\\_mg80/preview](https://onlinecourses.nptel.ac.in/noc25_mg80/preview)
2. [https://onlinecourses.nptel.ac.in/noc24\\_mg45/preview](https://onlinecourses.nptel.ac.in/noc24_mg45/preview)
3. <https://www.coursera.org/learn/managing-people-iese>
4. [https://www.udemy.com/topic/organizational-behavior/?srsltid=AfmBOoqnqkmy7IS\\_9U0iGMzGxhEhHsciebpf\\_d\\_eb2xwkQwkRZ\\_pXRrE](https://www.udemy.com/topic/organizational-behavior/?srsltid=AfmBOoqnqkmy7IS_9U0iGMzGxhEhHsciebpf_d_eb2xwkQwkRZ_pXRrE)



## Course Title: Publication Guidelines and Selection of Publishers

Semester: VI

Term: Even

Course Code: 24OE6012B

### 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

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

### Course Objectives:

1. Familiarize students with the fundamentals of research publication ethics, processes, and standards.
2. Enable learners to identify suitable journals, conferences, and publishers for their research work.
3. Develop understanding of indexing, impact metrics, and quality parameters of scientific journals.
4. Guide students in preparing high-quality manuscripts and avoiding unethical publication practices.

### Course Outcomes:

On successful completion of the course, students will be able to...

1. Explain the publication process, ethics, and structure of scholarly articles.
2. Identify appropriate journals and publishers based on indexing, scope, and impact factors.
3. Prepare a research manuscript adhering to standard publication guidelines.
4. Analyze different types of open access and subscription-based publishing models.
5. Evaluate journal quality using metrics such as Scopus, Web of Science, SJR, and CiteScore.
6. Demonstrate awareness of predatory journals, plagiarism, and intellectual property considerations in publishing.

Module	Content	Hours	COs
1	<p><b>Introduction to Research and Publication Ethics</b></p> <ul style="list-style-type: none"> <li>• Definition and importance of research publications</li> <li>• Types of research outputs – journal papers, conference papers, patents, books, chapters</li> <li>• Ethics in research and publication – plagiarism, fabrication, falsification, authorship ethics</li> <li>• Role of UGC-CARE, COPE, and other ethical bodies</li> </ul> <p><b>Self-Learning Topics:</b></p> <ul style="list-style-type: none"> <li>• Case studies of publication misconduct</li> <li>• Tools for plagiarism checking (Turnitin, iThenticate)</li> </ul>	8	CO1
2	<p><b>Structure and Components of a Research Paper</b></p> <ul style="list-style-type: none"> <li>• IMRaD format (Introduction, Methods, Results, and Discussion)</li> <li>• Title, abstract, keywords, and references</li> <li>• Writing style, clarity, and technical presentation</li> <li>• Common errors in manuscript writing</li> </ul> <p><b>Self-Learning Topics:</b></p> <ul style="list-style-type: none"> <li>• Review of high-quality papers in one's own domain</li> <li>• Practice: Drafting an abstract and title for a sample research topic</li> </ul>	8	CO2
3	<p><b>Journal Selection and Publisher Identification</b></p> <ul style="list-style-type: none"> <li>• Understanding journal scope and aims</li> <li>• Parameters for journal selection: indexing, impact factor, acceptance rate, review process</li> <li>• Publisher types: academic, society, and commercial publishers</li> <li>• Overview of major publishers (Elsevier, Springer, IEEE, Taylor &amp; Francis, Wiley, etc.)</li> </ul> <p><b>Self-Learning Topics:</b></p> <ul style="list-style-type: none"> <li>• Identifying suitable journals using Scopus, Web of Science, or DOAJ</li> <li>• Exploring publisher portals for submission guidelines</li> </ul>	7	CO3
4	<p><b>Indexing, Impact Metrics, and Quality Evaluation</b></p> <ul style="list-style-type: none"> <li>• Indexing databases: Scopus, Web of Science, PubMed, Google Scholar</li> <li>• Impact metrics: Impact Factor, SJR, CiteScore, h-index</li> <li>• Understanding quartiles (Q1–Q4)</li> <li>• Identifying predatory journals and fake publishers</li> </ul> <p><b>Self-Learning Topics:</b></p> <ul style="list-style-type: none"> <li>• Checking authenticity of journals via Scopus or UGC-CARE List</li> </ul>	7	CO4

	<ul style="list-style-type: none"> <li>Comparing journals using SJR or CiteScore</li> </ul>		
5	<p><b>Open Access and Copyright in Scholarly Publishing</b></p> <ul style="list-style-type: none"> <li>Open Access models: Gold, Green, Hybrid</li> <li>Publication charges (APC), institutional repositories</li> <li>Copyright, licensing (Creative Commons), and author rights</li> <li>Retraction and corrections in publications</li> </ul> <p><b>Self-Learning Topics:</b></p> <ul style="list-style-type: none"> <li>Study of Creative Commons licenses</li> <li>Explore open access repositories (arXiv, SSRN, ResearchGate)</li> </ul>	8	CO5
6	<p><b>Manuscript Submission, Review, and Post-Publication Process</b></p> <ul style="list-style-type: none"> <li>Journal submission systems (Editorial Manager, ScholarOne, etc.)</li> <li>Peer review process: types, timelines, reviewer feedback</li> <li>Revision and resubmission process</li> <li>Promoting research visibility: ORCID, ResearchGate, Google Scholar, LinkedIn</li> <li>Citation management tools (Mendeley, EndNote, Zotero)</li> </ul> <p><b>Self-Learning Topics:</b></p> <ul style="list-style-type: none"> <li>Creating and maintaining a professional research profile (ORCID, Google Scholar)</li> <li>Simulated peer-review exercise</li> </ul>	7	CO6
<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. **Santosh Kumar Yadav**, *Research and Publication Ethics*, Springer Nature Year: 2023
2. **Maria Bonn, Josh Bolick & Will Cross (eds.)**, *Scholarly Communication Librarianship and Open Knowledge*, Association of College & Research Libraries (ALA) / ALA Editions Year: 2023
3. **Patrick Gamsby**, *The Discourse of Scholarly Communication*, Lexington Books Year: 2023

## Text Books:

1. **Sheeba P. S.**, *Research and Publication Ethics: A Comprehensive Guide to Ethical Research Practices*, Notion Press, Year: 2024
2. **(Alternate Textbook)**, *Research Publication and Ethics: A Comprehensive Guide* Publisher / Author details: (Amazon listing), Year: 2024
3. **Uendra Pratap Singh, Sakshi Ahlawat, Sushma Sharma** — *Research & Publication Ethics*, Sultan Chand & Sons, 2025

## Useful Links:

[https://onlinecourses.swayam2.ac.in/nou25\\_ge91/preview](https://onlinecourses.swayam2.ac.in/nou25_ge91/preview)

[https://onlinecourses.swayam2.ac.in/cec24\\_ge17/preview](https://onlinecourses.swayam2.ac.in/cec24_ge17/preview)



## Course Title: Employability Enhancement Program -III (Industry Certification)

Semester: VI

Term: Even

Course Code: 24CSVSE601B

### Teaching Scheme

### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	2	-	-	1	1	-	-	-	-	25	25

### Introduction

As global competition intensifies, industries seek candidates who are not only skilled but also adaptable and ready to meet the demands of an evolving workforce. To bridge the gap between academic learning and industry expectations, SJCEM has introduced certification courses aimed at preparing students for impactful internships. These courses provide students with essential knowledge and skills, empowering them to excel in professional environments and increase their employability.

**Objectives:** The objectives of this course are to

1. Develop Professional Skills
2. Enhance Technical Competency
3. Cultivate Problem-Solving Abilities
4. Promote Ethical and Professional Conduct
5. Familiarize with Industry Standards and Expectations
6. Prepare for a Transition from Classroom to Workplace

**Outcomes:** After completion of this course, students will be able to

1. Communicate and Collaborate Effectively
2. Acquire Job-Ready Technical Skills
3. Enhanced Critical Thinking and Problem-Solving
4. Understand Ethical and Professional Standards
5. Use Industry Tools and Standards
6. Industry Integration effectively

### Certification GUIDELINES:

The general procedure for organizing certification courses is as follows:

#### 1. Identification of Industry Partners

Industries have been identified to provide in-house certification courses in various domains. Students are regularly informed and encouraged to pursue these certification courses.

#### 2. Selection of Certification Domain

Students can choose two domains of their interest for the certification course and express their willingness to pursue the certification.

Following combination of domains are offered in the even semesters:

	Domain 1	Domain 2
Track 1	SQL	.NET
Track 2	CCNA	AI-IBM
Track 3	Cyber Security	AI-IBM
Track 4	Creo	Solid Works
Track 5	Data Science	Prompt Engineering and AI
Track 6	MernStack	Flutter
Track 7	AR-VR	Game Development
Track 8	Drone	Data Analytics
Track 9	IELTS/GRE	Certificate in Social Science
Track 10	Robotic	IoT
Track 11	Blockchain Basics	Blockchain Intelligence
Track 12	AWS	MernStack

### 3. Allocation of Tracks

Each track can accommodate a maximum of 60 students or as per the availability of maximum seats. Allocation will be based on a first-come first-served basis. However, the institute reserves the right to reassign tracks as per the requirement.

### 4. Course Duration

Students have to complete the certification course, which has a minimum duration of 30 hours.

### 5. Oral & Practical Exam

Based on the entire syllabus, oral (20 marks) & practical/implementation (30 marks) examination will be conducted. Grades will be assigned as per the examination rules.

**Note:** A minimum of 90% attendance is required to award the certificate. If a student fails to meet this requirement, the student needs to re-register for the course internally or externally until successfully completed.



## Course Title: Internship I

Semester: VI

Term: Even

Course Code: 24CSOJT601B

### Teaching Scheme

### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	-	-	-	-	1	-	-	-	-	25	25

### Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program helps fresh pass-outs in gaining professional know-how and benefits corporate sectors. The internship also enhances the student's employability skills passing out from Technical Institutions.

### Objectives:

1. Integration of workshop with workplace in physical and/or hybrid model.
2. Developing research aptitude in emerging technologies
3. Enhance entrepreneurial capabilities and professional competency
4. Development of decision-making and teamwork skills
5. Cultivate a sense of Social Imagery and Citizenship Responsibility

**Outcomes:** After completion of this course, students will be able to

1. Apply practical skills effectively in physical and hybrid workplace settings.
2. Conduct and communicate research on emerging technologies.
3. Demonstrate creative problem-solving and an entrepreneurial mindset.
4. Meet industry standards with strong communication and technical skills.
5. Collaborate effectively and make informed decisions within teams.

### INTERNSHIP GUIDELINES:

- The students should apply for internships of their choice with the permission of the Institute.
- The internship duration ranges from 4 to 6 weeks and is scheduled during the summer vacation period for students
- Industry will confirm the training slots and the number of seats allocated for internships via confirmation letter/ email.
- Students on joining Training at the concerned Industry / Organization, submit the Joining Report/Letters / Email.
- Students undergo industrial training at the concerned Industry / Organization.
- Training and placement team will visit the industry and evaluate(s) the performance of students regularly and evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers.
- Students will submit training report after completion of internship.
- Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.



# 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**

- It will be evaluated on the basis of the following criteria:
  - Regularity in maintenance of the diary.
  - Project/Case study/Completion of assigned task by industry undertaken during the internship
  - Employer feedback
- Training Certificate to be obtained from industry followed by the presentation in the department.



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# Bachelor of Technology In Computer Engineering

Final Year  
Semester – VIII

SJCEM: R – 24B

**Effective from Academic Year 2025-26**

## Program Structure for Final Year Computer Engineering

(With Effect from 2025-2026)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CSPCC801B	PCC	Distributed Computing	3	-	2	3	-	1	4
24CSPEC801XB	PEC	Department Level Optional Course 5	3	-	2	3	-	1	4
24CSPEC802XB	PEC	Department Level Optional Course 6	3	-	2	3	-	1	4
24ILOCC802XB	OE	Institute Level Optional Course 2	3	-	-	3	-	-	3
24CSVSE801B	VSEC	Industry Certification	-	-	-	-	-	1	1
24CSPRJ801B	PRJ	Major Project 2 / Internship - III	-	-	10	-	-	5	5
<b>Total</b>			<b>12</b>	<b>0</b>	<b>16</b>	<b>12</b>	<b>0</b>	<b>9</b>	<b>21</b>

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA	OR/PR	Total
24CSPCC801B	PCC	Distributed Computing	20	20	60	25	25	150
24CSPEC801XB	PEC	Department Level Optional Course 5	20	20	60	25	25	150
24CSPEC802XB	PEC	Department Level Optional Course 6	20	20	60	25	25	150
24ILOCC802XB	OE	Institute Level Optional Course 2	20	20	60	-	-	100
24CSVSE801	VSEC	Industry Certification	-	-	-	-	25	25
24CSPRJ801B	PRJ	Major Project 2 / Internship - III	-	-	-	75	50	125
<b>Total</b>			<b>80</b>	<b>80</b>	<b>240</b>	<b>150</b>	<b>150</b>	<b>700</b>

### Department Optional Courses

Course Code	Sem. VIII: Department Optional Course- 5	Course Code	Sem. VIII: Department Optional Course – 6
24CSPEC8011B	Deep Learning	24CSPEC8021B	Optimization in Machine Learning
24CSPEC8012B	Digital Forensic	24CSPEC8022B	High Performance Computing
24CSPEC8013B	Applied Data Science	24CSPEC8023B	Social Media Analytics
24CSPEC8014	Data Analysis Using Python	24CSPEC8024	Full Stack Development



## Institute Elective Courses

Course Code	Institute Elective Course-II #
24ILO8021B	Project Management
24ILO8022B	Finance Management
24ILO8023B	Entrepreneurship Development and Management
24ILO8024B	Human Resource Management
24ILO8025B	Professional Ethics and CSR
24ILO8026B	Research Methodology
24ILO8027B	IPR and Patenting
24ILO8028B	Digital Business Management
24ILO8029B	Environmental Management

# Common with all branches



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# Syllabus

For

## Final Year Computer Engineering Semester – VIII

(With Effect from 2025-2026)



## Course Title: Distributed Computing

<b>Semester: VIII</b>			<b>Term: EVEN</b>			<b>Course Code: 24CSPCC801B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment

Examination ESE: End Semester

Examination CA: Continuous

Assessment

### Course Objectives:

1. To enable students to understand the fundamental concepts of distributed systems and middleware.
2. To understand inter-process communication techniques in distributed systems.
3. To understand clock synchronization, mutual exclusion, and deadlock handling in distributed systems.
4. To understand process management, scheduling, and migration techniques in distributed systems.
5. To understand the concepts of distributed shared memory, replication, consistency models, and fault tolerance in distributed systems.
6. To understand the design and features of distributed file systems and their implementation through case studies.

### Course Outcomes:

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

1. Analyze goals, issues, and types of distributed systems and Evaluate middleware models and their services.
2. Apply IPC mechanisms such as RPC, RMI, and message-oriented communication.
3. Analyze various clock synchronization techniques, mutual exclusion algorithms, and deadlock detection methods.
4. Analyze global scheduling algorithms, load management strategies, and process/code migration techniques.
5. Analyze distributed shared memory architectures, consistency models, and fault tolerance techniques for system reliability.
6. Evaluate file models, caching schemes, and replication strategies in distributed file systems.

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Distributed Systems</b>	5	<b>CO1</b>
	<p>Characterization of Distributed Systems: Issues, Goals, Types of distributed systems, Grid and Cluster Computing Models, Middle-ware: Models of middleware, Services offered by middleware.</p> <p><b>Self-Learning Topics:</b> Hardware and Software Concepts: NOS, DOS.</p>		
<b>II</b>	<b>Communication</b>	5	<b>CO2</b>
	<p>Inter-process communication (IPC): Remote Procedure Call (RPC), Remote Method Invocation (RMI), Message-Oriented Communication, Stream Oriented Communication, Group Communication.</p> <p><b>Self-Learning Topics:</b> Advanced Communication Protocols such as gRPC and Apache Kafka</p>		
<b>III</b>	<b>Synchronization</b>	11	<b>CO3</b>
	<p>Clock Synchronization: Physical clock, Logical Clocks, Election Algorithms, Distributed Mutual Exclusion, Requirements of Mutual Exclusion Algorithms and Performance measures.</p> <p>Non- token Based Algorithms: Lamport, Ricart–Agrawala_s and Maekawa's, Token-based Algorithms: Suzuki-Kasami_s Broadcast Algorithms and Raymond_s Tree-based Algorithm, Deadlock: In-troduction, Deadlock Detection: Centralized approach, Chandy Misra_Hass Algorithm.</p> <p><b>Self-Learning Topics: Consensus Algorithms</b> (e.g., Paxos and Raft)</p>		
<b>IV</b>	<b>Resource and Process Management</b>	8	<b>CO4</b>
	<p>Desirable Features of Global Scheduling algorithm, Task assign-ment approach, Load balancing approach and load sharing ap-proach.</p> <p>Introduction to Process Management, Process Migration, Code Mi-gration.</p> <p><b>Self-Learning Topics:</b> Dynamic Load Balancing Algorithms and Process Check pointing Techniques</p>		
<b>V</b>	<b>Replication, Consistency and Fault Tolerance</b>	9	<b>CO5</b>

	Distributed Shared Memory: Architecture, design issues. Introduction to replication and consistency, Data-Centric and Client-Centric Consistency Models, Replica Management, Fault Tolerance: <b>Self-Learning Topics:</b> Process resilience, Recovery.		
<b>VI</b>	<b>Distributed File Systems</b>	7	<b>CO6</b>
	Introduction and features of DFS, File models, File Accessing models, File Caching Schemes, File Replication, Case Study: Network File System (NFS) <b>Self-Learning Topics:</b> Google Case Study.		
	<b>Total</b>	<b>45</b>	

## List of Experiments:

Exp. No.	List of Experiment	COs
1	Implement and demonstrate inter-process communication using various IPC techniques like pipes, message queues, or shared memory.	CO2
2	Develop a simple client-server application using Remote Procedure Call (RPC) or Remote Method Invocation (RMI) for remote communication.	CO2
3	Simulate a group communication system to enable message exchange among multiple distributed processes.	CO2
4	Implement a clock synchronization algorithm to ensure consistent time across distributed nodes.	CO3
5	Demonstrate an election algorithm (e.g., Bully or Ring) to elect a coordinator in a distributed system.	CO3
6	Implement a distributed mutual exclusion algorithm to control access to a shared resource.	CO3
7	Implement a load balancing strategy to distribute tasks evenly across multiple nodes in a distributed environment.	CO4
8	Create a basic distributed shared memory system to simulate shared data access across multiple processes.	CO5
9	<b>Case Study: CORBA:</b> Study and analyze the architecture and functionalities of the Common Object Request Broker Architecture (CORBA).	CO6
10	<b>Case Study: Android Stack:</b> Explore the Android software stack, focusing on its key components like Linux kernel, libraries, and application framework.	CO6



## 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.



## Reference Books:

1. M. L. Liu, —Distributed Computing Principles and Applications, Pearson Addison Wesley, 2004.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005.

## Text Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education. ...
2. Mukesh Singhal, Niranjana G. Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", MC Graw Hill education.
3. Pradeep K.Sinha, "Distributed Operating System-Concepts and design", PHI.

## Useful Links:

1. <https://nptel.ac.in/courses/106106107>
2. <https://nptel.ac.in/courses/106106168>
3. <http://csis.pace.edu/~marchese/CS865/Lectures/Chap7/Chapter7fin.htm>
4. <https://nptel.ac.in/courses/106104182>

Course Title: Deep Learning												
Semester: VIII			Term: EVEN				Course Code: 25CSPEC8011B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment

Examination ESE: End Semester

Examination CA: Continuous

Assessment

### Course Objectives:

1. To learn the fundamentals of Neural Network.
2. To gain an in-depth understanding of training Deep Neural Networks.
3. To Gain insights into regularization techniques to prevent overfitting and enhance model general- ization.
4. To Study the principles of auto encoders and their role in unsupervised learning, along with appli- cations.
5. To CNNs for image processing and RNNs for sequence data, and explore architectures like LeNet, AlexNet, LSTM, and GRU.
6. To investigate the latest advancements in deep learning, such as GANs, and their applications in areas like image generation and Deep Fakes.

### Course Outcomes:

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

1. Demonstrate an understanding of neural network structures and their learning mechanisms, in- cluding perceptrons and multilayer networks.
2. Apply various optimization techniques and loss functions to effectively train deep neural net- works.
3. Implement regularization techniques to handle overfitting and improve model performance in real- world scenarios.
4. Develop and apply auto encoders for unsupervised learning tasks, including dimensionality reduc- tion and data compression.
5. Design and implement CNN and RNN architectures for image and sequence data tasks, respec- tively, using modern deep learning frameworks.
6. Analyse the architecture and functioning of GANs, and explore their application in generating synthetic data such as images.

Module	Contents	Hours	COs
<b>I</b>	<b>Fundamentals of Neural Network</b>	05	CO1
	Biological neuron, Mc-Culloch Pitts Neuron, Perceptron, Perceptron Learning, Delta learning, Multilayer Perceptron: Linearly separable, linearly non-separable classes Deep Networks: Fundamentals, Brief History, Three Classes of Deep Learning Basic Terminologies of Deep Learning  <b>Self-Learning Topics:</b> Hebbian Learning Theory, XOR Problem and its solution using Multilayer Perceptron (MLP)		
<b>II</b>	<b>Training, Optimization and Regularization of Deep Neural Network</b>	11	CO2
	Training Feedforward DNN : Multi Layered Feed Forward Neural Network, Learning Factors, Activation functions: Tanh, Logistic, Linear, Softmax, ReLU, Leaky ReLU, Loss functions: Squared Error loss, Cross Entropy, Choosing output function and loss function. Optimization Learning with backpropagation, Learning Parameters: Gradient Descent (GD), Stochastic and Mini Batch GD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, Adam, RMSProp Regularization Overview of Overfitting, Types of biases, Bias Variance Tradeoff Regularization Methods: L1, L2 regularization, Parameter sharing, Dropout, Weight Decay, Batch normalization, Early stopping, Data Augmentation, Adding noise to input and output  <b>Self-Learning Topics:</b> Advanced Optimizers: Nadam, AMSGrad Transfer Learning: Concept and Application		
<b>III</b>	<b>Autoencoders: Unsupervised Learning</b>	07	CO3
	Introduction, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoders. Denoising Autoencoders, Sparse Autoencoders, and Contractive Autoencoders. Application of Autoencoders: Image Compression  <b>Self-Learning Topics:</b> Variational Autoencoders (VAEs), Applications of Autoencoders in Anomaly Detection		
<b>IV</b>	<b>Convolutional Neural Networks (CNN): Supervised Learning</b>	08	CO4

	<p>Convolution operation, Padding, Stride, Relation between input, out- put and filter size, CNN architecture: Convolution layer, Pooling Layer, Weight Sharing in CNN, Fully Connected NN vs CNN, Vari- ants of basic Convolution function</p> <p>Modern Deep Learning Architectures: LeNET: Architecture, AlexNET: Architecture</p> <p><b>Self-Learning Topics:</b> Residual Networks (ResNet) and Skip Connections, DenseNet: Densely Connected Convolutional Networks</p>		
<b>V</b>	<b>Recurrent Neural Networks (RNN)</b>	09	CO5
	<p>Sequence Learning Problem, Unfolding Computational graphs, Re- current Neural Network, Bidirectional RNN, Backpropagation Through Time (BTT), Vanishing and Exploding Gradients, Trun- cated BTT.</p> <p>Long Short Term Memory: Selective Read, Selective write, Selective Forget, Gated Recurrent Unit</p> <p><b>Self-Learning Topics:</b> Applications of RNNs in Natural Language Processing (NLP), Attention Mechanisms in Sequence Models</p>		
<b>VI</b>	<b>Recent Trends and Applications</b>	05	CO6
	<p>Generative Adversarial Network (GAN): Architecture</p> <p>Applications: Image Generation, DeepFake</p> <p><b>Self-Learning Topics:</b> Variational Autoencoders vs. GANs: A Comparative Study, Applications of GANs in Medical Imaging</p>		
	<b>Total</b>	<b>45</b>	

## List of Experiments:

Sr. No.	Experiment Topic	COs
<b>1</b>	<p><b>Based on Module 1 (Any two) using Virtual Lab</b></p> <ol style="list-style-type: none"> <li>1. Implement Mc-Culloch Pitts model for binary logic functions.</li> <li>2. Implement Perceptron algorithm to simulate any logic gate.</li> <li>3. Implement Multilayer Perceptron algorithm to simulate XOR gate.</li> <li>4. To explore python libraries for deep learning e.g. Theano, TensorFlow etc.</li> </ol>	CO1

2	<p><b>Module 2 (Any Two)</b></p> <p>5. Apply any of the following learning algorithms to learn the parameters of the supervised single layer feed forward neural network.</p> <ol style="list-style-type: none"> <li>Stochastic Gradient Descent</li> <li>Mini Batch Gradient Descent</li> <li>Momentum GD</li> <li>Nestorev GD</li> <li>Adagrad GD</li> <li>Adam Learning GD</li> </ol> <p>6. Implement a backpropagation algorithm to train a DNN with at least 2 hidden layers.</p> <p>7. Design and implement a fully connected deep neural network with at least 2 hidden layers for a classification application. Use appropriate Learning Algorithm, output function and loss function</p>	CO2
3	<p><b>Module 3 (Any One)</b></p> <p>8. Design the architecture and implement the autoencoder model for Image Compression.</p> <p>9. Design the architecture and implement the autoencoder model for Image denoising</p>	CO3
4	<p><b>Module 4 (Any One)</b></p> <p>10. Design and implement a CNN model for digit recognition application.</p> <p>11. Design and implement a CNN model for image classification</p>	CO4
5	<p><b>Module 5 (Any Two)</b></p> <p>12. Design and implement LSTM for Sentiment Analysis.</p> <p>13. Design and implement GRU for classification on text data.</p> <p>14. Design and implement RNN for classification of temporal data.</p>	CO5



## 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.



## Reference Books:

1. Buduma, N. and Locascio, N., —Fundamentals of deep learning: Designing next-generation machine intelligence algorithms" 2017. O'Reilly Media, Inc."
2. François Chollet. —Deep learning with Python —(Vol. 361). 2018 New York: Manning.
3. Douwe Osinga. —Deep Learning Cookbook, O'REILLY, SPD Publishers, Delhi.
4. Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc
5. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India

## Text Books:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville. —Deep Learning, MIT Press Ltd, 2016
2. Li Deng and Dong Yu, —Deep Learning Methods and Applications, Publishers Inc.
3. Satish Kumar "Neural Networks A Classroom Approach" Tata McGraw-Hill.
4. JM Zurada —Introduction to Artificial Neural Systems, Jaico Publishing House
5. M. J. Kochenderfer, Tim A. Wheeler. —Algorithms for Optimization, MIT Press.

## Useful Links:

1. <https://nptel.ac>.
2. <https://deeplearning.cs.cmu.edu/S21/index.html>
3. <http://www.cse.iitm.ac.in/~miteshk/CS6910.html>
4. <https://nptel.ac.in/courses/106/106/106106184/>
5. <https://www.deeplearningbook.org/>

## Course Title: Digital Forensics

<b>Semester: VIII</b>			<b>Term: EVEN</b>				<b>Course Code: 25CSPEC8012B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment

Examination ESE: End Semester

Examination CA: Continuous Assessment

### Course Objectives:

1. To discuss the need and process of digital forensics and Incident Response Methodology.
2. To explore the procedures for identification, preservation, and acquisition of digital evidence.
3. To explore techniques and tools used in digital forensics for Operating system and malware investigation
4. To explore techniques and tools used for Mobile forensics and browser, email forensics
5. To analyse legal and ethical considerations in the field of digital forensics and the handling of digital evidence.
6. To evaluate the use of advanced digital forensics tools and techniques in cloud computing environments and network forensics.

### Course Outcomes:

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

1. Explain the phases of Digital Forensics and the methodology for handling computer security incidents.
2. Demonstrate the process of collecting, analysing, and recovering digital evidence.
3. Utilize various tools to analyse malware and acquired images of RAM/hard drives.
4. Apply digital forensic investigation techniques to mobile devices.
5. Evaluate the source and content authentication of emails and web browsers.
6. Generate clear and precise investigation reports that present valid conclusions.

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Digital Forensics</b>	7	CO1
	Digital Forensics: Definition, Digital Forensics Goals, Digital Forensics Categories - Computer Forensics, Mobile Forensics, Network Forensics, Database Forensics Introduction to Incident - Computer Security Incident, Goals of Incident Response, CSIRT, Incident Response Methodology, Phase after detection of an incident  <b>Self-Learning Topics:</b> Goals of Incident Response in Digital Forensics		
<b>II</b>	<b>Digital Evidence, Forensics Duplication and Digital Evidence Acquisition</b>	10	CO2
	Digital evidence, Types of Digital Evidence, Challenges in acquiring Digital evidence, Admissibility of evidence, Challenges in evidence handling, Chain of Custody Digital Forensics Examination Process - Seizure, Acquisition, Analysis, Reporting. Necessity of forensic duplication, Forensic Image formats, Forensic duplication techniques. Acquiring Digital Evidence - Forensic Image File Format, Acquiring Volatile Memory (Live Acquisition), Acquiring Nonvolatile Memory (Static Acquisition), Hard Drive Imaging Risks and Challenges, Network Acquisition  <b>Self-Learning Topics:</b> Challenges in Acquiring and Handling Digital Evidence		
<b>III</b>	<b>Forensics Investigation</b>	5	CO3
	Analyzing Hard Drive Forensic Images, Analyzing RAM Forensic Image, Investigating Routers Malware Analysis - Malware, Viruses, Worms, Essential skills and tools for Malware Analysis, List of Malware Analysis Tools and Techniques  <b>Self-Learning Topics:</b> Cloud Forensics		
<b>IV</b>	<b>Windows and Unix Forensics Investigation</b>	9	CO4
	Investigating Windows Systems - File Recovery, Windows Recycle Bin Forensics, Data Carving, Windows Registry Analysis, USB Device Forensics, File Format Identification, Windows Features, Forensics Analysis, Windows 10 Forensics, Cortana Forensics Investigating Unix Systems - Reviewing Pertinent Logs, Performing Keyword Searches, Reviewing Relevant Files,		

	Identifying Unau- thorized User Accounts or Groups, Identifying Rogue Processes, Checking for Unauthorized Access Points, Analyzing Trust Rela- tionships  <b>Self-Learning Topics:</b> Encryption in Digital Forensics Investiga- tions		
<b>V</b>	<b>Mobile Forensics</b>	9	CO5
	Android Forensics, Mobile Device Forensic Investigation – Storage location, Acquisition methods, Data Analysis GPS forensics - GPS Evidentiary data, GPS Exchange Format (GPX), GPX Files, Extraction of Waypoints and Track Points, Dis- play the Tracks on a Map. SIM Cards Forensics - The Subscriber Identification Module (SIM), SIM Architecture, Security, Evidence Extraction.  <b>Self-Learning Topics:</b> Securing Mobile Devices for Forensic Inves- tigations		
<b>VI</b>	<b>Browser, Email Forensic &amp; Forensic Investigation Reporting</b>	5	CO6
	Web Browser Forensics, Google chrome, Other web browser investigation Email forensics - Sender Policy Framework (SPF), Domain Key Identified Mail (DKIM), Domain based Message Authentication Re- porting and Confirmation (DMARC) Investigative Report Template, Layout of an Investigative Report, Guidelines for Writing a Report  <b>Self-Learning Topics:</b> Impact of Privacy Features in Web Browsers on Forensic Investigations		
	<b>Total</b>	<b>45</b>	

## List of Experiments:

Sr. No.	Title of Experiment	COs
1	Analysis of forensic images using open source tools: <ul style="list-style-type: none"> <li>• FTK Imager</li> <li>• Autopsy</li> </ul>	CO2



<b>2</b>	Explore forensics tools in kali linux for acquiring, analyzing and duplicating data: <ul style="list-style-type: none"><li>• Dd</li><li>• dcfldd</li></ul>	CO2
<b>3</b>	Performing penetration testing using Metasploit - kali Linux.	CO3
<b>4</b>	Performing RAM Forensic to analyze memory images to find traces of an attack. <ul style="list-style-type: none"><li>• Capturing RAM Using the DumpIt Tool</li><li>• Volatility tool</li></ul>	CO2, CO3
<b>5</b>	Network forensics using Network Miner.	CO1, CO2
<b>6</b>	Windows Recycle Bin Forensics	CO2
<b>7</b>	Data Carving using open source tools <ul style="list-style-type: none"><li>• Foremost</li><li>• Scalpel</li><li>• Jpegcarver</li></ul>	CO2 CO4
<b>8</b>	USB Device Forensics using <ul style="list-style-type: none"><li>• USBDeview</li><li>• USB Detective</li></ul>	CO2
<b>9</b>	Web Browser Forensics using DB Browser for SQLite.	CO5
<b>10</b>	Generate a Timeline Report Using Autopsy	CO6
<b>11</b>	Email Analysis	CO5, CO6



## 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.



## Reference Books:

1. Bill Nelson, Amelia Phillips, and Christopher Steuart, **Guide to Computer Forensics and Investigations**, 5th Edition, Cengage Learning, 2018.r
2. Eoghan Casey, **Digital Evidence and Computer Crime**, 3rd Edition, Academic Press, 2011.
3. Harlan Carvey, **Windows Forensic Analysis Toolkit**, 4th Edition, Syngress, 2014.
4. Rohit Tamma and Donnie Tindall, **Learning Android Forensics**, 1st Edition, Packt Publishing, 2015
5. Darren R. Hayes, **Email Forensics: Web-based and Email Investigations**, 1st Edition, Pearson, 2020.

## Text Books:

1. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGrawHill, 2006.
2. Digital Forensics Basics A Practical Guide Using Windows OS — Nihad A. Hassan, APress Publication, 2019.
3. Xiaodong Lin, "Introductory Computer Forensics: A Hands-on Practical Approach", Springer Nature, 2018.

## Useful Links:

1. <https://nptel.ac.in/courses/106/105/106105217/>
2. [https://onlinecourses.swayam2.ac.in/cec20\\_lb06/preview](https://onlinecourses.swayam2.ac.in/cec20_lb06/preview)
3. <https://www.coursera.org/learn/incident-response>
4. <https://www.coursera.org/learn/ibm-penetration-testing-incident-response-forensics>
5. <https://www.coursera.org/learn/digital-forensics-essentials-dfe>



## Course Title: Applied Data Science

<b>Semester: VIII</b>		<b>Term: EVEN</b>				<b>Course Code: 24CSPEC8013B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment

Examination ESE: End Semester

Examination CA: Continuous

Assessment

### Course Objectives:

1. To introduce students to the basic concepts of data science.
2. To acquire an in-depth understanding of data exploration and data visualization.
3. To be familiar with various anomaly detection techniques.
4. To understand the data science techniques for different applications.

### Course Outcomes:

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

1. To gain fundamental knowledge of the data science process.
2. To apply data exploration and visualization techniques.
3. To apply anomaly detection techniques.
4. To gain an in-depth understanding of time-series forecasting.
5. Apply different methodologies and evaluation strategies.
6. To apply data science techniques to real world applications.

Module	Contents	Hours	COs
I	<b>Introduction to Data Science</b>	4	CO1
	Introduction to Data Science, Data Science Process <b>Motivation to use Data Science Techniques:</b> Volume, Dimensions and Complexity, Data Science Tasks and Examples. Overview of Data Preparation, Modelling, Difference between data science and data analytics  <b>Self-Learning Topics:</b> Applications of Data Science		
II	<b>Data Exploration</b>	8	CO2
	Types of data, Properties of data <b>Descriptive Statistics:</b> <b>Univariate Exploration:</b> Measure of Central Tendency, Measure of Spread, Symmetry. <b>Skewness:</b> Karl Pearson Coefficient of skewness, Bowley's Coefficient, Kurtosis Multivariate <b>Exploration:</b> Central Data Point, Correlation, Different forms of correlation, Karl Pearson Correlation Coefficient for bivariate distribution <b>Inferential Statistics:</b> Overview of Various forms of distributions: Normal, Poisson, Test Hypothesis, Central limit theorem, Confidence Interval, Z-test, t-test, Type-I, Type-II Errors, ANOVA  <b>Self-Learning Topics:</b> Two Way ANOVA		
III	<b>Methodology and Data Visualization</b>	8	CO3
	<b>Methodology:</b> Overview of model building, Cross Validation, K-fold cross validation, leave-1 out, Bootstrapping <b>Data Visualization:</b> Univariate Visualization: Histogram, Quartile, Distribution Chart Multivariate Visualization: Scatter Plot, Scatter Matrix, Bubble chart, Density Chart Roadmap for Data Exploration  <b>Self-Learning Topics:</b> Visualizing high dimensional data: Parallel chart, Deviation chart, Andrews Curves.		
IV	<b>Anomaly Detection</b>	8	CO4
	Outliers, Causes of Outliers, Anomaly detection techniques, Outlier Detection using Statistics Outlier Detection using Distance based method, Outlier detection using density-based methods, SMOTE  <b>Self-Learning Topics:</b> SMOTE dataset balancing Applications		
V	<b>Time Series Forecasting</b>	8	CO5

	Taxonomy of Time Series Forecasting methods, Time Series Decomposition <b>Smoothing Methods:</b> Average method, Moving Average smoothing, Time series analysis using linear regression, ARIMA Model, <b>Performance Evaluation:</b> Mean Absolute Error, Root Mean Square Error, Mean Absolute Percentage Error, Mean Absolute Scaled Error <b>Self-Learning Topics:</b> Real-world Applications of ARIMA Model		
VI	<b>Applications of Data Science</b>	9	CO6
	<b>Predictive Modeling:</b> House price prediction, Fraud Detection <b>Clustering:</b> Customer Segmentation <b>Time series forecasting:</b> Weather Forecasting <b>Recommendation engines:</b> Product recommendation  <b>Self-Learning Topics:</b> Case Study on Product Recommendation systems		
	<b>Total</b>	<b>45</b>	

## List of experiments:

Exp. No	List of Experiment	COs
1	Explore the descriptive and inferential statistics on the given dataset.	CO1,CO2
2	Apply data cleaning techniques (e.g. Data Imputation).	CO1,CO2
3	Explore data visualization techniques.	CO3
4	Implement and explore performance evaluation metrics for Data Models (Supervised/Unsupervised Learning)	CO2,CO4
5	Use SMOTE technique to generate synthetic data.(to solve the problem of class imbalance)	CO4
6	Outlier detection using distance based/density based method.	CO4
7	Implement time series forecasting.	CO5
8	Illustrate data science lifecycle for selected case study. (Prepare case study document for the selected case study) Suggested Case Studies: 1. Customer Segmentation 2. Fraud Detection 3. House Price prediction 4. Product Recommendation 5. Stock price prediction 6. Weather prediction	CO1,CO2 , CO3,CO4 , CO5,CO6



## 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.



## Reference Books:

1. Jake VanderPlas. —Python Data Science Handbook, O'reilly Publications.
2. Francesco Ricci, LiorRokach, BrachaShapira, Paul B. Kantor, —Recommender Systems Handbook, Springer.
3. C. Gupta, V. K. Kapoor —Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi.
4. B. L. Agrawal. —Basic Statistics, New Age Publications, Delhi.

## Text Books:

1. Vijay Kotu, Bala Deshpande. —Data Science Concepts and Practicell, Elsevier, M.K. Publishers.
2. Steven Skiena, —Data Science Design Manuall, Springer International Publishing AG
3. Samir Madhavan. —Mastering Python for Data Sciencell, PACKT Publishing
4. Dr. P. N. Arora, Sumeet Arora, S. Arora, Ameet Arora, —Comprehensive Statistical Methodsl, S.Chand Publications, New Delhi.

## Useful Links:

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs32/preview](https://onlinecourses.nptel.ac.in/noc22_cs32/preview)
2. [https://onlinecourses.nptel.ac.in/noc21\\_cs69/preview](https://onlinecourses.nptel.ac.in/noc21_cs69/preview)

## Course Title: Data Analysis Using Python

<b>Semester: VIII</b>			<b>Term: Even</b>			<b>Course Code: 24CSPEC8014B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment, TW: Term Work

**Course Objectives:** The course aims:

1. To learn foundational Python programming concepts with practical exercises for coding skills development.
2. To enable efficient numerical data manipulation and analysis using advanced NumPy operations.
3. To equip students with skills for creating advanced data visualizations using Seaborn and Matplotlib.
4. To learn efficient data manipulation using pandas for optimized data analysis workflows.
5. To develop advanced pandas skills for data analysis, including EDA and handling time-series data.
6. To train students in analyzing and interpreting sales data using EDA and other advanced techniques.

**Course Outcomes:**

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

1. Build a solid foundation in Python programming with hands-on practice in key concepts and coding skills.
2. Perform efficient numerical data analysis and manipulation using advanced NumPy operations.
3. Create compelling data visualizations with Seaborn and Matplotlib, including advanced plotting techniques.
4. Manipulate, clean, and manage data efficiently using pandas for streamlined workflows.
5. Analyze real-world datasets using advanced DataFrame manipulation and Exploratory Data Analysis (EDA).
6. Students will gain skills to analyze and manipulate data effectively.



Module	Contents	Hours	COs
I	<b>Python Essentials: A Rapid Recap</b>	5	CO1
	<p><b>Foundations of Programming:</b> Revisiting the building blocks and the "why" of programming.</p> <p><b>Your Python Workspace:</b> Installation, editors, and environment setup essentials.</p> <p><b>Mastering Variables &amp; Operators:</b> The core of computations simplified. <b>Decision-Making &amp; Loops Unleashed:</b> Streamlining logic with conditions and iterations.</p> <p><b>Power of Functions:</b> Leveraging built-in tools for efficient coding.</p> <p><b>Strings Demystified:</b> Navigating and manipulating text data.</p> <p><b>Data Collections Simplified:</b> Working with lists and tuples seamlessly. <b>Sets &amp; Dictionaries Decoded:</b> Unique and key-value data operations. <b>Diving into OOP:</b> Basics of Object-Oriented Programming and exception handling.</p> <p><b>Hands-On Exploration:</b> Practical exercises to solidify understanding.</p> <p><b>Self-Learning Topics:</b></p> <p><b>Advanced Data Structures Exploration:</b> Dive into Stacks, Queues, and Linked Lists.</p> <p><b>File Handling Fundamentals:</b> Master reading, writing, and managing CSV/JSON files.</p> <p><b>Error Handling Mastery:</b> Perfect your skills in try, except, finally, and custom exceptions.</p> <p><b>Comprehension Power:</b> Unlock the potential of list, set, and dictionary comprehensions.</p> <p><b>Module Magic:</b> Create and import custom modules and packages for modular code.</p> <p><b>Regex Mastery:</b> Discover the world of regular expressions for pattern matching.</p> <p><b>Decorator Deep Dive:</b> Enhance your code with function and class decorators.</p> <p><b>Generator &amp; Iterator Essentials:</b> Learn to create efficient iterators and generators using yield.</p> <p><b>Database Interaction:</b> Build your skills in database operations with SQLite.</p> <p><b>Debugging Excellence:</b> Master Python's built-in debugging tools and error logging techniques.</p>		
II	<b>NumPy Essentials</b>	8	CO2

Module	Contents	Hours	COs
	<p><b>Introduction to NumPy:</b> Unlock the foundation of numerical data analysis.</p> <p><b>Mastering NumPy Data Types:</b> Discover the building blocks for efficient data handling.</p> <p><b>Array Creation Mastery:</b> Learn multiple ways to create powerful NumPy arrays.</p> <p><b>Indexing &amp; Slicing Wizardry:</b> Access and manipulate data with precision.</p> <p><b>Copy vs View Demystified:</b> Understand memory management in NumPy arrays.</p> <p><b>Reshaping Arrays Like a Pro:</b> Transform arrays to suit your analysis needs.</p> <p><b>NumPy Functions Unleashed:</b> Explore search, split, sort, join, and filter operations.</p> <p><b>Randomness &amp; Transposition:</b> Generate random numbers and manipulate data structure.</p> <p><b>Statistical Power with NumPy:</b> Leverage built-in statistical functions for deep analysis.</p> <p><b>Mathematical &amp; Logical Operations:</b> Perform advanced calculations and logic with ease.</p> <p><b>Self-Learning Topics:</b></p> <p><b>Efficient Data Handling:</b> Dive into NumPy data types and learn how they optimize data manipulation.</p> <p><b>Array Operations Mastery:</b> Master slicing, reshaping, and understanding the nuances of copies vs. views.</p> <p><b>Mathematical &amp; Statistical Power:</b> Harness NumPy's functions for advanced calculations and data insights.</p>		
III	<b>Data Visualization Excellence</b>	8	CO3
	<p><b>The Art of Visualization:</b> Unlock the power of data storytelling through visual representation.</p> <p><b>Seaborn &amp; Matplotlib Mastery:</b> Dive deep into two of the most popular libraries for creating stunning plots.</p> <p><b>Plotting Essentials:</b> Master line, bar, histogram, pie, and scatter plots for clear data insights.</p> <p><b>Subplots for Clarity:</b> Learn how to present multiple views in one cohesive display.</p> <p><b>Polishing Your Plots:</b> Refine your visuals with expert formatting techniques for impactful presentations</p> <p><b>Self-Learning Topics:</b></p> <p><b>Trend Tracking:</b> Visualize time-based data with the area plot.</p> <p><b>Distribution Unveiled:</b> Detects outliers using the box plot.</p> <p><b>Data Density Insight:</b> Unlock correlations with the heatmap.</p> <p><b>Visualizing Probabilities:</b> Explore the violin plot for distribution clarity. <b>Proportions in Perspective:</b> Master the stacked bar plot for category breakdowns.</p> <p><b>Multidimensional Insights:</b> Dive into the radar chart for complex data visualization.</p>		



Module	Contents	Hours	COs
	<p><b>Three-Dimensional Data:</b> Enhance insights with the bubble plot.</p> <p><b>Variable Relationships:</b> Use pair plots to explore data connections.</p> <p><b>Cumulative Data Trends:</b> Track growth with the area chart.</p> <p><b>Financial Insights:</b> Analyze market movements with the candlestick chart.</p>		
IV	<b>Pandas Introduction</b>	8	CO4
	<p><b>Unleashing the Power of Pandas:</b> Discover why pandas outshines NumPy in data manipulation.</p> <p><b>Series vs. DataFrame:</b> Dive into pandas' core structures and understand their unique roles.</p> <p><b>Crafting and Managing DataFrames:</b> Learn how to seamlessly create, update, and organize DataFrames.</p> <p><b>CSV Mastery:</b> Effortlessly read and save data with pandas for smooth workflow.</p> <p><b>Data Perfection:</b> Clean and prep your data by handling missing values and eliminating duplicates.</p> <p><b>Self-Learning Topics:</b></p> <p><b>Series Unleashed:</b> Dive deep into the advanced manipulation of pandas Series.</p> <p><b>DataFrame Dynamics:</b> Master the art of creating, updating, and managing DataFrames seamlessly.</p> <p><b>CSV Conqueror:</b> Perfect the skill of importing and exporting data from CSVs with pandas.</p> <p><b>Data Detox:</b> Cleanse your datasets by handling missing values and eliminating duplicates effortlessly.</p> <p><b>Automation Alchemist:</b> Build custom functions to streamline your data cleaning process.</p>		
V	<b>Advanced Data Analysis Mastery</b>	8	CO5
	<p><b>Mastering DataFrame Manipulation:</b> Learn sorting, filtering, and merging DataFrames to enhance data organization.</p> <p><b>Mathematical Magic with DataFrames:</b> Apply mathematical and custom functions to perform advanced operations on DataFrames.</p> <p><b>Pivoting Power:</b> Create and manipulate Pivot Tables for better data aggregation and insights.</p> <p><b>Time Series Techniques:</b> Master DateTime handling and resampling to analyze time-based data effectively.</p> <p><b>Exploratory Data Analysis (EDA):</b> Gain hands-on experience with real- world datasets to perform comprehensive data analysis and uncover trends.</p> <p><b>Self-Learning Topics:</b></p> <p><b>DataFrame Wizardry:</b> Master sorting and filtering with advanced techniques.</p> <p><b>Math in Motion:</b> Dive into mathematical functions and apply them to your DataFrames.</p> <p><b>Function Mastery:</b> Unlock the power of apply(), map(), and lambda for custom data transformations.</p> <p><b>Pivot Power:</b> Create dynamic PivotTables to gain deeper insights from</p>		



Module	Contents	Hours	COs
	your data. <b>Time Traveler:</b> Navigate time series data with DateTime handling and resampling skills.		
<b>VI</b>	<b>Pandas Sales Data Analysis</b>	8	CO6
	<b>Data Unveiling:</b> Import and structure your sales data for analysis. <b>Sorting &amp; Filtering Mastery:</b> Organize your sales data like a pro based on key criteria. <b>Mathematical Insights:</b> Calculate total sales, averages, and growth trends to uncover key metrics. <b>Transformation Magic:</b> Clean and customize sales data with apply(), map(), and lambda functions. <b>Pivot Power Play:</b> Analyze and visualize sales trends across categories, regions, and time. <b>Time-Series Exploration:</b> Harness DateTime handling and resampling to track sales over time. <b>Insight Discovery:</b> Dive deep into exploratory data analysis (EDA) to find hidden sales patterns. <b>Self-Learning Topics:</b> Import, explore, sort, filter, clean, and analyze sales data using Pandas functions, create PivotTables, resample time series data, and perform exploratory data analysis (EDA) to uncover key trends and insights.		
	<b>Total</b>	<b>45</b>	

Exp. No.	List of Experiments	COs
1.	<b>Budget Tracker:</b> Track daily expenses by category, allowing users to add, view, and delete expenses.	CO1
2.	<b>Contact Book:</b> Store and manage contact information with options to add, delete, and search contacts.	CO1
3.	<b>Weather Data Prediction:</b> Simulate and predict weather patterns using random number generation and statistical functions.	CO2
4.	<b>Stock Price Movement Analysis:</b> Analyze historical stock prices to identify trends and correlations using NumPy's statistical tools.	CO2
5.	<b>Sales Performance Dashboard:</b> Visualize e-commerce sales trends over time using line, bar, and pie charts.	CO3
6.	<b>Weather Patterns Visualization:</b> Plot temperature and precipitation trends with line plots and histograms to reveal seasonal patterns.	CO3
7.	<b>Survey Data Cleaning:</b> Use pandas to clean and organize survey data by handling missing values, duplicates, and preparing it for analysis.	CO4
8.	<b>Product Profitability Analysis:</b> Create Pivot Tables to aggregate product sales and profit data for in-depth profitability analysis.	CO5
9.	<b>Marketing Campaign Effectiveness:</b> Analyze marketing campaign data through EDA, identifying key trends, customer engagement, and ROI.	CO5
10.	<b>Customer Purchase Behavior:</b> Use mathematical functions to analyze customer data, calculating average purchases and identifying high-value customers.	CO6
11.	<b>Inventory Forecasting:</b> Use sales data to forecast future demand based on historical trends and seasonal patterns through time-series analysis.	CO6

## 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):

The End Semester examination of 60 Marks will be conducted based on the entire syllabus.

### C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following **Experiments / Tutorials (8 to 10):**

10 marks (All COs / LOs should be covered) **Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

**MCQ (weekly) & Lab assignments (daily)**



## List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

**Note:** Number of activities to be conducted under TAE would be as per the subject need.

## D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be held.

### Reference Books:

1. "Python for Data Analysis" by Wes McKinney
2. "Data Science from Scratch: First Principles with Python" by Joel Grus

### Useful Links:

1. <https://docs.python.org/3/tutorial/>
2. <https://towardsdatascience.com/>



Course Title: Optimization in Machine Learning												
Semester: VIII			Term: EVEN				Course Code: 25CSPEC8021B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment

Examination ESE: End Semester

Examination CA: Continuous

Assessment

### Course Objectives:

1. Learn fundamental concepts in optimization theory
2. Understand, analyse and apply existing derivatives-based optimization algorithms
3. Analyse and apply stochastic methods in optimization
4. Analyse convex optimization for machine learning problems
5. Understand real life problems and apply evolutionary methods to optimize them
6. Apply advanced evolutionary methods to tackle real-world challenges in fields such as engineering

### Course Outcomes:

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

1. To understand basics and background of optimization theory
2. To understand foundational optimization ideas including gradient descent, stochastic gradient methods
3. To understand concepts and properties of stochastic processes and their applications in various fields
4. To apply convex optimization algorithm
5. To analyse and demonstrate several population methods in Evolutionary Computation
6. To apply advanced evolutionary algorithms such as particle swarm and ant colony optimization

Module	Contents	Hours	COs
<b>I</b>	<b>Module 1 Introduction and Background to Optimization Theory</b>	5	CO1
	Basic Ingredients of Optimization Problems, Optimization Problem Classifications, Optima Types, Optimization Method Classes, Overview of Unconstrained and Constrained Optimization, <b>Self-Learning Topics:</b> Basics of convex optimization		
<b>II</b>	<b>Module 2 Derivative based Optimization</b>	11	CO2
	The Basics of Optimization (univariate, bivariate and multivariate optimization), Convex Objective Functions First-Order optimization Methods: Gradient Descent, Conjugate Gradient, Momentum, Nesterov Momentum, Adagrad, RMSProp, learning rate optimization <b>Self-Learning Topics:</b> Second order optimization: Newton method		
<b>III</b>	<b>Module 3 Stochastic Methods</b>	7	CO3
	Noisy Descent, Mesh Adaptive Direct Search, Cross-Entropy Method, Natural Evolution Strategies <b>Self-Learning Topics:</b> Covariance Matrix Adaptation		
<b>IV</b>	<b>Module 4 Convex Optimization</b>	7	CO4
	Optimization problems, Convex optimization, Linear optimization problems, Quadratic optimization problems, Geometric programming <b>Self-Learning Topics:</b> Overview of Generalized inequality constraints and Vector optimization		
<b>V</b>	<b>Module 5 Evolutionary Methods</b>	9	CO5
	Introduction to Evolutionary Computation: Generic Evolutionary Algorithm, Representation: The Chromosome, Initial Population, Fitness Function, Selection: Selective Pressure, Random Selection, Proportional Selection, Tournament Selection, Rank-Based Selection, Elitism and Evolutionary Computation versus Classical Optimization, Stopping conditions Canonical Genetic Algorithm <b>Self-Learning Topics:</b> Binary Representations of Crossover and Mutation: Binary Representations, Control Parameters		



VI	Module 6 Advance Evolutionary Methods	6	CO6
	Basic Particle Swarm Optimization, Global Best PSO, Local Best PSO, g-best versus l-best PSO, Velocity Components, Geometric Illustration, Algorithm Aspects, Social Network Structures, Ant Colony Optimization Meta-Heuristic, Foraging Behavior of Ants, Stigmergy and Artificial Pheromone, Simple Ant Colony Optimization  <b>Self-Learning Topics:</b> Ant System, Ant Colony System		
	<b>Total</b>	<b>45</b>	

## List of Experiments:

Exp. No.	List of Experiment	COs
1	To explore unconstrained and constrained optimization, with a focus on convex Optimization.	CO1
2	To implement Gradient Descent algorithm	CO2
3	To implement the Stochastic Gradient Descent algorithm	CO3
4	To implement Newton method	CO2
5	To implement and solve linear optimization problems	CO4
6	To implement and solve quadratic optimization problems	CO4
7	To apply Genetic Algorithm for real world problem	CO5
8	To compare and implement different selection mechanism using genetic algorithm	CO5
9	To implement various mutation and crossover mechanisms	CO5
10	To implement Particles Swarm optimization	CO6
11	To implement Ant colony optimization	CO6



## 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:

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

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.



## Reference Books:

1. SuvritSra, Sebastian Nowozin, Stephen J. Wright, "Optimization for Machine Learning", The MIT Press
2. Xin-She Yang Middlesex," Optimization techniques and applications with examples", Wiley
3. A.E. Eiben, J. E. Smith, "Introduction to Evolutionary Computing", Springer

## Text Books:

1. Charu C. Aggarwal, "Linear Algebra and Optimization for Machine Learning", Springer ,2020.
2. Mykel J. Kochenderfer, Tim A.Wheeler, Algorithms for Optimization, MIT Press (2019)
3. Andries P Engelbrecht, Computational Intelligence-An Introduction, Second-Edition, Wiley publication

## Useful Links:

1. [Convex Optimization](#)
2. [Constrained and Unconstrained Optimization \(NPTEL\)](#)
3. [Machine-learning-model-performance \(Coursera\)](#)
4. [Deep-neural-network optimization \(Coursera\)](#)

Course Title: High Performance Computing												
Semester: VIII			Term: EVEN				Course Code: 24CSPEC8022B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment

Examination ESE: End Semester

Examination CA: Continuous

Assessment

### Course Objectives:

1. To understand parallel computing concepts, parallel architectures, and classification models.
2. To explore parallel programming platforms and algorithm design techniques for effective parallel computing.
3. To evaluate the performance of parallel systems using key metrics.
4. To introduce multi-core programming models and demonstrate the use of OpenMP and MPI for parallel programming.
5. To introduce GPGPU architecture and explore parallel programming using CUDA and OpenCL.
6. To understand virtualization, containerization, and parallel computing frameworks for cloud-based HPC.

### Course Outcomes:

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

1. Analyse levels of parallelism and various parallel architecture models.
2. Evaluate communication costs and algorithm design techniques for optimizing parallel algorithms.
3. Analyse performance and improve system scalability.
4. Implement parallel programs using OpenMP and MPI and evaluate their performance.
5. Develop parallel applications using CUDA and OpenCL and analyze their efficiency.
6. Deploy and scale HPC applications using virtualization and containerization techniques.

Module	Contents	Hours	COs
<b>I</b>	<b>Introduction to Parallel Computing</b>	<b>6</b>	<b>CO1</b>
	<p>Parallelism (What, Why, Applications), Levels of parallelism (instruction, transaction, task, thread, memory, function)</p> <p>Classification Models: Architectural Schemes (Flynn's, Shore's, Feng's, Handler's), Memory Access: Distributed Memory, Shared Memory, Hybrid Distributed Shared Memory, Parallel Architecture: Pipeline Architecture: Arithmetic pipelines, Floating Point, Array Processor</p> <p><b>Self-Learning Topics:</b> Parallelism classification.</p>		
<b>II</b>	<b>Parallel Programming Platform and Algorithm Design</b>	<b>12</b>	<b>CO2</b>
	<p>Parallel Programming Platform: Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines</p> <p>Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.</p> <p><b>Self-Learning Topics:</b> Parallel Programming</p>		
<b>III</b>	<b>Performance Measures</b>	<b>05</b>	<b>CO3</b>
	<p>Speedup, execution time, efficiency, cost, scalability, Effect of granularity on performance, Scalability of Parallel Systems, Amdahl's Law, Gustavson's Law, Performance Bottlenecks, The Karp Flatt Metric.</p> <p><b>Self-Learning Topics:</b> Performance and Scalability</p>		
<b>IV</b>	<b>HPC Programming: OpenMP and MPI</b>	<b>11</b>	<b>CO4</b>
	<p><b>OpenMP</b></p> <p>Introduction: Threads, Share memory Architecture, Multi-core processors and Hyperthreading, Fork and join model.</p> <p>OpenMP directives: #pragma omp parallel, Hello world with openMP, #pragma omp for, #pragma omp for schedule. Serial vs Parallel PI program, Synchronisation: Introduction, Private vs Shared variables. Critical section, #pragma omp critical, #pragma omp atomic, #pragma omp barrier, #pragma omp reduction</p> <p><b>MPI</b></p> <p>Introduction: Processes, Multiprocessor programming model, Distributed system programming model, Inter-process communication using message passing: Asynchronous and Synchronous MPI Programming: Hello world problem, mpi_initMPI_sendMPI_Recv, Synchronisation: MPI_Barrier</p> <p>Hybrid (MPI + OpenMP) programming, Hardware requirement, Threads inside Processes, Hybrid Matrix multiplication</p>		

	Message passing vs Share memory communication: Advantages and disadvantage <b>Self-Learning Topics:</b> HPC and MPI		
<b>V</b>	<b>Parallel programming using accelerators</b>	<b>05</b>	<b>CO5</b>
	An Overview of GPGPUs, Introduction to CUDA, Introduction to Heterogeneous Computing using OpenCL, An Overview of OpenCL API, Heterogeneous Programming in OpenCL. <b>Self-Learning Topics:</b>		
<b>VI</b>	<b>High Performance Computing in the Cloud</b>	<b>05</b>	<b>CO6</b>
	Virtualization and Containerization, Parallel Computing Frameworks, Scaling, HPC in the Cloud Use Cases. <b>Self-Learning Topics:</b>		
	<b>Total</b>	<b>45</b>	

## List of Experiments:

Exp No.	List of Experiments	COs
1	Analysis of the Linux based computer systems using following commands: a. top , b.ps , c. kill, d. cat /proc/cpuinfo,vmstat <b>Hardware/Software Requirement:</b> Linux Operating System	CO1
2	To setup SSH passwordless logins for two or more Linux based machines and execute commands on a remote machine. <b>Hardware/Software Requirement:</b> Linux Operating System, Multi-core computer systems	CO1
3	Write a program in C to multiply two matrices of size 10000 x 10000 each and find its execution-time using "time" command. Try to run this program on two or more machines having different configurations and compare execution-times obtained in each run. Comment on which factors affect the performance of the program. <b>Hardware/Software Requirement:</b> Linux Operating System, gcc compiler, Multi-core computer systems	CO2
4	Write a "Hello World" program using OpenMP library also display number of threads created during execution. <b>Hardware/Software Requirement:</b> Linux Operating System, gcc compiler, Dual core with HT or Quad-core or higher computer system.	CO3
5	Write a parallel program to calculate the value of PI/Area of Circle using OpenMP library. <b>Hardware/Software Requirement:</b> Linux Operating System, gcc compiler, Dual core with HT or Quad-core or higher computer system.	CO3
6	Write a parallel program to multiply two matrices using openMP library and compare the execution time with its serial version. Also change the number of threads using omp_set_num_threads() function and analyse how thread count affects the execution time.	CO4



Exp No.	List of Experiments	COs
	<b>Hardware/Software Requirement:</b> Linux Operating System, gcc compiler, Dual core with HT or Quad-core or higher computer system.	
7	Install MPICH library and write a "Hello World" program for the same. <b>Hardware/Software Requirement:</b> Linux Operating System, MPICH, Multiprocessor systems or MPI Cluster.	CO4
8	Write a parallel program to multiply two matrices using MPI library and compare the execution-time with its OpenMP and serial version. <b>Hardware/Software Requirement:</b> Linux Operating System, MPICH, gcc, Multiprocessor systems, or MPI Cluster.	CO5
9	Install MPICH on two and more machines and create a MPI cluster. Execute MPI programs on this cluster and check the performance. <b>Hardware/Software Requirement:</b> Linux Operating System, MPICH, Multiprocessor systems or MPI Cluster.	CO5
10	Implement a program to demonstrate balancing workload on MPI platform. <b>Hardware/Software Requirement:</b> Linux Operating System, MPICH, Multiprocessor systems or MPI Cluster.	CO6



## 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
  
10. Mind Mapping
11. Any Other

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.



## Reference Books:

1. Michael J. Quinn —Parallel Programming in C with MPI and OpenMPI by, McGraw Hill Education, 2008.
2. Kai Hwang ,Zhiwei, —Scalable Parallel Computing: Technology, Architecture, Programming, McGraw-Hill Education, 1998.
3. Laurence T. Yang, Minyi Guo, —High-Performance Computing: Paradigm and Infrastructure, by, Wiley, 2006.

## Text Books:

1. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar —Introduction to Parallel Computing, 2nd edition, Addison Wesley, 2003....
2. Shane Cook, Morgan Kaufmann —CUDA Programming: A Developer's Guide to Parallel Computing with GPUs, 2012.
3. M. R. Bhujade —Parallel Computing, 2nd edition, New Age International Publishers, 2009.
4. Kai Hwang, Naresh Jotwani, —Advanced Computer Architecture: Parallelism, Scalability, Programmability McGraw Hill, Second Edition, 2010.
5. Georg Hager, Gerhard Wellein, Chapman —Introduction to High Performance Computing for Scientists and Engineers, Hall/CRC Computational Science Series, 2011.

## Useful Links:

1. <https://nptel.ac.in/courses/112105293>
2. <https://archive.nptel.ac.in/courses/128/106/128106014/>



Course Title: Social Media Analytics												
Semester: VIII			Term: EVEN			Course Code: CSDC8023B						
Teaching Scheme						Evaluation Scheme						
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
03	-	02	03	-	01	04	20	20	60	25	25	150

IAE: Internal Assessment  
 Examination ESE: End Semester  
 Examination CA: Continuous  
 Assessment

### Course Objectives:

1. To familiarize the learners with the concept of social media.
2. To familiarize the learners with the concept of social media analytics and understand its significance.
3. To enable the learners to develop skills required for analysing the effectiveness of social media.
4. To familiarize the learners with different tools of social media analytics.
5. To familiarize the learner with different visualization techniques for Social media analytics.
6. To examine the ethical and legal implications of leveraging social media data.

### Course Outcomes:

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

1. To understand the concept of Social media
2. To understand the concept of social media Analytics and its significance.
3. To learners will be able to analyse the effectiveness of social media
4. To learners will be able to use different Social media analytics tools effectively and efficiently.
5. To learners will be able to use different effective Visualization techniques to represent social media analytics.
6. To acquire the fundamental perspectives and hands-on skills needed to work with social media data.



Module	Contents	Hours	COs
<b>I</b>	<b>Module 1: Social Media Analytics: An Overview</b>	8	CO1
	<p>Core Characteristics of Social Media, Types of Social Media, and Social media landscape.</p> <p>Need for Social Media Analytics (SMA), SMA in small &amp; large organizations. Purpose of Social Media Analytics, Seven Layers of Social Media Analytics, Types of Social Media Analytics, Social Media Analytics Cycle.</p> <p>Challenges to Social Media Analytics, Social Media Analytics Tools</p> <p><b>Self-Learning Topics:</b> Social Media vs. Traditional Business Analytics.</p>		
<b>II</b>	<b>Module 2: Social Network Structure, Measures &amp; Visualization</b>	8	CO2
	<p>Basics of Social Network Structure - Nodes, Edges &amp; Tie Describing the Networks Measures - Degree Distribution, Density, Connectivity, Centralization.</p> <p>Tie Strength &amp; Trust Network Visualization - Graph Layout, Visualizing Network features, Scale Issues.</p> <p>Social Media Network Analytics - Common Network Terms, Common Social Media Network Types, Common Network Terminologies. Network Analytics Tools.</p> <p><b>Self-Learning Topics:</b> Types of Networks</p>		
<b>III</b>	<b>Module 3: Social Media Text, Action &amp; Hyperlink Analytics</b>	7	CO3
	<p>Social Media Text Analytics - Types of Social Media Text, Purpose of Text Analytics, Steps in Text Analytics.</p> <p>Social Media Text &amp; Analysis Tools Social Media Action Analytics - What Is Actions Analytics? Common Social Media Actions. Actions Analytics Tools Social Media Hyperlink Analytics - Types of Hyperlinks.</p> <p>Hyperlink Analytics Tools</p> <p><b>Self-Learning Topics:</b> Types of Hyperlink Analytics.</p>		
<b>IV</b>	<b>Module 4: Social Media Location &amp; Search Engine Analytics</b>	8	CO4
	<p>Location Analytics - Sources of Location Data, Categories of Location Analytics, Location Analytics Tools</p> <p>Search Engine Analytics - Types of Search Engines, Search Engine Analytics.</p> <p>Search Engine Analytics Tools.</p> <p><b>Self-Learning Topics:</b> Location Analytics and Privacy Concerns.</p>		

Module	Contents	Hours	COs
V	<b>Module 5: Social Information Filtering</b>	8	CO5
	Social Information Filtering - Social Sharing and filtering, Automated Recommendation systems. Understanding Social Media and Business Alignment. Social Media KPI, Formulating a Social Media Strategy. Managing Social Media Risks.  <b>Self-Learning Topics:</b> Traditional Vs social Recommendation Sys- tems		
VI	<b>Module 6: Social Media Analytics Applications and Privacy</b>	6	CO6
	Social media in public sector - Analyzing public sector social media, analyzing individual users. Case study: Business use of Social Media - Measuring success, Interaction and monitoring. Case study: data ownership and maintaining privacy online.  <b>Self-Learning Topics:</b> Privacy - Privacy policies		
	<b>Total</b>	<b>45</b>	

## List of Experiments:

Sr. No.	Title of Experiment
1	Study various - i) Social Media platforms ( Facebook, twitter, YouTubeetc) ii) Social Media analytics tools ( Facebook insights, google analytics net lyticetc) iii) Social Media Analytics techniques and engagement metrics (page level, post level, member level) iv) Applications of Social media analytics for business. e.g. Google Analytics <a href="https://marketingplatform.google.com/about/analytics/">https://marketingplatform.google.com/about/analytics/</a> <a href="https://netlytic.org/">https://netlytic.org/</a>
2	Data Collection-Select the social media platforms of your choice (Twitter, Facebook, LinkedIn, YouTube, Web blogs, etc), connect to and capture social media data for business (scraping, crawling, parsing).
3	Data Cleaning and Storage- Preprocess, filter and store social media data for business (Using Python, MongoDB, R, etc).
4	Exploratory Data Analysis and visualization of Social Media Data for business.
5	Develop Content (text, emoticons, image, audio, video) based social media analytics model for business. (e. g. Content Based Analysis: Topic, Issue , Trend, sentiment/opinion analysis, audio, video, image analytics).



Sr. No.	Title of Experiment
6	Develop Structure based social media analytics model for any business. (e. g. Structure Based Models -community detection, influence analysis).
7	Develop a dashboard and reporting tool based on real time social media data.
8	Design the creative content for promotion of your business on social media platform.
9	Analyse competitor activities using social media data.
10	Develop social media text analytics models for improving existing product/ service by analyzing customer's reviews/comments.

## 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.

### C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

**Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered)

**Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

#### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any Other

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be conducted.



## Reference Books:

1. Social Media Analytics [2015], Techniques and Insights for Extracting Business Value Out of Social Media, Matthew Ganis, Avinash Kohirkar, IBM Press.
2. Social Media Analytics Strategy\_ Using Data to Optimize Business Performance, Alex Gonçalves, A Press Business Team.
3. Social Media Data Mining and Analytics, Szabo, G., G. Polatkan, O. Boykin & A. Chalkiopoulos (2019), Wiley, ISBN 978-1-118-82485-6.

## Text Books:

1. Seven Layers of Social Media Analytics\_ Mining Business Insights from Social Media Text, Actions, Networks, Hyperlinks, Apps, Search Engine, and Location Data, Gohar F. Khan,(ISBN-10: 1507823207).
2. Analysing the Social Web 1st Edition by Jennifer Golbeck.
3. Mining the Social Web\_ Analysing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites, Matthew A Russell, O'Reilly.
4. Charu Aggarwal (ed.), Social Network Data Analytics, Springer, 2011.

## Useful Links:

1. <https://cse.iitkgp.ac.in/~pawang/courses/SC16.html>
2. [https://onlinecourses.nptel.ac.in/noc20\\_cs78/preview](https://onlinecourses.nptel.ac.in/noc20_cs78/preview)
3. <https://nptel.ac.in/courses/106106146>
4. <https://7layersanalytics.com/>

Course Title: Full Stack Development												
Semester: VIII			Term: Even			Course Code: 24CSPEC8024						
Teaching Scheme						Evaluation Scheme						
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	2	3	-	1	4	20	20	60	25	25	150

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment, TW: Term Work

### Course Objectives:

1. To build a strong foundation in Java programming, emphasizing object-oriented principles and robust software solutions.
2. To develop essential web development skills for creating structured, responsive web pages using HTML5, CSS3, and Bootstrap.
3. To master MySQL for data management, covering SQL commands, query optimization, and advanced data manipulation.
4. To understand data persistence with JPA, focusing on entity classes, lifecycle management, and querying techniques.
5. To gain expertise in the Spring framework, including IoC, DI, Spring Boot, Spring Data JPA, REST, and Spring Security.
6. To develop dynamic and secure web applications using Angular, with a focus on components, forms, routing, and authentication.

### Course Outcomes:

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

1. Develop efficient, maintainable, and tested Java applications using object-oriented principles, memory management, and exception handling.
2. Build structured and responsive web pages using HTML5, CSS3, and Bootstrap for modern web design.
3. Manage and analyze databases effectively using advanced SQL commands, joins, and query optimization in MySQL.
4. Implement data persistence in Java applications using JPA for entity management, querying, and relationship handling.
5. Create secure and scalable Java applications using Spring Core, Spring Boot, Spring Data JPA, REST, and Spring Security.
6. Develop dynamic, secure web applications with Angular, focusing on components, routing, forms, and authentication.

Module	Contents	Hours	COs
I	<b>Core Java Recap</b>	5	CO1
	<p><b>Java Foundations &amp; Code Conventions:</b> Identifiers, Legal Naming, Java Code Practices, Class Declarations, Modifiers, Interface Constants.</p> <p><b>Access Control &amp; Object Behavior:</b> Access Modifiers, Constructors, Static Elements, Overloading, Polymorphism, Interface Implementation. <b>Core Object-Oriented Principles:</b> Encapsulation, Inheritance, Method Overriding, Cohesion, and Casting.</p> <p><b>Memory, Assignments &amp; Operations:</b> Variable Assignments, Operators (Arithmetic, Relational, Logical), Arrays, Wrapper Classes, Autoboxing, and Garbage Collection.</p> <p><b>Flow, Exceptions &amp; Testing:</b> Control Flow (if, switch, Loops), Exception Handling.</p> <p><b>Self-Learning Topics:</b></p> <p><b>Concurrency &amp; Threading:</b> Learn how to create and manage threads, synchronize code, handle thread states, and avoid deadlocks for efficient multi-threaded programming.</p> <p><b>Generics &amp; Collections:</b> Master the use of generics for type safety and explore core Java collections (List, Set, Map, Queue) for managing data structures effectively.</p> <p><b>Design Patterns:</b> Study key design patterns like Singleton, Factory, and Observer to create scalable and reusable software solutions.</p> <p><b>Lambda Expressions &amp; Stream API:</b> Learn how to use lambda expressions for functional programming and explore Stream API for handling data in a declarative way.</p>		
II	<b>HTML 5, CSS 3 with Bootstrap Recap</b>	5	CO2
	<p><b>HTML Basics &amp; Structure:</b> Learn HTML5 structure, semantic elements, character effects, document spacing, and working with tables, lists, and hyperlinks.</p> <p><b>Image Handling &amp; Forms:</b> Understand image roles, adding images to web pages, using images as links, and handling user input through various form elements (text fields, checkboxes, radio buttons, etc.).</p> <p><b>CSS3 Fundamentals:</b> Explore CSS syntax, selectors, text formatting, fonts, colors, borders, and advanced features like CSS Grid.</p> <p><b>Bootstrap Introduction &amp; Components:</b> Get started with Bootstrap, utilizing grid systems and essential components like headers, dropdowns, and navigation bars.</p> <p><b>Self-Learning Topics:</b></p> <p><b>Responsive Web Design:</b> Learn to build websites that adapt to different screen sizes and devices using media queries, flexible layouts, and mobile- first design principles.</p> <p><b>JavaScript DOM Manipulation:</b> Gain proficiency in manipulating HTML elements with JavaScript to dynamically change content, styles, and handle events, enhancing interactivity.</p> <p><b>CSS Flexbox:</b> Master the Flexbox layout system to create responsive and</p>		

	<p>well-aligned page structures with minimal code, making layouts easier to build and maintain.</p> <p><b>Version Control with Git:</b> Learn Git for tracking code changes, collaborating on projects, managing branches, and using GitHub or GitLab to streamline development and teamwork.</p>		
<b>III</b>	<b>MySQL Database Recap</b>	5	CO3
	<p><b>Mastering MySQL Fundamentals:</b> Dive into data types, core SQL commands, and filtering with advanced WHERE clauses.</p> <p><b>Advanced Data Manipulation:</b> Harness aggregate functions, string/date operations, and optimize joins with aliases and constraints.</p> <p><b>Shaping and Aggregating Results:</b> Refine your queries with ORDER BY, GROUP BY, HAVING, and dynamic aggregation techniques.</p> <p><b>Self-Learning Topics:</b></p> <p><b>Optimizing Performance &amp; Advanced Techniques:</b> Unlock performance with indexing, stored procedures, triggers, and explore complex SQL, normalization, and backup strategies.</p>		
<b>IV</b>	<b>Entity Management and ORM with JPA</b>	8	CO4
	<p><b>Data Persistence &amp; ORM Tools:</b> Overview of data persistence, introduction to ORM tools, and understanding JPA specifications.</p> <p><b>Entity Classes &amp; Persistence:</b> Requirements for entity classes, persistent fields and properties, collections in entities, primary keys, and validation of fields.</p> <p><b>Managing Entities:</b> EntityManager interface, container-managed and application-managed entities, lifecycle management, and synchronizing entity data.</p> <p><b>Querying Entities:</b> Java Persistence Query Language (JPQL), Criteria API for querying entities.</p> <p><b>Entity Relationships &amp; Cascade Operations:</b> Direction in relationships, bidirectional and unidirectional relationships, cascade operations, and relationship queries.</p> <p><b>Self-Learning Topics:</b></p> <p><b>JPA Annotations:</b> Understanding the essential JPA annotations (@Entity, @Id, @OneToMany, @ManyToOne, etc.) for mapping Java objects to database tables and defining relationships.</p> <p><b>Lazy vs Eager Loading:</b> Mastering the concepts of lazy and eager loading to optimize performance when fetching data in entity relationships.</p> <p><b>JPQL Advanced Queries:</b> Learning how to write advanced JPQL queries using joins, subqueries, grouping, and aggregation functions to retrieve data efficiently.</p> <p><b>Transactions in JPA:</b> Understanding how to manage transactions with @Transactional and ensure data consistency and isolation during operations.</p> <p><b>Optimizing JPA Performance:</b> Exploring techniques like batch processing, caching, and fetch strategies to improve the performance of JPA in large-scale applications.</p>		
<b>V</b>	<b>Mastering Spring Framework</b>	12	CO5



	<p><b>Spring Core Unveiled:</b> Mastering Loose Coupling, IoC, and DI with Bean Configuration</p> <p><b>Spring Boot Essentials:</b> Fast-Track Your Development with Auto-Configuration and Embedded Servers</p> <p><b>Spring Data JPA Deep Dive:</b> Harnessing Repositories, Named Queries, and Transaction Management</p> <p><b>Spring Data REST Integration:</b> Exposing REST APIs with Seamless Repository Management</p> <p><b>Spring Security &amp; Microservices:</b> Building Scalable, Secure APIs with Real-World Demos.</p> <p><b>Self-Learning Topics:</b></p> <p><b>Advanced Dependency Injection Techniques:</b> Exploring scope, lifecycle, @Scope, @Lazy, and custom scopes.</p> <p><b>Spring AOP (Aspect-Oriented Programming):</b> Implementing logging, security, and transactions using AOP.</p> <p><b>Spring Cloud:</b> Understanding microservices architecture and tools like Config Server and Eureka.</p> <p><b>Spring Reactive Programming:</b> Building non-blocking, event-driven applications using Spring WebFlux.</p> <p><b>Spring Security OAuth2:</b> Implementing OAuth2 for secure authentication and authorization in applications</p>		
<p><b>VI</b></p>	<p><b>Angular Framework</b></p>	<p>10</p>	<p>CO6</p>
	<p><b>Angular Framework Essentials:</b> Introduction to Angular, setting up the environment with Angular CLI, project setup, bootstrapping the app, building components, and understanding app structure.</p> <p><b>Angular Components and Data Binding:</b> Creating and nesting components, setting up templates, handling property/event binding, two-way data binding, and managing input/output properties.</p> <p><b>Directives and Styles in Angular:</b> Working with built-in directives, creating custom attribute directives using Renderer and HostListener, applying styles, and using View Encapsulation with Bootstrap integration.</p> <p><b>Forms, Pipes, and Dependency Injection:</b> Understanding template-driven vs reactive forms, built-in and custom validators, creating services, using dependency injection, and implementing pipes.</p> <p><b>Routing, HTTP Requests, and Authentication:</b> Implementing routing with navigation, child routes, passing parameters, making HTTP requests, using observables, and securing routes with JWT and route guards.</p> <p><b>Self-Learning Topics:</b></p> <p><b>Advanced Routing Techniques:</b> Learn how to handle lazy loading, preloading strategies, and advanced route guards to optimize your Angular application's navigation.</p> <p><b>State Management with NgRx:</b> Understand state management using NgRx, including Actions, Reducers, and Store for managing the</p>		



	<p>application's state in a reactive way.</p> <p><b>Optimizing Angular Performance:</b> Explore techniques for improving performance in Angular apps, such as change detection strategies, Ahead-of-Time (AOT) compilation, and lazy loading of modules.</p> <p><b>Angular Testing Best Practices:</b> Learn how to write unit and integration tests using Jasmine, Karma, and Angular testing utilities. Understand mocking services, testing components, and coverage tools.</p> <p><b>Angular Animations:</b> Discover how to implement animations in Angular applications using the Angular Animation API for transitions, triggers, and complex sequences.</p>		
	<b>Total</b>	<b>45</b>	

Exp. No.	List of Experiments	COs
1.	<b>Employee Management System:</b> Implement Java classes and objects to manage employee details, using constructors, modifiers, and access control.	CO1
2.	<b>Online Banking Application:</b> Use polymorphism and interface implementation to manage various types of bank accounts with different behaviors.	CO1
3.	<b>Personal Portfolio Website:</b> Create a responsive portfolio using HTML5, semantic elements, and Bootstrap grid system to showcase your work.	CO2
4.	<b>Blog Website:</b> Structure a blog using HTML for text content and CSS for formatting, with proper use of headings, paragraphs, and hyperlinks.	CO2
5.	<b>Employee Performance Dashboard:</b> Aggregate and group employee performance data by department, using ORDER BY and GROUP BY to display key metrics.	CO3
6.	<b>Customer Database Management:</b> Build a customer database with SQL queries to store and filter customer information using WHERE clauses.	CO3
7.	<b>Inventory Management System:</b> Use JPA and ORM tools to persist product and stock data, with entity classes for products, categories, and suppliers.	CO4
8.	<b>Online Banking System:</b> Secure APIs and transactions using Spring Security, building a scalable banking application with microservices architecture.	CO5
9.	<b>Online Learning Platform:</b> Build a course and student management system, integrating REST APIs and Spring Security to ensure secure access.	CO5
10.	<b>Blog Website:</b> Create a blog platform with Angular routing for dynamic blog posts, HTTP requests to fetch data, and JWT-based authentication for login.	CO6
11.	<b>Movie Booking System:</b> Build a movie ticket booking system with Angular forms for seat selection, pipes for sorting, and routing for different theater locations.	CO6



## 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):

The End Semester Mettl examination of 100 Marks will be conducted based on the entire syllabus.

### C. Continuous Assessment (CA) :

Continuous Assessment should consist of the following **Experiments / Tutorials (8 to 10):** 10 marks (All COs / LOs should be covered) **Attendance (Theory & Practical):** 05 marks

**Teacher Assessment Examination (TAE):** 10 Marks

**MCQ (weekly) & Lab assignments (daily)**

### List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study
3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flip Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other

**Note:** Number of activities to be conducted under TAE would be as per the subject needed.

### D. Oral & Practical Exam

Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will be held.

### Reference Books:

1. Spring in Action by Craig Walls
2. Java Persistence with Hibernate by Christian Bauer, Gavin King, and Gary Gregory
3. Spring Boot in Action by Craig Walls
4. Full Stack Development with Spring Boot and Angular by Ranga Karanam



## Useful Links:

1. <https://docs.spring.io/spring-framework/reference/>
2. <https://docs.oracle.com/javaee/7/api/javax/persistence/package-summary.html>
3. <https://hibernate.org/orm/documentation/>
4. <https://angular.io/docs>
5. <https://www.journaldev.com/22728/spring-boot-angular>
6. <https://github.com/in28minutes/full-stack-with-angular-and-spring-boot>

<b>Course Title: Project Management</b>												
<b>Semester: VIII</b>			<b>Term: Even</b>			<b>Course Code: 24ILO8021B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
03	-	-	03	-	-	03	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>1. Understanding the Foundations of Project Management</li> <li>2. Developing Leadership and Interpersonal Skills</li> <li>3. Mastering Project Planning and Risk Management</li> <li>4. Enhancing Monitoring, Evaluation, and Software Proficiency</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. Demonstrate an understanding of project management principles and models</li> <li>2. Exhibit leadership and interpersonal skills</li> <li>3. Plan and execute projects effectively</li> <li>4. Utilize advanced scheduling and resource management techniques</li> <li>5. Implement project monitoring and control mechanisms</li> <li>6. Leverage software and simulation tools</li> </ol>												

Module	Contents	Hours	COs
I	<b>Introduction to project management:</b> Introduction to project management - I, introduction to project management - II, agile project management, project selection models, examples of project selection models	6	CO1
II	<b>Role of the Project Manager:</b> Project manager, attributes of effective project manager, managing for stakeholders, resolving conflicts, negotiation, project in the organization structure, human factors and the project team	8	CO2
III	<b>Comprehensive Project Planning and Risk Management:</b> Traditional project activity planning, agile project planning, project charter, coordination through integration management, project feasibility analysis, estimating project budgets project risk management, quantitative risk assessment methodologies, critical path method (CPM)	8	CO3
IV	<b>Advanced Scheduling and Resource Optimization Techniques in Project Management:</b> Programme evaluation and review technique (PERT), risk analysis with simulation for scheduling, Gantt chart, scheduling with scrum, crashing a project, resource loading, resource levelling Goldratt's critical chain	9	CO4
V	<b>Project Monitoring, Control, and Closure: Insights and Case Studies:</b> Planning-monitoring-controlling cycle, earned value analysis, agile tools for tracking project, three types of project-controlling, control of change scope and scope creep, project audit, essentials of an audit/evaluation, when to close a project, benefits realisation, case study on the success of Chandrayan-3.	9	CO5
VI	<b>Leveraging Software Tools for Effective Project Management:</b> Software for project management, demo on project management software, simulations software for project management	5	CO6
	<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 Book:**

1. Project Management (A Strategic Managerial Approach) by Meredith

## **Online Reference:**

[https://onlinecourses.nptel.ac.in/noc25\\_mg71/preview](https://onlinecourses.nptel.ac.in/noc25_mg71/preview)

<b>Course Title: Finance Management</b>													
<b>Semester: VIII</b>			<b>Term: Even</b>				<b>Course Code: 24ILO8022B</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</b>	<b>Total</b>	
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>								
03	-	-	03	-	-	03	20	20	60	-	-	100	

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

### Course Objectives:

1. To understand financial and cost accounting principles, corporate finance concepts and financial statements. and the preparation and interpretation of financial statements
2. To understand cash flow and analysis of financial statements.
3. To understand and define break even analysis and budgeting.
4. To describe capital structure, risk-return analysis, time value of money, valuation methods for bonds and stocks, compute WCC, evaluate capital investments and analyze dividend policies..

### Course Outcomes:

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

1. Explain the concepts related to financial and cost accounting, corporate finance and financial statements.
2. Prepare, interpret and analyze financial and cash flow statements.
3. Apply cost accounting techniques to prepare cost sheets and optimize resource allocation.
4. Explain cost accounting and Allocation and Apportionment of Overheads, prepare a
5. Analyze financial decisions, evaluate risks, and apply valuation techniques for bonds and stocks.
6. Compute WACC, evaluate capital investments, and analyze dividend policies in real-world scenarios.

Module	Contents	Hours	COs
I	<p><b>Introduction to Financial and Cost Accounting:</b> Distinctions Between Financial and Cost/Management Accounting, Processes of Recording Business Transactions, Users of Financial and Cost/Management Accounting Information, Decision-Making Through Cost/Management Accounting</p> <p><b>Introduction to Corporate Finance:</b> Meaning and Functions of Corporate Finance, Fundamentals of the Time Value of Money</p> <p><b>Financial Statements Basics:</b> Recording, Classifying, and Summarizing Transactions, Income Statement and Balance Sheet Concepts, Dual Effect Concept (Double-Entry Bookkeeping), Accrual and Entity Concepts in Accounting</p>	7	CO1
II	<p><b>Preparation of Financial Statements:</b> Classification of Items (Assets, Liabilities, Equity, Revenue, Expenses), Applications of Double-Entry System, Accruals, Depreciation, and Adjustments (Prepaid Expenses, Accrued Interest)</p> <p><b>Cash Flow Statements:</b> Direct and Indirect Methods, Cash Flow from Operating, Investing, and Financing Activities, Analysis of Cash Flow with Income Statement and Balance Sheet</p> <p><b>Financial Statement Analysis: Ratio Analysis:</b> Liquidity, Profitability, Efficiency, Dividend Ratios, Working Capital Management</p>	9	CO2
III	<p><b>Introduction to Cost Accounting:</b> Cost, Costing, and Cost Accounting: Definitions and Purposes, Classification of Costs: Fixed, Variable, Direct, Indirect, Opportunity Costs</p> <p><b>Preparation of Cost Sheets:</b> Prime Cost, Conversion Cost, and Total Cost, Classification of Manufacturing and Non-Manufacturing Costs</p> <p><b>Allocation and Apportionment of Overheads:</b> Primary and Secondary Distribution, Activity-Based Costing (ABC): Concepts, Drivers, and Applications</p>	9	CO3
IV	<p><b>Break-Even Analysis:</b> Contribution Analysis, Cost-Volume-Profit Analysis, Margin of Safety and Operating Leverage</p> <p><b>Decision-Making Examples:</b> Keep or Drop Products, Make or Buy Decisions, Incremental Costs and Relevant Costs</p> <p><b>Budgeting:</b> Types of Budgets: Self-Imposed, Master, and Cash Budgets, Flexible Budget and Variance Analysis</p>	7	CO4
V	<p><b>Capital Structure and Valuation Basics:</b> Structure of Finance Function, Capital Structure Decisions, Risk and Return Concepts: Beta, Sharpe Ratio, Jensen's Alpha</p> <p><b>Time Value of Money and Valuation:</b> Present Value and Future Value (Single and Multi-Period Cases), Perpetuity, Growing Perpetuity, and Annuity</p> <p><b>Bond and Stock Valuation:</b> Bond Pricing, Yield to Maturity, and</p>	6	CO5

	Zero-Coupon Bonds, Stock Valuation: Zero Growth, Constant Growth, Differential Growth		
VI	<b>Cost of Capital and WACC:</b> Capital Asset Pricing Model (CAPM) and Dividend Discount Model (DDM), Cost of Debt, Equity, and Preferred Stock, Weighted Average Cost of Capital (WACC) <b>Capital Investment Decisions:</b> Techniques: NPV, IRR, Payback Period, Comparisons Between Techniques <b>Dividend and Payout Policies:</b> Types of Payout: Regular Dividend, Stock Dividend, Stock Splits, Dividend Signaling and Real-World Implications	7	CO6
	<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. Accounting: Text and Cases; Robert N Anthony, David F Hawkins and Kenneth A Merchant, McGraw Hill Education.
2. Cost Accounting; Horngren, Foster & Dattar; PHI Publication
3. Corporate Finance by Ross, Westerfield, Jaffe, Jordan and Kakani, McGraw Hill Education.

### Online Reference:

[https://onlinecourses.nptel.ac.in/noc25\\_ec02/preview](https://onlinecourses.nptel.ac.in/noc25_ec02/preview)

Course Title: Entrepreneurship Development and Management												
Semester: VIII			Term: Even				Course Code: 24ILO8023B					
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							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

### Course Objectives:

1. To introduce the fundamental concepts of entrepreneurship, including its types, team building, and innovation processes.
2. To provide exposure to case studies and real-world examples, emphasizing the transition from design to entrepreneurship.
3. To enable students to develop entrepreneurial skills through frameworks such as Business Model Canvas and Lean Canvas.
4. To guide students from ideation to proof of concept, fostering creativity and technology-led entrepreneurship.

### Course Outcomes:

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

1. Understand the principles of entrepreneurship and its significance in driving innovation and business growth.
2. Analyze different types of entrepreneurship and their applications in fields like bio-med innovation and technology.
3. Develop cohesive and effective entrepreneurial teams and apply creativity to generate viable product ideas.
4. Utilize frameworks like Business Model Canvas and Lean Canvas to create structured business plans and pitches.
5. Transition from a product idea to a proof of concept, demonstrating practical entrepreneurial skills.
6. Evaluate successful start-up stories and apply their lessons to develop and pitch innovative business models.

Module	Contents	Hours	COs
I	Introduction to Entrepreneurship, What is Entrepreneurship GDC Program, Hand holding for Entrepreneurship GDC start-up stories	7	CO1
II	Entrepreneurship Types, Team Building, Innovation and Entrepreneurship, Solar Oven case-study Paradigm shift from Design to Entrepreneurship	9	CO2
III	Bio- Med Innovation and Entrepreneurship, New-age Entrepreneurship	9	CO3
IV	Business Model Canvas, Technology led Entrepreneurship	7	CO4
V	Entrepreneurship as Academic Program - IITH case study, Creativity and Generating Product Ideas, From Idea to Proof of Concept, Network Entrepreneurship	6	CO5
VI	Learning from examples Start-up PITCHES - Using Lean Canvas Model Part 1, Learning from examples Start-up PITCHES - Using Lean Canvas Model Part 2	7	CO6
	<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. Disciplined Entrepreneurship: 24 Steps to a Successful Startup by Bill Aulet
2. The Essence of Medical Device Innovation by B Ravi
3. THE FORTUNE AT BOTTOM OF PYRAMID: Eradicating Poverty Through Profits by C. K. Prahalad Stay Hungry
4. Stay Foolish by Rashmi Bansal
5. The Entrepreneurial Connection: East Meets West in the Silicon Valley by Gurmeet Naroola
6. Innovation By Design: Lessons from Post Box Design & Development by B. K. Chakravarthy , Janaki Krishnamoorthi

## Online Reference:

[https://onlinecourses.nptel.ac.in/noc25\\_de07/preview](https://onlinecourses.nptel.ac.in/noc25_de07/preview)



## Course Title: Human Resource Management

<b>Semester: VIII</b>		<b>Term: Even</b>				<b>Course Code: 24ILO8024B</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</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 CA: Continuous

Assessment

### Course Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource management
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
3. To familiarize the students about the latest developments, trends & different aspects of HRM
4. To acquaint the student with the importance of inter-personal & inter-group behavioural skills in an organizational setting required for future stable engineers, leaders and managers

### Course Outcomes: Learner will be able to...

1. Evaluate the concept, scope, and importance of Human Resource Management (HRM) within organizations.
2. Evaluate the impact of personality traits and perceptions on individual decision-making and behavior within organizations.
3. Create a framework for designing an effective organizational structure that aligns with the organization's goals and strategy.
4. Develop a framework for designing an effective organizational structure that aligns with the organization's goals and strategy.
5. Identify the causes of diversity within organizations and evaluate the impact of diversity on employee motivation and performance.
6. Critically evaluate the key concepts and principles of Human Resource Management (HRM), including its scope, importance, and interdisciplinary nature.

Module	Contents	Hours	COs
I	<p><b>Introduction to HR</b> Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring.</p> <p><b>Self-Learning:</b> Rightsizing, Empowerment, TQM, Managing ethical issues</p>	8	CO1
II	<p><b>Organizational Behaviour (OB)</b> Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness Perception: Attitude and Value, Effect of perception on Individual Decision- making, Attitude and Behaviour Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor); 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.</p> <p><b>Self-Learning:</b> Case study</p>	8	CO2
III	<p><b>Organizational Structure &amp; Design</b> Structure, size, technology, Environment of organization; Organizational Roles &amp; conflicts: Concept of roles; role dynamics; role conflicts and stress. Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. Power and Politics: Sources and uses of power; Politics at workplace.</p> <p><b>Self-Learning:</b> Tactics and strategies.</p>	8	CO3
IV	<p><b>Human resource Planning</b> Recruitment and Selection process, Job-enrichment, Empowerment - Job- Satisfaction, employee morale Performance Appraisal Systems: Traditional &amp; modern methods, Performance Counselling, Career Planning</p> <p><b>Self-Learning:</b> Training &amp; Development: Identification of Training Needs, Training Methods</p>	7	CO4
V	<p><b>Emerging Trends in HR</b></p>	7	CO5



# 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

	<p>Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development , managing processes &amp; transformation in HR. Organizational Change, Culture, Environment</p> <p>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</p> <p><b>Self-Learning:</b> Intra company cultural difference in employee motivation</p>		
VI	<p><b>HR &amp; MIS:</b> 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> <p><b>Strategic HRM:</b> 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 <b>Labor Laws.</b></p> <p><b>Self-Learning: Industrial Relations:</b> Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act</p>	7	CO6
	<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. Stephen Robbins, Organizational Behavior, 16<sup>th</sup> Ed, 2013
2. V S P Rao, Human Resource Management, 3<sup>rd</sup> Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6<sup>th</sup> edition, 2011
4. 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

## Text Books:

1. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5<sup>th</sup> Ed, 2013, Himalaya Publishing
2. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

## Links for online NPTEL/SWAYAM courses:

1. <https://archive.nptel.ac.in/courses/110/105/110105069/>



### Course Title: Professional Ethics and CSR

Semester: VIII

Term: Even

Course Code: 24ILO8025B

#### Teaching Scheme

#### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

#### Course Objectives:

1. To understand professional ethics in business
2. To recognized corporate social responsibility

#### Course Outcomes: Learner will be able to...

1. Understand rights and duties of business
2. Understand professional ethics in the marketspace
3. Demonstrate professional ethics of consumer protection
4. Understand legal aspects of corporate social responsibility
5. Understand Public-Private Partnership in India
6. Analyse Corporate Social Responsibility in Globalizing India

Module	Contents	Hours	COs
I	<p><b>Professional Ethics and Business:</b> The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights</p> <p><b>Self-Learning:</b> Duties of Business</p>	8	CO1
II	<p><b>Professional Ethics in the Marketplace:</b> Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy <b>Professional Ethics and the Environment:</b> Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control.</p> <p><b>Self-Learning</b> Ethics of Conserving Depletable Resources</p>	8	CO2
III	<p><b>Professional Ethics of Consumer Protection:</b> Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy <b>Professional Ethics of Job Discrimination:</b> Nature of Job Discrimination; Extent of Discrimination</p> <p><b>Self-Learning:</b> Reservation of Jobs.</p>	8	CO3
IV	<p><b>Introduction to Corporate Social Responsibility:</b> Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection.</p> <p><b>Self-Learning:</b> Trajectory of Corporate Social Responsibility in India</p>	7	CO4
V	<p><b>Corporate Social Responsibility:</b> Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility.</p> <p><b>Self-Learning:</b> Public-Private Partnership (PPP) in India</p>	7	CO5
VI	<p><b>Corporate Social Responsibility in Globalizing India:</b> Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India.</p> <p><b>Self-Learning:</b> Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.</p>	7	CO6
	<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. 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.

## Text Books:

1. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Pub- lisher: Pearson, New Delhi.
2. Corporate Social Responsibility in India (2015) by Bidyut Chakrabarty, Routledge, New Delhi.

## Links for online NPTEL/SWAYAM courses:

1. [https://onlinecourses.nptel.ac.in/noc21\\_mg54/preview](https://onlinecourses.nptel.ac.in/noc21_mg54/preview)

<b>Course Title: Research Methodology</b>												
<b>Semester: VIII</b>			<b>Term: Even</b>				<b>Course Code: 24ILO8026B</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</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

CA: Continuous Assessment

## Course Objectives

1. To provide an understanding of the fundamentals of research, including literature surveys, experimental skills, and data analysis.
2. To equip students with the skills for effective technical writing and presentations, emphasizing clarity and precision.
3. To foster creativity and ethical awareness in the design and execution of research projects.
4. To introduce students to intellectual property concepts and department-specific research methodologies.

## Course Outcomes:

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

1. Conduct comprehensive literature surveys and analyze data to identify research gaps and trends.
2. Develop and execute experimental designs effectively while adhering to ethical principles.
3. Apply technical writing techniques to prepare research papers, case studies, and project reports.
4. Deliver impactful technical presentations showcasing research findings.
5. Demonstrate creativity in problem-solving and innovation within research contexts.
6. Understand and apply principles of intellectual property in protecting and commercializing research outcomes.

Module	Contents	Hours	COs
I	A group discussion on what is research; overview of research, literature survey, experimental skills	8	CO1
II	Data analysis, modelling skills; technical writing; technical presentations; creativity in research	8	CO2
III	Creativity in research; group discussion on ethics in research, design of experiments	8	CO3
IV	Intellectual property	7	CO4
V	Department-specific research discussions	7	CO5
VI	Case study/Research paper writing	7	CO6
	<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. 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

## Online Reference:

[https://onlinecourses.nptel.ac.in/noc25\\_ge28/preview](https://onlinecourses.nptel.ac.in/noc25_ge28/preview)

## Course Title: IPR and Patenting

<b>Semester: VIII</b>			<b>Term: Even</b>			<b>Course Code: 24ILO8027B</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</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 CA: Continuous

Assessment

### Course Objectives:

1. To understand intellectual property rights protection system
2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures
3. To get acquaintance with Patent search and patent filing procedure and applications.

**Course Outcomes:** Learner will be able to...

1. Understand to Intellectual Property Rights and its importance in modern global economic environment
2. Apply Enforcement of Intellectual Property Rights
3. Understand Emerging Issues in IPR
4. Understand and apply basics of patenting
5. Understand patent rules and apply
6. Understand and implement Procedure for Filing a Patent

Module	Contents	Hours	COs
I	<p><b>Introduction to Intellectual Property Rights (IPR):</b> Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc.</p> <p><b>Importance of IPR in Modern Global Economic Environment:</b> Theories of IPR, Philosophical aspects of IPR laws</p> <p><b>Self-Learning:</b> Need for IPR, IPR as an instrument of development</p>	8	CO1
II	<p><b>Enforcement of Intellectual Property Rights:</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, 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.</p> <p><b>Self-Learning:</b> History of IPR</p>	8	CO2
III	<p><b>Emerging Issues in IPR:</b> Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.</p> <p><b>Self-Learning:</b> Cross-border IPR Enforcement</p>	8	CO3
IV	<p><b>Basics of Patents:</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.</p> <p><b>Self-Learning:</b> Method of getting a patent</p>	7	CO4
V	<p><b>Patent Rules:</b> Indian patent act, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)</p> <p><b>Self-Learning:</b> European patent rules</p>	7	CO5
VI	<p><b>Procedure for Filing a Patent (National and International):</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</p> <p><b>Self-Learning: Patent databases:</b> Important websites, Searching international databases</p>	7	CO6
	<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. 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

## Text Books:

1. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights,
2. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company

## Links for online NPTEL/SWAYAM courses:

[https://onlinecourses.nptel.ac.in/noc22\\_hs59/preview](https://onlinecourses.nptel.ac.in/noc22_hs59/preview)



## Course Title: Digital Business Management

**Semester: VIII**

**Term: Even**

**Course Code: 24ILO8028B**

### Teaching Scheme

### Evaluation Scheme

Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

### Course Objectives:

1. To familiarize with digital business concept
2. To acquaint with E-commerce
3. To give insights into E-business and its strategies

### Course Outcomes: Learner will be able to...

1. Identify drivers of digital business
2. Illustrate various approaches and techniques for E-business and management
3. Understand Digital Business Support services
4. Understand Managing E-Business
5. Understand E-Business Strategy
6. Materializing e-business from idea to realization

Module	Contents	Hours	COs
I	<p><b>Introduction to Digital Business-</b> Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, <b>Drivers of digital business-</b> Big Data &amp; Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services)</p> <p><b>Self-Learning:</b> Opportunities and Challenges in Digital Business</p>	8	CO1
II	<p><b>Overview of E-Commerce</b> <b>E-Commerce-</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</p> <p><b>Self-Learning:</b> Legal, Ethics and Societal impacts of EC</p>	8	CO2
III	<p><b>Digital Business Support services:</b> ERP as e –business backbone, knowledge Tope Apps, Information and referral system</p> <p><b>Self-Learning: Application Development:</b> Building Digital business Applications and Infrastructure</p>	8	CO3
IV	<p><b>Managing E-Business-</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</p> <p><b>Self-Learning:</b> Prominent Cryptographic Applications</p>	7	CO4
V	<p><b>E-Business Strategy-</b>E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy</p> <p><b>Self-Learning:</b> E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)</p>	7	CO5
VI	<p><b>Materializing e-business: From Idea to Realization-</b>Business plan preparation</p> <p><b>Self-Learning:</b> Case Studies and presentations</p>	7	CO6
	<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. 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

## Text Books:

1. Digital Business Concepts and Strategy, Eloise Coupey, 2<sup>nd</sup> Edition, Pearson
2. Trend and Challenges in Digital Business Innovation, Vinocenzo Morabito, Springer
3. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan

## Links for online NPTEL/SWAYAM courses:

[https://onlinecourses.nptel.ac.in/noc19\\_mg54/preview](https://onlinecourses.nptel.ac.in/noc19_mg54/preview)

Course Title: Environmental Management												
Semester: VIII			Term: Even				Course Code: 24ILO8029B					
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							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

### Course Objectives:

1. To introduce Environmental Management and EIA concepts, including legal and regulatory frameworks.
2. To understand EIA procedures like scoping, screening, and baseline studies.
3. To explore EIA methodologies, tools, and techniques.
4. To highlight public involvement, impact mitigation, and EMP preparation.
5. To develop skills in EIA reporting, decision-making, and implementation through case studies.

### Course Outcomes: At the end of the course students will be able to:

1. Explain the significance of Environmental Management and EIA in sustainability.
2. Conduct scoping, screening, and baseline assessments.
3. Apply EIA methodologies and tools effectively.
4. Propose mitigation strategies and prepare EMPs.
5. Evaluate EIA reports and ensure compliance.
6. Implement and follow up on EIA processes using case-based insights.

## Course Content:

Module	Contents	Hours	COs
I	Introduction to Environment Management & EIA, Legal, Policy & Regulatory Framework	7	CO1
II	EIA Procedure - Scoping & Screening and Establishing Baseline Conditions, EIA Methodologies	8	CO2
III	Connectedness: connected spaces and subspaces, Connectedness of the real line, Intermediate value theorem, EIA Methods, Tools and Techniques	8	CO3
IV	Public Involvement in EIA , Impact Management - Mitigation & Preparation of Environment Management Plans (EMP)	8	CO4
V	EIA Reporting & Review of EIA Quality, Decision Making & Project Management	7	CO5
VI	Implementation & follow up, EIA Case Examples	7	CO6
<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. Wathern P., "Environmental Impact Assessment: Theory and Practice", Routledge Publishers, 1990
2. Marriott B., "Environmental Impact Assessment: A Practical Guide", McGraw-Hill Publication, 1997
3. Shrivastava A.K., Baxter Nicola, Grimm Jacob, "Environmental Impact Assessment", APH Publishers, 2003
4. Anjaneyulu Y., Manickam Valli, "Environmental Impact Assessment Methodologies", CRC Press, 2011
5. Glasson J., Therivel Riki, Chadwick Andrew, "Introduction to Environmental Impact Assessment", Oxford Brookes University 2012 (4<sup>th</sup> edition).

## Online Reference:

[https://onlinecourses.nptel.ac.in/noc25\\_ar03/preview](https://onlinecourses.nptel.ac.in/noc25_ar03/preview)

<b>Course Title: Industry Certification</b>												
<b>Semester: VIII</b>			<b>Term: Even</b>				<b>Course Code: 24CSVSE801B</b>					
<b>Teaching Scheme</b>							<b>Evaluation Scheme</b>					
<b>Contact Hrs.</b>			<b>Credit Allotted</b>			<b>Total Credits</b>	<b>IAE 1</b>	<b>IAE 2</b>	<b>ESE</b>	<b>CA</b>	<b>OR/PR</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
-	-	-	-	-	1	1	-	-	-	-	25	25

### Introduction

As global competition intensifies, industries seek candidates who are not only skilled but also adaptable and ready to meet the demands of an evolving workforce. To bridge the gap between academic learning and industry expectations, SJCEM has introduced certification courses aimed at preparing students for impactful internships. These courses provide students with essential knowledge and skills, empowering them to excel in professional environments and increase their employability.

**Course Objectives:** The objectives of this course are to

1. Develop Professional Skills
2. Enhance Technical Competency
3. Cultivate Problem-Solving Abilities
4. Promote Ethical and Professional Conduct
5. Familiarize with Industry Standards and Expectations
6. Prepare for a Transition from Classroom to Workplace

**Course Outcomes:** After completion of this course, students will be able to

1. Communicate and Collaborate Effectively
2. Acquire Job-Ready Technical Skills
3. Enhanced Critical Thinking and Problem-Solving
4. Understand Ethical and Professional Standards
5. Use Industry Tools and Standards
6. Industry Integration effectively

### Certification GUIDELINES:

The general procedure for organizing certification courses is as follows:

#### 1. Identification of Industry Partners

Industries have been identified to provide in-house certification courses in various domains. Students are regularly informed and encouraged to pursue these certification courses.

#### 2. Selection of Certification Domain

Students can choose two domains of their interest for the certification course and express their willingness to pursue the certification.

Following combination of domains are offered in the even semesters:

	Domain 1	Domain 2
Track 1	SQL	.NET
Track 2	CCNA	AI-IBM
Track 3	Cyber Security	AI-IBM
Track 4	Creo	Solid Works
Track 5	Data Science	Prompt Engineering and AI
Track 6	MernStack	Flutter
Track 7	AR-VR	Game Development
Track 8	Drone	Data Analytics
Track 9	IELTS/GRE	Certificate in Social Science
Track 10	Robotic	IoT
Track 11	Blockchain Basics	Blockchain Intelligence
Track 12	AWS	MernStack

### 3. Allocation of Tracks

Each track can accommodate a maximum of 60 students or as per the availability of maximum seats. Allocation will be based on a first-come first-served basis. However, the institute reserves the right to reassign tracks as per the requirement.

### 4. Course Duration

Students have to complete the certification course, which has a minimum duration of 30 hours.

### 5. Oral & Practical Exam

Based on the entire syllabus, oral (20 marks) & practical/implementation (30 marks) examination will be conducted. Grades will be assigned as per the examination rules.

**Note:** A minimum of 90% attendance is required to award the certificate. If a student fails to meet this requirement, the student needs to re-register for the course internally or externally until success- fully completed.

## Course Title: Major Project II

<b>Semester: VIII</b>		<b>Term: EVEN</b>				<b>Course Code: 24CSPRJ801B</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</b>	<b>Total</b>
<b>Th</b>	<b>Tu</b>	<b>Pr</b>	<b>Th</b>	<b>Tu</b>	<b>Pr</b>							
-	-	10	-	-	5	5	-	-	-	75	50	125

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

**Course Objectives:** The objective focuses on:

1. **Technical Proficiency:** Students apply the knowledge gained throughout their graduation to real-world problems.
2. **Problem-Solving:** From identification to solution implementation.
3. **Holistic Development:** It emphasizes not just technical skills but also professional and ethical development.

**Course Outcomes:**

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

1. Apply technical and professional skills to implement solutions for the selected problem.
2. Assess the societal and environmental impact of solutions to promote sustainable development.
3. Effectively collaborate and utilize modern tools by integrating best practices.
4. Demonstrate proficiency in communication, leadership, and teamwork throughout the project.
5. Exhibit professional conduct and ethical behavior in project execution.
6. Develop expertise that fosters a lifelong learning approach.

**Guidelines:**

1. Internal guide has to keep track of the progress of the project and also has to maintain attendance report. This progress report can be used for awarding term work marks.

**2. Project Report Format:**

At the end of semester, each group need to prepare a project report as per the guidelines issued by the University of Mumbai. Report should be submitted in hardcopy. Also, each group should submit softcopy of the report along with project documentation, implementation code, required utilities, software and user Manuals. A project report should preferably contain at least following details:

- Abstract
- Introduction
- Literature Survey/ Existing system
- Limitation Existing system or research gap
- Problem Statement and Objective
- Proposed System
- Analysis/Framework/ Algorithm
- Design details
- Methodology (your approach to solve the problem) Proposed System



- Experimental Set up
  - Details of Database or details about input to systems or selected data
  - Performance Evaluation Parameters (for Validation)
  - Software and Hardware Set up
  - Results and Discussion
  - Conclusion and Future Work
  - References
  - Appendix – List of Publications or certificates

Desirable: Students should be encouraged -

- To participate in various project competition.
- To write minimum one technical paper & publish in good journal.
- To participate in national / international conference.

### **3. Continuous Assessment (CA):**

Distribution of marks for term work shall be done based on following:

- a. Weekly Log Report
- b. Completeness of the project and Project Work Contribution
- c. Project Report (Black Book) (both side print)
- d. Term End Presentation (Internal)

The final certification and acceptance of TW ensures the satisfactory performance on the above aspect s.

### **4. Oral & Practical:**

Oral & Practical examination (Final Project Evaluation) of Project 2 should be conducted by Internal and External examiners approved by University of Mumbai at the end of the semester.

**Suggested quality evaluation parameters are as following:**

- a. Relevance to the specialization / industrial trends
- b. Modern tools used
- c. Innovation
- d. Quality of work and completeness of the project
- e. Validation of results
- f. Impact and business value
- g. Quality of written and oral presentation
- h. Individual as well as team work

Course Title: Internship III												
Semester: VIII			Term: Even				Course Code: 24CSPRJ801B					
Teaching Scheme						Evaluation Scheme						
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	OR/PR	Total
Th	Tu	Pr	Th	Tu	Pr							
-	-	10	-	-	5	5	-	-	-	75	50	125

## Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program helps fresh pass-outs in gaining professional know-how and benefits corporate sectors. The internship also enhances the student's employability skills passing out from Technical Institutions.

## Course Objectives:

1. Integration of workshop with workplace.
2. Understanding of the world of work.
3. Physical and hybrid model learning.
4. Developing research aptitude.
5. Exposure in emerging technologies
6. Enhance entrepreneurial capabilities.
7. Development of decision-making and teamwork skills.
8. Cultivate a sense of Social Imagery and Citizenship Responsibility.
9. Stimulate collaborative influence.
10. Enhancing professional competency.

**Course Outcomes:** After completion of this course, students will be able to

1. Get exposure to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
2. Get possible opportunities to learn, understand and sharpen the real time technical skills required at the job(s).
3. Get possible opportunities to learn, understand and sharpen the real time managerial skills required at the job(s).
4. Gain experience in writing technical reports / projects and presentation of it.
5. Learn and gain exposure to the engineer's responsibilities and ethics.
6. Understand the social, economic and administrative considerations that influence the working environment of industrial organizations.



## **INTERNSHIP GUIDELINES:**

- The students should apply for internships of their choice with the permission of the Institute.
- The internship duration ranges from 4 to 6 weeks and is scheduled during the summer vacation period for students
- Industry will confirm the training slots and the number of seats allocated for internships via confirmation letter/ email.
- Students on joining Training at the concerned Industry / Organization, submit the Joining Report/Letters / Email.
- Students undergo industrial training at the concerned Industry / Organization.
- Training and placement team will visit the industry and evaluate(s) the performance of students regularly and evaluation Report of the students is submitted in department office/TPO with the consent of Industry persons/ Trainers.
- Students will submit training report after completion of internship.
- Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:
  - Regularity in maintenance of the diary.
  - Project/Case study/Completion of assigned task by industry undertaken during the internship
  - Employer feedback
- Training Certificate to be obtained from industry.