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

Autonomy Syllabus Scheme of Bachelor of Technology in Computer Engineering (Semester: IV, VI, VIII)

Academic Year 2024-25

VISION

"To be a department committed to develop capable and efficient Computer Engineering graduates with an aptitude for research and leadership qualities"

MISSION

- To inculcate a habit of lifelong learning to become globally competent Computer Engineering graduates
- To promote excellence by encouraging creativity, critical thinking and discipline
- To establish relationship with other institutes as well as industries to have collaborative learning

AUTONOMY SCHEME

SJCEM : R-24

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 AcademicYear**	With effect from Academic Year:2024-25
6	**Total Credits**	Maximum 172
7	**Honor / Minor Courses offered**	**Data Science** (Additional Credits: 18)
8	**Eligibility Criteria for Honor /Minor**	• Students with no backlog in semesterI, II and III. • The CGPI based on Semester I, II andIII of the students must be 6.75 and above. • For Direct Second Year (DSE) Students – No backlog in semester III and CGPI must be 6.75 and above.

Preface

University Grants Commission vide Letter No. F. 2–10/2023 (AC–Policy) dated 19th 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 4th 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 leaner 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 curriculum will be implemented for Computer Engineering from the academic year 2024-25.

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 relatedto vocation/professional practice/skill based
- Seminar/Group Discussion: 1 Credit = 15 hours of participation
- Community Engagement Projects: 1 Credit = 30 hours of contact time alongwith 15 hours of activities preparation, report writing, independent reading etc.

Dr. Nilesh T. Deotale
BoS Chairman

Dr. Kamal Shah
Principal

Bachelor of Technology
In
Computer Engineering

Second Year
Semester – IV

SJCEM : R – 24

Effective from Academic Year 2024-25

Scheme of Second Year (Fourth Semester)
Computer Engineering(With Effect from 2024-2025)

Semester IV

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CSPCC401	PCC	Statistics and Probability	2	1	-	2	1	-	3
24CSPCC402	PCC	Analysis of Algorithm	3	-	2	3	-	1	4
24CSPCC403	PCC	Computer Networks	3	-	2	3	-	1	4
24CSPCC404	PCC	Operating System	2	-	2	2	-	1	3
24CSPCC405	PCC	Programming Language II (Python)	1	-	2	1	-	1	2
24CSAEC401	AEC	Corporate Communication & Employability Skills - I	-	-	2	-	-	1	1
24CSVSE401	VSEC	Employability Enhancement Program (Technical) - I	1	-	2	1	-	1	2
24CSVSE402	VSEC	Industry Certification	-	-	-	-	-	1	1
24CSOJT401	OJT	Internship I	-	-	-	-	-	2	2
		Total	**12**	**01**	**12**	**12**	**01**	**09**	**22**

Course Code	Vertical	Course Name	Evaluation Scheme					Total
			Theory			Practical		
			IAE 1	IAE 2	ESE	CA	OR/PR	
24CSPCC401	PCC	Statistics and Probability	20	20	60	25	-	125
24CSPCC402	PCC	Analysis of Algorithm	20	20	60	25	25	150
24CSPCC403	PCC	Computer Networks	20	20	60	25	-	125
24CSPCC404	PCC	Operating System	20	20	60	25	-	125
24CSPCC405	PCC	Programming Language II (Python)	10	10	30	25	-	75
24CSAEC401	AEC	Corporate Communication & Employability Skills - I	-	-	-	25	-	25
24CSVSE401	VSEC	Employability Enhancement Program (Technical) -I	10	10	30	25	-	75
24CSVSE402	VSEC	Industry Certification	-	-	-	-	25	25
24CSOJT401	OJT	Internship I	-	-	-	-	50	50
		Total	**100**	**100**	**300**	**175**	**100**	**775**

Syllabus

for

Second Year Computer Engineering

Semester – IV

SJCEM : R – 24

(With Effect from 2024-2025)

Course Title: Statistics and Probability												
Semester: IV			Term: Even				Course Code: 24CSPCC401					
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	-	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
I	**Statistical Techniques:**	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. **Self-learning Topics:** Covariance, fitting of exponential curve.		
II	**Probability Theory:**	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. **Self-learning Topics:** Cumulative Distribution Function, Moment generating function, Skewness and Kurtosis of distribution (data).		
III	**Probability Distribution:**	4	CO3
	Probability Distribution: Binomial, Poisson and Normal distribution - problems (No derivation for mean and standard deviation) **Self-learning Topics:** Bernoulli's Distribution, Uniform Distribution, Exponential Distribution		
IV	**Sampling Theory:**	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. **Self-learning Topics**: Yate's Correction.		
V	**Counting**	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.n^m or An+B) , Solving recurrence relations. **Self-learning Topics:** Extended Pigeonhole Principle, Non-Homogeneous Recurrence Relation(where f(n)= An^2+Bn+C or A.a^n or (An+B)e^n)		
VI	**Graph Theory:**	5	CO6
	Introduction, Simple Graphs, Multigraphs, Isomorphic Graphs, Subgraphs, Handshaking lemm+a(Without proof), Complete graph, Regular, Planar graph, Walks, Trials, Path, Cycle, Connected and Disconnected Graph, Bipartite graph, Euler and Hamiltonian Graphs, Components of graph, Cut-Set, Cut-Vertex, Weighted graph, Dijkstra's Algorithm. **Self-learning Topics:** Traversal algorithms- breadth-first search, depth-first search		
	Total	**30**	

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, 2nd Edition.
2. Discrete and Combinatorial Mathematics-An Applied Introduction, Ralph P. Grimaldi and B V Ramana, Pearson Education, Asia, 5th Edition.

Useful Links:

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

Course Title: Analysis of Algorithms												
Semester: IV			**Term: EVEN**				**Course Code: 24CSPCC402**					
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 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 techniquesto 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
I	**Introduction to analysis of algorithm**	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. **Recurrences:** -The substitution method -Recursion tree method -Master method **Divide and Conquer Approach:** General method. Analysis of Merge sort, Analysis of Quick sort , Analysis of Binary search, Finding minimum and maximum algorithm and analysis **Self-Learning Topics**: Strassen' s matrix multiplication		
II	**Dynamic Programming Approach**	**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 **Self-Learning Topics:** Principles of Dynamic Programming Approach		
III	**Greedy Method Approach**	**7**	CO3
	General Method, Single Source Shortest Path, Knapsack problem, Job Sequencing with deadlines Minimum cost spanning trees-Kruskal's and Prim's algorithm **Self-Learning Topics:** Optimal storage on tapes		
IV	**Backtracking and Branch-and-bound:**	**7**	CO4
	General Method, N-queen problem, Sum of subsets, Graph coloring, 15 puzzle problem, Travelling salesman problem. **Self-Learning Topics:** Optimization in Backtracking, Constraint Propagation		
V	**String Matching Algorithms:**	6	CO5
	The naïve string matching Algorithms ,The Rabin Karp algorithm String matching with finite automata, The knuth-Morris-Pratt algorithm **Self-Learning Topics:** Boyer-Moore Algorithm		
VI	**Non-deterministic polynomial algorithms:**	5	CO6
	Polynomial time, Polynomial time verification, NP Completeness and reducibility, NP Completeness proofs, Vertex Cover Problems , Clique Problems **Self-Learning Topics:** Importance of NP Problems		
	Total	**45**	

List of Experiments:

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- HillEdition.
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.coreman , C.E. Leiserson,R.L. Rivest, and C. Stein, "Introduction to algorithms", 2ndedition , PHI publication 2005.
2. Ellis horowitz , Sartaj Sahni , S. Rajsekaran. "Fundamentals of computer algorithms" UniversityPress

Useful Links:

1. https://leetcode.com/explore/interview/card/leetcodes-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												
Semester: IV			Term: Even				Course Code: 24CSPCC403					
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: 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 / super netting schemes.
5. Analyze transport layer protocols and congestion control algorithms.
6. Explore protocols at application layer

Module	Contents	Hours	COs
I	**Introduction to Networking**	5	CO1
	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. Reference models: Layer details of OSI, TCP/IP models. Communication Between layers. **Self-learning Topics:** Real-world applications of each network topology.		
II	**Physical Layer**	4	CO2
	Introduction to communication: Electromagnetic spectrum Guided transmission media: Twisted pair, coaxial, fiber optics. Unguided transmission media: Radio waves, micro waves, infrared **Self-learning Topics:** Factors affecting the performance of guided and unguided transmission media		
III	**Data Link Layer**	9	CO3
	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) & (CSMA/CA)) **Self-learning Topics:** CSMA/CD, and CSMA/CA protocols in wireless networks.		
IV	**Network Layer**	13	CO4
	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 (Dijkastra's), link state routing, distance vector routing Protocols - ARP, RARP, ICMP, IGMP Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters, token & leaky bucket algorithms **Self-learning Topics:** Importance of IPv6 Protocol		
V	**Transport Layer**	7	CO5
	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 **Self-learning Topics:** Role of TCP timers in ensuring reliable data transmission		
VI	**Application Layer**	7	CO6
	DNS: Name Space, Resource Record, and Types of Name Server. HTTP, SMTP, Telnet, FTP, and DHCP **Self-learning Topics:** Various application layer protocols like SSH, TFTP, NFS, SNMP		
	Total	**45**	

List of Experiments:

Exp. No.	Experiment Name	COs
1.	Use basic networking commands in Linux (ping, tracert, nslookup, netstat, ARP, RARP, ip, ifconfig, dig, route)	CO1
2.	Study of RJ45 and CAT6 Cabling and connection using crimping tool.	CO2
3.	Build a simple network topology and configure it for static routing protocol using packet tracer. Setup a network and configure IP addressing, subnetting, masking.	CO4
4.	Perform network discovery using discovery tools (e.g.. Nmap, mrtg)	CO4
5.	Use Wire shark to understand the operation of TCP/IP layers: 1. Ethernet Layer: Frame header, Frame size etc. 2. Data Link Layer: MAC address, ARP (IP and MAC address binding) 3. Network Layer: IP Packet (header, fragmentation), ICMP (Query and Echo) 4. Transport Layer: TCP Ports, TCP handshake segments etc. 5. Application Layer: DHCP, FTP, HTTP header formats	CO4
6.	Use simulator (e.g., NS2) to understand functioning of ALOHA, CSMA/CD.	CO3
7.	Socket programming using TCP or UDP	CO5
8.	Perform File Transfer and Access using FTP	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 Mark

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 conducted.

Reference Books:

1. A. S. Tanenbaum, Computer Networks, 4th Edition, Pearson Education
2. B. A. Forouzan, Data Communications and Networking, 5th Edition, TMH
3. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, 6th 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												
Semester: IV			**Term: Even**				**Course Code: 24CSPCC404**					
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	-	2	2	-	1	3	20	20	60	25	-	125

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

Course Objectives:

1. The objective of this course is to familiarize students with the functionality of an Operating System, its basic components & interaction among them.
2. To expose students to analyze and evaluate different policies for scheduling, deadlocks, memory management, synchronization, system calls, file systems & I/O and implement these policies using a suitable programming language.

Course Outcomes:

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

1. Understand the basic concepts related to Operating Systems.
2. Analyze and evaluate the performance of different process and disk scheduling algorithms
3. Demonstrate inter-process communication and process synchronization.
4. Analyze and evaluate various deadlock detection, avoidance and removal techniques.
5. Analyze and evaluate memory management policies in different scenarios.
6. Evaluate different file organization and access techniques

Module	Contents	Hours	COs
I	**Introduction:**	4	CO1
	Operating System operations, Process management, Memory management, storage management, Protection and security. **System Structure:** Operating system services and interface, System calls and its types, System programs, Operating System Design and implementation, OS structure, Virtual machines, System boot. **Self-learning Topics:** Study of any three different OS. System calls with examples for different OS.		
II	**Processes and Process Scheduling**	6	CO2
	Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Multithreading. Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, SRTF, RR Scheduling. **Self-learning Topics:** Performance comparison of Scheduling Algorithms, Selection of Scheduling Algorithms for different situations, Real-time Scheduling		
III	**Inter-process Communication and Deadlocks**	6	CO3
	Critical Section, Race Conditions, Mutual Exclusion, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc. Definition, Necessary and sufficientconditions for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery. **Self-learning Topics:** Study a real time case,study for Deadlock detection and recovery.		
IV	**Memory Management**	6	CO4
	Basic concept,Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing,		

	Disadvantages of paging. **Virtual Memory**: Basics of Virtual Memory– Hardware and control structures –Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Optimal Page Replacement and Least Recently used (LRU). **Self-learning Topics:** Memory Management ,for any one Operating System, Implementation of Page Replacement Algorithms.		
V	**File Management**	4	CO5
	Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), efficiency and performance. **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting. **Self-learning Topics:** Case study on UNIX and WINDOWS Operating System.		
VI	**Storage Management**	4	C06
	File System: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection. Implementing file System: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free- Space Management **Secondary Storage Structure:** Overview of Mass-Storage Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management; RAID Structure **Self-learning Topics:** Overview of Disk Management		
	Total	**30**	

List of Experiments:

Exp. No.	Experiments Name	COs
1	Study of Linux general purpose commands	CO1
2	Basic System administrative task: Process management, Memory management, File system management, User management	CO1
3	Shell Scripts and AWK programs	CO1
4	Implementation of Scheduling algorithms (FIFO, SJF, Priority, Round Robin)	CO2
5	Implementation of classic Synchronization problems using semaphores (producer-consumer, reader-writer, dining philosophers)	CO3
6	Implementation of Bankers Problem (Deadlock avoidance)	CO4
7	Implementation of Memory management/ allocation policies (1st fit, best fit, worst fit)	CO5
8	Implementation of Page replacement algorithms (FIFO, LRU, OPTIMAL)	CO5
9	File Systems	CO6
10	Case Study on Android/ mac OS	CO1,CO3, 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.

A. Continuous Assessment (CA):

1. Term work should consist of 10-12 experiments.
2. Journal must include at least 2 assignments.
3. The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing marks in term work.
4. Total 25 Marks: (Minimum passing marks is 40%)

Experiments: 15 marks
Attendance (Theory & Practical): 05 marks
Assignments: 05 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.

B. Oral & Practical Exam

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

Reference Books:

1. N. Chauhan, Principles of Operating Systems, 1st ed., Oxford University Press, 2014.
2. A. Tanenbaum and A. Woodhull, Operating System Design and Implementation, 3rd edPearson.
3. R. Arpaci-Dusseau and A. Arpaci-Dusseau, Operating Systems: Three Easy Pieces, CreateSpace Independent Publishing Platform, 1st ed., 2018

Text Books:

1. Abraham Silberschatz, Greg Gagne, Peter Baer Galvin, "Operating System Concepts", 8th Edition, Wiley, January 2018. 15
2. Tanenbaum, "Modern Operating System", 4th Edition, Pearson Education, 2014.
3. William Stallings, "Operating Systems: Internal and Design Principles", 8th Edition, Pearson, 2014.
4. Randal. K. Michael, "Mastering Shell Scripting", 2nd Edition, Wiley Publication, 2008.

Useful Links

1. https://www.nptel.ac.in/
2. https://swayam.gov.in/
3. https://www.youtube.com/@GateSmashers

Course Title: Programming Language II (Python)												
Semester: IV			Term: EVEN				Course Code: 24CSPCC405					
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	-	2	1	-	1	2	10	10	30	25	-	75

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

Course Objectives:

1. To introduce the fundamental concepts of Python programming.
2. To learn Python control flow with conditional statements and loops, creation and usage of functions.
3. To learn Object Oriented Programming concepts in python.
4. To learn Concepts of modules and packages in python.
5. To learn how to develop GUI-based applications using Python.
6. To equip students with the skills to handle email communication in Python.

Course Outcomes:

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

1. Understand the structure, syntax, semantics and data types of the Python language.
2. Familiarize with various control flow structures and function in Python.
3. Illustrate the concepts of object-oriented programming as used in Python.
4. Create Python applications using modules and packages.
5. Design GUI applications and evaluate database operations in python.
6. Develop Python scripts to send and receive emails using libraries.

Prerequisite: Basic Programming syntax of Java/C. Installation and configuration of python

Module	Contents	Hours	COs
I	**Basics of Python:**	3	CO1
	Introduction, Basic & Built-in Math functions, Basic data types (Numeric, Boolean, Compound), Quotes, print() function, range() function, Tuples, Lists, Dictionaries, Sets, Numpy Arrays, Strings. **Self-learning Topics:** Practical applications with combined data types.		
II	**Control Statements and Function:**	3	CO2
	Control flow statements: Conditional statements (if, if…else, nested if), Looping in Python (while loop, for loop, nested loops), Built-in functions in python, Defining a Function, Checking & Setting Your Parameters, Default arguments, Variable length arguments, Defining and calling functions within a function, Recursive functions, Anonymous Functions (Lambda, Map, Reduce, Filter). **Self-learning Topics:** Zip() function, Function decorators.		
III	**Object Oriented Programming:**	2	CO3
	Creating Classes and Objects, Self-Variable, Constructors, Inheritance, Polymorphism. **Self-learning Topics:** Exceptions Handling, User Defined Exceptions.		
IV	**Modules and Packages:**	2	CO4
	Importing own module as well as external modules, Understanding Packages, modules and external packages, Opening and Reading Files and Folders (Python OS Module, Python Datetime Module, Python Math and Random Modules). **Self-learning Topics:** Regular expression in python, Text Processing.		
V	**GUI Programming with Database Connectivity:**	3	CO5
	GUI Programming Toolkits, Creating GUI Widgets with Tkinter, Creating Layouts, Form Components, Dialog Boxes. Types of Databases used with Python, Mysql database Connectivity with Python, Performing DML operations on database. **Self-learning Topics:** File handling, Pickle in Python.		
VI	**Advanced Python:**	2	CO6
	Emails with Python: Introduction to Emails with Python, Sending Emails with Python, Receiving Emails with Python. **Self-learning Topics:** Networking in Python: Client Server socket programming.		
	Total	**15**	

List of Experiments:

Exp. No.	List of Experiments	CO
1	Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.	CO1
2	Write a Python program to implement Basic String Operations & String Methods.	CO1
3	Write a Python program to implement functions of List, Tuples, and Dictionaries.	CO1
4	Write a Python program to implement Arrays / Numpy Array (1D, 2D) applications.	CO1
5	Write python programs to demonstrate applications of different decision-making statements.	CO2
6	Write a Python program to implement Functions and Recursion.	CO2
7	Write a Python program to implement Programs based on Lambda, Map and Reduce Functions.	CO2
8	Write python programs to implement Classes & objects, Constructors.	CO3
9	Write python programs to implement Inheritance & Polymorphism.	CO3
10	Write python programs to create user-defined modules/packages and import them in a program.	CO4
11	Write python programs to understand GUI designing and database operations (Programs based on GUI designing using Tkinter, Mysql database creation & Database connectivity with DML).	CO5
12	Write python program to implement sending automated emails with Python.	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 / Term Work (CA / TW):

1. Term work should consist of 8 - 10 experiments.
2. Journal must include at least 02 assignments based on different pedagogy in group wise manner.
3. The final certification and acceptance of term work ensures the satisfactory performance of

laboratory work, attendance and minimum passing marks in term work.

4. Total 25 Marks: (Minimum passing marks is 40%)

Experiments/ Tutorials: 10 marks

Attendance (Theory & Practical): 05 marks

Assignments: 10 Marks

Reference Books:

1. Zed A. Shaw, "Learn Python 3 the Hard Way", Zed Shaw's Hard Way Series.
2. Martin C. Brown," Python: The Complete Reference", McGraw-Hill Publication.
3. Paul Barry," Head First Python", 2nd Edition, O'Reilly Media, Inc.

Text Books:

1. Dr. R. Nageswara Rao," Core Python Programming" , Dreamtech Press, Wiley Publication
2. M. T. Savaliya , R. K. Maurya, "Programming through Python", StarEdu Solutions.
3. E Balagurusamy, "Introduction to computing and problem-solving using python", McGraw Hill Publication.

Useful Links:

1. https://onlinecourses.swayam2.ac.in/cec22_cs20/preview
2. http://docs.python.org/release/3.0.1/tutorial/
3. http://spoken-tutorial.org
4. www.staredusolutions.org
5. https://www.tutorialspoint.com/python/index.htm

Course Title: Corporate Communication & Employability Skills - I												
Semester: IV			Term: Even			Course Code: 24CSAEC401						
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

Course Objectives:

1. To understand the importance of active listening in effective communication.
2. To cultivate effective inter-personal skills and employment skills for organizational development.

Course Outcomes:

After successful completion of the course, learner will be able to …

1. Understand the importance of active listening and social etiquette for effective communication.
2. Enhance written communication, official and technical skills
3. Strengthen their personal and professional relationship in career building.
4. Ace their employability Skills through personal SWOT, Group Discussion and Resume Writing

Module	Contents	Hours	COs
I	**Listening & Social Skills**	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		
II	**Proposal & Report Writing**	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		
III	**Interpersonal Skills**	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		
IV	**Employability Skills**	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		
	Total	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:

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/uj6rlM62Bqk

Motivational Speech
https://youtu.be/xrEq-1UujOo
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

Course Title: Employability Enhancement Program (Technical) - I												
Semester: IV			Term: EVEN				Course Code: 24CSVSE401					
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	-	2	1	-	1	2	10	10	30	25	-	75

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

Course Objectives:

1. Skill enhancement: Ensuring students receive the best skill-sets to have a better transition from campus to corporate.
2. Employability skills: To increase their employability value to ensure success in their future endeavors.
3. Skilled Professionals: To help students not just pass out as graduate but skilled professionals.

Course Outcomes:

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

1. Gain a strong foundation in Python's core features, organize code effectively with modules and packages, perform file handling, and apply OOP principles in real-world scenarios.
2. Understand Python's role in development cycles, gain basic database knowledge, and apply database concepts to organize and manage data in applications.
3. Manage and manipulate data using SQL, work with advanced queries, and connect Python to SQL databases to create interactive data-driven applications.

Module	Contents	Hours	COs
I	**Module 1 Core Python Programming**	12	CO1
	Introduction to Python: Basics, setup, syntax, control structures (if-else, loops). Modules and Packages: Understanding modules, creating packages, using libraries (math, requests, etc.). File Handling: Reading/writing files, modes (r, w, a), error handling with try-except. Object-Oriented Programming (OOP): Principles of classes, inheritance, polymorphism, encapsulation, real-life examples. **Self-Learning Topics:** Explore data types (lists, tuples, sets), concise processing (list comprehensions, lambdas), error handling, decorators, generators, regular expressions, and coding standards (PEP8).		
II	**Module 2 Python for Application Development**	8	CO2
	Software Development Life Cycle (SDLC): Phases, model types (Waterfall, Agile), Python's role in automation and prototyping. Introduction to Databases and DBMS: Database fundamentals, types of DBMS, differences between DBMS and RDBMS. Relational Database Management System (RDBMS): Concepts of tables, normalization, using RDBMS for structured data management. **Self-Learning Topics:** Practice SDLC models, Git basics, relational and NoSQL database design, Django/Flask for web development, and REST APIs.		
III	**Module 3 SQL and Database Integration with Python**	10	CO3
	SQL Basics: DDL and DML commands (SELECT, INSERT, UPDATE, DELETE), constraints (PRIMARY KEY, FOREIGN KEY). Advanced SQL: Joins, aggregate functions, subqueries for data analysis. Python and Databases: Connecting Python to databases using SQL (sqlite3, MySQL), implementing CRUD operations **Self-Learning Topics:** Practice advanced SQL functions, indexing, transactions, ORM with SQL Alchemy, basic DB administration, and CRUD operations with joins.		
	Total	**30**	

List of Experiments:

Exp. No.	List of Experiment	COs
1	Basic Calculator: Create a calculator in Python using control structures (if-else and loops) that performs addition, subtraction, multiplication, and division.	CO1
2	Library Organizer with Modules and Packages: Organize a set of math functions (e.g., area calculations, trigonometry) within a Python package, then import and use them in a separate program.	CO2
3	File-Based To-Do List: Build a program that reads, writes, and appends tasks in a text file, using exception handling to manage errors.	CO3
4	Simple ATM Simulator with OOP: Design a basic ATM system that allows users to check balances, withdraw, and deposit money using classes, inheritance, and encapsulation.	CO4
5	SDLC Mini Case Study: Outline a Python project following SDLC phases (e.g., a library management system), detailing the phases from requirements to maintenance.	CO5
6	Database Schema for Student Records: Create a basic schema design using relational database concepts for storing student information, courses, and grades.	CO5
7	Normalization Experiment: Take a table of customer order data and apply normalization techniques (up to 3NF) to reduce redundancy.	CO5
8	Student Database with SQL Commands: Use DDL and DML commands to create a student table, add records, update information, and delete entries.	CO6
9	Sales Analysis with SQL Joins and Aggregate Functions: Set up tables for sales and customer data and analyse average sales per customer using SQL joins and aggregate functions.	CO6
10	CRUD Application in Python with SQL Integration: Develop a Python app that connects to an SQL database (sqlite3 or MySQL) to manage records (Create, Read, Update, Delete) for an inventory or contact list.	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

D. Oral & Practical Exam

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

Reference Books:

1. Learning Python
2. Database System Concepts, Software Engineering: A Practitioner's Approach
3. SQL for Data Scientists: A Beginner's Guide for Building Datasets for Analysis

Text Books:

1. Wes McKinney, "Python for Data Analysis" Second Edition, **Publisher**: O'Reilly Media, 2017
2. Mark Lutz: "Learning Python", O'Reilly Media, 2013, fifth Edition.
3. John M. Zelle, "Python Programming: An Introduction to Computer Science", Franklin, Beedle & Associates Inc., 2016, Third Edition.

Useful Links:

https://resource.prepcrazy.com/

Course Title: Industry Certification

Semester: IV			Term: Even				Course Code: 24CSVSE402					
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: IV			Term: Even			Course Code: 24CSOJT401						
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	2	-	-	-	-	50	50

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.

Bachelor of Technology
In
Computer Engineering

Third Year
Semester – VI

SJCEM : R - 24

Effective from Academic Year 2024-25

Program Structure for Third Year Computer Engineering

(With Effect from 2024-2025)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CSPCC601	PCC	System Programming & Compiler Construction	3	-	2	3	-	1	4
24CSPCC602	PCC	Cryptography & System Security	3	-	2	3	-	1	4
24CSPCC603	PCC	Mobile Computing	3	-	2	3	-	1	4
24CSPCC604	PCC	Artificial Intelligence	3	-	2	3	-	1	4
24CSPEC601X	PEC	Department Level Optional Course 2	3	-	-	3	-	-	3
24CSVSE601	VSEC	Employability Enhancement Program (Technical) - II	-	-	4	-	-	2	2
24CSVSE602	VSEC	Industry Certification	-	-	-	-	-	1	1
24CSOJT601	OJT	Internship - II	-	-	-	-	-	1	1
Total			**15**	**0**	**12**	**15**	**0**	**8**	**23**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA	OR/PR	Total
24CSPCC601	PCC	System Programming & Compiler Construction	20	20	60	25	25	150
24CSPCC602	PCC	Cryptography & System Security	20	20	60	25	-	125
24CSPCC603	PCC	Mobile Computing	20	20	60	25	-	125
24CSPCC604	PCC	Artificial Intelligence	20	20	60	25	25	150
24CSPEC601X	PEC	Department Level Optional Course 2	20	20	60	-	-	100
24CSVSE601	VSEC	Employability Enhancement Program - II	-	-	-	50	-	50
24CSVSE602	VSEC	Industry Certification	-	-	-	-	25	25
24CSOJT601	OJT	Internship - II	-	-	-	-	50	50
Total			**100**	**100**	**300**	**150**	**125**	**775**

Department Level Optional Course 2

Course Code	Department Level Optional Course
24CSPEC6011	Internet of Things
24CSPEC6012	Digital Signal and Image Processing
24CSPEC6013	Quantitative Analysis

Syllabus

For
Third Year Computer Engineering
Semester – VI

(With Effect from 2024-2025)

Course Title: System Programming & Compiler Construction												
Semester: VI			Term: EVEN				Course Code: 24CSPCC601					
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 the role and functionality of various system programs over application programs.
2. To understand basic concepts, structure and design of assemblers, macro processors, linkers and loaders.
3. To understand the basic principles of compiler design, its various constituent parts, algorithms and data structures required to be used in the compiler.
4. To understand the need to follow the syntax in writing an application program and to learn how the analysis phase of compiler is designed to understand the programmer 's requirements without ambiguity
5. To synthesize the analysis phase outcomes to produce the object code that is efficient in terms of space and execution time

Course Outcomes:

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

1. Identify the relevance of different system programs.
2. Explain various data structures used for assembler design.
3. Explain various data structures used for microprocessor design.
4. Distinguish between different loaders and linkers and their contribution in developing efficient user applications.
5. Understand fundamentals of compiler design and identify the relationships among different phases of the compiler.
6. Evaluate the synthesis process

Module	Contents	Hours	COs
I	**Module 1 Introduction to System Software**	3	CO1
	Concept of System Software, Goals of system software, system program and system programming, Introduction to various system programs such as Assembler, Macro processor, Loader, Linker, Compiler, Interpreter, Device Drivers, Operating system, Editors, Debuggers. **Self-Learning Topics:** Role of Operating system		
II	**Module 2 Assemblers**	9	CO2
	Elements of Assembly Language programming, Assembly scheme, pass structure of assembler, Assembler Design: Two pass assembler Design and single pass Assembler Design for X86 processor, data structures used. **Self-Learning Topics:** the syntax rules for writing assembly code, including directives, labels, and comments.		
III	**Module 3 Macros and Macro Processor**	8	CO3
	Introduction, Macro definition and call, Features of Macro facility: Simple, parameterized, conditional and nested. Design of Two pass macro processor, data structures used. **Self-Learning Topics:** How Macro Processors fit into the compilation process.		
IV	**Module 4 Loaders and Linkers**	8	CO 4
	Introduction, functions of loaders, Relocation and Linking concept, Different loading schemes: Relocating loader, Direct Linking Loader, Dynamic linking and loading. **Self-Learning Topics:** How loaders and linkers fit into the overall compilation and execution flow.		
V	**Module 5 Analysis Phase**	10	CO 5
	Introduction to compilers, Phases of compilers: Lexical Analysis- Role of Finite State Automata in Lexical Analysis, Design of Lexical analyzer, data structures used. Syntax Analysis- Role of Context Free Grammar in Syntax analysis, Types of Parsers: Top down parser- LL (1), Bottom up parser- SR Parser, Operator precedence parser, SLR. Semantic Analysis, Syntax directed definitions.		

	Self-Learning Topics: the basics of formal language theory, including Chomsky hierarchy, which underpins the syntax analysis		
VI	**Module 6 Compilers: Synthesis phase**	7	CO 6
	Intermediate Code Generation: Types of Intermediate codes: Syntax tree, Postfix notation, three address codes: Triples and Quadruples, indirect triple. Code Optimization: Need and sources of optimization, Code optimization techniques: Machine Dependent and Machine Independent. Code Generation: Issues in the design of code generator, code generation algorithm. Basic block and flow graph. **Self-Learning Topics:** various object code formats (e.g., ELF, PE) and their structures		
	Total	**45**	

List of Experiments:

Exp. No.	List of Experiment	COs
1	To understand the fundamental concepts of system software, its types, functions, and its role in managing hardware and software resources.	CO1
2	To implement two pass Assembler.	CO2
3	To implement Two pass Macro Processor.	CO3
4	To explore static linking	CO4
5	To implement Lexical Analyser.	CO5
6	To implement Parser (Any one)	CO5
7	Case study: GCC (GNU Compiler Collection)	CO5
8	To implement the Intermediate code generation phase of the compiler.	CO6
9	To implement the code generation phase of the compiler.	CO6
10	Study and implement experiments on LEX, YACC.	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

D. Oral & Practical Exam

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

Reference Books:

1. John R. Levine, Tony Mason & Doug Brown, Lex & YACC, O 'Reilly publication, second Edition
2. D, M .Dhamdhere ,"Compiler construction 2e", Macmillan publication, second edition .
3. Kenneth C. Louden ,"Compiler construction: principles and practices", Cengage Learning
4. Leland L. Beck, "System software: An introduction to system programming", Pearson publication, Third Edition

Text Books:

1. D. M Dhamdhere, " Systems programming and Operating Systems", Tata McGraw Hill, Revised Second Edition
2. A. V. Aho, R. Shethi, Monica Lam, J.D. Ulman: "Compilers Principles, Techniques and Tools", Pearson Education, Second Edition.
3. J. J. Donovan, "Systems Programming", Tata McGraw Hill, Edition 1991

Useful Links:

1. http://www.nptelvideos.in/2012/11/compiler-design.html
2. https://www.coursera.org/lecture/nand2tetris2/unit-4-1-syntax-analysis-5pC2Z

Course Title: Cryptography & System Security												
Semester: VI			Term: EVEN				Course Code: 24CSPCC602					
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 introduce classical encryption techniques and concepts of modular arithmetic and number theory.
2. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms.
3. To explore the design issues and working principles of various authentication protocols.
4. To explore the design issues and working principles of various PKIstandards and various secure communication standards including Kerberos, IPsec, and SSL/TLS.
5. To develop the ability to use existing cryptographic utilities.
6. To build programs for secure communication.

Course Outcomes:

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

1. Understand system security goals and concepts, classical encryption techniques.
2. Acquire fundamental knowledge on the concepts of modular arithmetic and number theory.
3. Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
4. Apply different message digest and digital signature algorithms to verify integrity and achieve authentication and design secure applications.
5. Understand network security basics, analyse different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
6. Analyse and apply system security concept to recognize malicious code.

Module	Contents	Hours	COs
I	**Introduction - Number Theory and Basic Cryptography**	9	CO1,CO2
	Security Goals, Attacks, Services and Mechanisms, Techniques. Modular Arithmetic: Euclidean Algorithm, Fermat's and Euler's theorem ,Classical Encryption techniques, Symmetric cipher model, mono- alphabetic and polyalphabetic substitution techniques: Vigenere cipher, playfair cipher, Hill cipher, transposition techniques: keyed and keyless transposition ciphers **Self-Learning Topics:** Introduction to Cryptography, Symmetric Cryptography, Asymmetric Cryptography.		
II	**Symmetric and Asymmetric key Cryptography and key Management**	12	CO3,CO4
	Block cipher principles, block cipher modes of operation, DES, Double DES, Triple DES, Advanced Encryption Standard (AES), StreamCiphers: RC4 algorithm ,Public key cryptography: Principles of public key cryptosystems- TheRSA Cryptosystem, The knapsack cryptosystem, Symmetric Key Distribution: KDC, Needham-schroeder protocol. Kerberos: Kerberos Authentication protocol, Symmetric key agreement: Diffie Hellman, Public key Distribution: Digital Certificate: X.509, PKI **Self-Learning Topics:** Types of Symmetric Ciphers,Block cipher Algoritms,Security of Symmetric Encryption,Hybrid Cryptography		
III	**Cryptographic Hash Functions**	4	CO3
	Cryptographic hash functions, Properties of secure hash function, MD5, SHA-1, MAC, HMAC, and CMAC. **Self-Learning Topics**: Introduction to Cryptographic Hash Function ,Properties of hash functions ,Cryptanalysis of Hash Functions, RIPEMD		
IV	**Authentication Protocols & Digital Signature Schemes**	6	CO6
	User Authentication, Entity Authentication: Password Base, ChallengeResponse Based, Digital Signature, Attacks on Digital Signature, Digital Signature Scheme:RSA **Self-Learning Topics:** Authentication vs Authorization, Types of Authentication, Digital Signature Scheme : ECDSA		
V	**Network Security and Applications**	10	CO5
	Network security basics: TCP/IP vulnerabilities (Layer wise), Network Attacks: Packet Sniffing, ARP spoofing, port scanning, IP spoofing, Denial of Service: DOS attacks, ICMP flood, SYN flood, UDP flood, Distributed Denial of Service, Internet Security Protocols: PGP, SSL, IPSEC. Network security: IDS,Firewalls		

	Self-Learning Topics: CIA Triad, TCP/IP Protocol,TCP/IP Model vs OSI Model,Layers of the TCP/IP Model		
VI	**System Security**	4	CO6
	Buffer Overflow, malicious Programs: Worms and Viruses, SQL injection **Self-Learning Topics:** Basic Security principles,Role of Operating System in Security,Security Features in Modern OS, Types of Malwares , Defense Mechanisms		
	Total	**45**	

List of Experiments:

Sr. No	Title of Experiment	COs
1	Design and Implementation of a product cipher using Substitution and Transpositionciphers.	CO1
2	Implementation and analysis of RSA crypto system.	CO3
3	Implementation of Diffie Hellman Key exchange algorithm	CO4
4	For varying message sizes, test integrity of message using MD-5, SHA-1, andanalyse the performance of the two protocols. Use crypt APIs.	CO3
5	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, ns lookup to gather information about networks and domain registrars.	CO5
6	Study of packet sniffer tools: wireshark,: Download and install wireshark and capture icmp, tcp, and http packets inpromiscuous mode. Explore how the packets can be traced based on different filters.	CO5
7	Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, xmas scan etc.	CO5
8	Detect ARP spoofing using nmap and/or open-source tool ARPWATCH and wireshark. Use arping tool to generate gratuitous arps and monitor using wireshark	CO6
9	Simulate DOS attack using Hping, hping3 and other tools	CO5
10	Simulate buffer overflow attack using Ollydbg, Splint, Cpp check etc	CO6
11	. Set up IPSEC under LINUX. . Set up Snort and study the logs.	CO1
12	Setting up personal Firewall using iptables	CO1
13	Explore the GPG tool of linux to implement email security	CO2
14	SQL injection attack, Cross-Cite Scripting attack simulation	CO2
15	Case Study /Seminar: Topic beyond syllabus related to topics covered.	CO1

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. Bruce Schneier, ***"Applied Cryptography, Protocols Algorithms and Source Code in C",*** Second Edition, Wiley.
2. Atul Kahate, ***"Cryptography and Network Security",*** Tata McGraw-Hill Education, 2003.
3. Eric Cole, ***"Network Security Bible",*** Second Edition, Wiley, 2011.

Text Books:

1. William Stallings, ***"Cryptography and Network Security, Principles and Practice"***, 6th Edition, Pearson Education, March 2013
2. Behrouz A. Ferouzan, ***"Cryptography & Network Security"***, Tata McGraw Hill
3. Behrouz A. Forouzan & Debdeep Mukhopadhyay, ***"Cryptography and Network Security"*** 3rd Edition, McGraw Hill

Useful Links:

1. https://github.com/cmin764/cmiN/blob/master/FII/L3/SI/book/W.Stallings%20-%20Cryptography%20and%20Network%20Security%206th%20ed.pdf
2. https://docs.google.com/file/d/0B5F6yMKYDUbrYXE4X1ZCUHpLNnc/view

Course Title: Mobile Computing												
Semester: VI			**Term: EVEN**				**Course Code: 24CSPCC603**					
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 introduce the fundamentals of mobile computing, including telecommunication generations and cellular systems.
2. To understand the structure and operation of GSM and GPRS mobile communication systems, including system architecture and protocols.
3. To explore the key aspects of mobile networking, including IP, TCP enhancements, and mobility management techniques.
4. To provide an understanding of wireless LAN technologies, including IEEE 802.11 standards, Wi-Fi security, and Bluetooth architecture.
5. To study the concepts of mobility management, focusing on IP mobility, macro and micro mobility, and protocols such as MIPv6 and HMIPv6.
6. To gain knowledge of the LTE (Long-Term Evolution) and the evolution of 3GPP, understanding LTE-Advanced and 5G technologies.

Course Outcomes:

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

1. To develop and demonstrate mobile applications using various tools
2. To articulate the knowledge of GSM, CDMA & Bluetooth technologies and demonstrate it.
3. To carry out simulation of frequency reuse, hidden/exposed terminal problem.
4. To implement security algorithms for mobile communication network
5. To demonstrate simulation and compare the performance of Wireless LAN.
6. To evaluate the LTE system architecture, understand its evolution from UMTS, and compare different generations of mobile networks, including 5G advancements.

Module	Contents	Hours	COs
I	**Module 1: Introduction to Mobile Computing**	6	CO1
	Introduction to Mobile Computing, Telecommunication Generations, Cellular systems. Electromagnetic Spectrum, Antenna, Signal Propagation, Signal Characteristics, Multiplexing, Spread Spectrum: DSSS & FHSS. **Self-Learning Topics:** Co-channel interference		
II	**Module 2: GSM Mobile services**	8	CO2
	GSM Mobile services, System Architecture, Radio interface, Protocols, Localization and Calling, Handover, security (A3, A5 & A8). GPRS system and protocol architecture. UTRAN, UMTS core network. **Self-Learning Topics:** Improvements on Core Network		
III	**Module 3: Mobile Networking**	8	CO3
	Medium Access Protocol, Internet Protocol and Transport layer Mobile IP: IP Packet Delivery, Agent Advertisement and Discovery, Registration, Tunneling and Encapsulation, Reverse Tunneling. Mobile TCP: Traditional TCP, Classical TCP Improvements like Indirect TCP, Snooping TCP & Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/Timeout Freezing **Self-Learning Topics:** Selective Retransmission		
IV	**Module 4: Wireless Local Area Networks**	8	CO4
	Wireless Local Area Networks: Introduction, Infrastructure and ad-hoc network. IEEE 802.11:System architecture , Protocol architecture , Physical layer, Medium access control layer, MAC management, 802.11a, 802.11b standard. Wi-Fi security : WEP ,WPA, Wireless LAN Threats , Bluetooth: Introduction, User Scenario, Architecture, protocol stack. **Self-Learning Topics:** Securing Wireless Networks.		
V	**Module 5: Mobility Management**	7	CO5
	Mobility Management : Introduction, IP Mobility, Optimization, IPv6 Macro Mobility : MIPv6, FMIPv6 Micro Mobility: CellularIP, HAWAII, HMIPv6 **Self-Learning Topics:** CellularIP		
VI	**Module 6: Long-Term Evolution (LTE) of 3GPP**	8	CO6
	Long-Term Evolution (LTE) of 3GPP : LTE System Overview, Evolution from UMTS to LTE LTE/SAE Requirements, SAE Architecture EPS: Evolved Packet System, E-UTRAN, Voice over LTE (VoLTE), Introduction to LTE-Advanced		

	Self-Organizing Network (SON-LTE), SON for Heterogeneous Networks (Het-Net), Comparison between Different Generations (2G, 3G, 4G and 5G) **Self-Learning Topics:** Introduction to 5G.		
	Total	**45**	

Experiment List:

Sr. No.	Title of Experiment	COs
1	Implementation a Bluetooth network with application as transfer of a file from one device to another.	CO2
2	To implement a basic function of Code Division Multiple Access (CDMA).	CO2
3	Implementation of GSM security algorithms (A3/A5/A8).	CO4
4	Illustration of Hidden Terminal/Exposed terminal Problem. Consider two Wi-fi base stations (STA) and an access point (AP) located along the x-axis. All the nodes are fixed. The AP is situated at the middle of the two STA, the distance of separation being 150 m. [variable]. Node #0 and node #1 are the hidden terminals. Both are transmitting some data to the AP (almost at same rate) at the same time. The loss across the wireless link between each STA and the AP is fixed at 50 dB irrespective of the distance of separation. To study how RTS/CTS helps in wireless networks, 1. No RTS/CTS is being sent. 2. Nodes do exchange RTS/CTS packets. Compare the no. of packet retransmissions required in both the cases (as obtained in the output) and compare the results.	CO3
5	To setup & configuration of Wireless Access Point (AP). Analyze the Wi-Fi communication range in the presence of the access point (AP) and the base station (BS). Consider BS and AP are static. Find out the maximum distance to which two way communications is possible. Try multiple iterations by adjusting its distance in the code and test it.	CO5
6	Study of security tools (like Kismet, Netstumbler).	CO5
7	Develop an application that uses GUI components.	CO1
8	Write an application that draws basic graphical primitives on the screen.	CO1
9	Develop an application that makes use of database.	CO
10	Develop a native application that uses GPS location information.	CO
11	Implement an application that creates an alert upon receiving a message.	CO1
12	Implementation of income tax/loan EMI calculator and deploy the same on real devices (Implementation of any real time application).	CO1

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

Reference Books:

1. Seppo Hamalainen, Henning Sanneck , Cinzia Sartori, "LTE Self-Organizing Networks (SON): Network Management Automation for Operational Efficiency", Wiley publications.
2. Ashutosh Dutta, Henning Schulzrinne "Mobility Protocols and Handover Optimization: Design, Evaluation and Application", IEEE Press, Wiley Publication.
3. Michael Gregg, "Build your own security lab", Wiley India edition.
4. Dipankar Raychaudhuri, Mario Gerla, "Emerging Wireless Technologies and the Future Mobile Internet", Cambridge.
5. Andreas F. Molisch, "Wireless Communications", Second Edition, Wiley Publication.

Text Books:

1. Jochen Schilller, "Mobile Communication", Addision wisely, Pearson Education.
2. William Stallings "Wireless Communications & Networks", Second Edition, Pearson Education.
3. Christopher Cox, "An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications", Wiley publications
4. Raj Kamal, "Mobile Computing", 2/e, Oxford University Press-New

Useful Links:

1. https://www.coursera.org/learn/smart-device-mobile-emerging-technologies
2. https://nptel.ac.in/courses/106/106/106106167/

Course Title: Artificial Intelligence												
Semester: VI			**Term: EVEN**				**Course Code: 24CSPCC604**					
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 conceptualize the basic ideas and techniques underlying the design of intelligent systems.
2. To make students understand and explore the mechanism of mind that enables intelligent thought an action.
3. To make students understand advanced representation formalism and search techniques.
4. To make students understand how to deal with uncertain and incomplete information.
5. To equip students with foundational knowledge of planning techniques in artificial intelligence.
6. Introduce students to the core concepts of Natural Language Processing.

Course Outcomes:

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

1. Ability to develop a basic understanding of AI building blocks presented in intelligent agents.
2. Ability to choose an appropriate problem solving method and knowledge representation technique.
3. Ability to analyze the strength and weaknesses of AI approaches to knowledge intensive problem solving.
4. Ability to design models for reasoning with uncertainty as well as the use of unreliable information.
5. Ability to design and develop AI applications in real world scenarios.
6. Demonstrate the ability to solve planning problems.

Module	Contents	Hours	COs
1	**Introduction to Artificial Intelligence**	05	CO1
	Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Applications of AI, Current trends in AI. **Self-Learning Topics:** Research types of intelligent systems and explore case studies of their applications (e.g., DeepMind's Alpha Go, Tesla's Auto-pilot).		
2	**Intelligent Agents**	05	CO2
	Agents and Environments, The concept of rationality, The nature of Environment, The structure of Agents, Types of Agents, Learning Agent. Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems. **Self-Learning Topics:** Start by researching examples of agents like robots, self-driving cars, and AI systems in gaming environments. Understanding how sensors (perception) and actuators (action) work in these systems is key.		
3	**Problem solving**	11	CO3
	Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID), Informed Search Methods: Greedy best first Search, A*Search, Memory bounded heuristic Search. Local Search Algorithms and Optimization Problems: Hill climbing search, simulated annealing, Genetic algorithms. Adversarial Search: Game Playing, Min-Max Search, Alpha Beta Pruning. **Self-Learning Topics:** Study BFS examples on trees and graphs, starting with simple maze problems. Visualize using tools like **VisuAlgo** or **Graphviz** for graph traversal.		
4	**Knowledge and Reasoning**	13	CO4
	Knowledge based Agents, Brief Overview of propositional logic, First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining. Knowledge Engineering in First-Order Logic, Unification, Resolution. Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain, the semantics of belief network, Simple Inference in belief network. **Self-Learning Topics:** Explore logic programming languages like **Prolog** to gain a hands-on understanding of knowledge-based agents.		

5	**Planning and Learning**	06	CO5
	The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning. Learning: Forms of Learning, Theory of Learning, PAC learning. Introduction to statistical learning (Introduction only) Introduction to reinforcement learning: Learning from Rewards, Passive Reinforcement Learning, Active reinforcement Learning **Self-Learning Topics:** Explore classical planning algorithms such as STRIPS and PDDL (Planning Domain Definition Language).		
6	**AI Applications**	05	CO6
	Introduction to NLP- Language models, Grammars, Parsing , Robotics - Robots, Robot hardware, Problems Robotics can solve ,AI applications in Healthcare, Retail, Banking **Self-Learning Topics:** Start by implementing basic NLP preprocessing tasks such as tokenization, stemming, and stopword removal using libraries like **NLTK** or **spaCy**.		
	Total	**45**	

List of Experiment:

Exp. No.	List of Experiment	COs
1	One case study on AI applications published in IEEE/ACM/Springer or any prominent journal.	CO1
2	Assignments on State space formulation and PEAS representation for various AI applications.	CO2
3	Program on uninformed search methods.	CO3
4	Program on informed search methods.	CO3
5	Program on Game playing algorithms.	CO3
6	Program for first order Logic	CO4
7	Planning Programming	CO5
8	Implementation for Bayes Belief Network	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):

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

Text Books:

1. Stuart J. Russell and Peter Norvig, "***Artificial Intelligence: A Modern Approach***", Fourth Edition" Pearson Education, 2020.
2. Saroj Kaushik, "***Artificial Intelligence***", Cengage Learning, First edition, 2011
3. George F Luger, "***Artificial Intelligence***" Low Price Edition, Fourth edition, Pearson Education.,2005

Useful Links:

1. https://nptel.ac.in/courses/106/105/106105078/
2. https://thestempedia.com/blog/simple-ai-and-machine-learning-projects-for-students-and-beginners/
3. https://nptel.ac.in/courses/106/105/106105079/

Course Title: Internet of Things												
Semester: VI			**Term: EVEN**				**Course Code: 24CSPEC6011**					
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 equip students with the fundamental knowledge
2. To understand basic technical competence in the field of Internet of Things (IoT).
3. To learn the Core IoT Functional Stack.
4. To emphasize on core IoT functional Stack to build assembly language programs.
5. To understand the different common application protocols for IoT and apply IoT knowledge to key industries that IoT is revolutionizing.
6. To examines various IoT hardware items and software platforms used in projects for each platform that can be undertaken by a beginner, hobbyist, student, academician, or researcher to develop useful projects or products.

Course Outcomes:

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

1. Understand the concepts of IoT and the Things in IoT.
2. Apply IoT knowledge to key industries that IoT is revolutionizing.
3. Emphasize core IoT functional Stack
4. Understand application protocols for IoT.
5. Understand the concept of IoT in various domains.
6. Examines various IoT hardware items and software platforms used in projects.

Module	Contents	Hours	COs
I	**Module 1 Introduction to Internet of Things (IoT)**	09	CO1
	What is IoT? - IoT and Digitization IoT Impact – Connected Roadways, Connected Factory, Smart Connected Buildings, Smart Creatures. Convergence of IT and OT, IoT Challenges. The oneM2M IoT Standardized Architecture. The IoT World Forum (IoTWF) Standardized Architecture. IoT Data Management and Compute Stack – Design considerations and Data related problems, Fog Computing, Edge Computing **Self-Learning Topics:** The Hierarchy of Edge, Fog and Cloud.		
II	**Module 2 Things in IoT**	09	C02
	Sensors/Transducers – Definition, Principles, Classifications, Types, Characteristics and Specifications. Actuators -– Definition, Principles, Classifications, Types, Characteristics and Specifications. Smart Object – Definition, Characteristics and Trends. Sensor Networks – Architecture of Wireless Sensor Network, Network Topologies. Enabling IoT Technologies - Radio Frequency Identification Technology, Micro-Electro-Mechanical Systems (MEMS), NFC (Near Field Communication), Bluetooth Low Energy (BLE) **Self-Learning Topics:** LTE-A (LTE Advanced), IEEE 802.15.4– Standardization and Alliances, ZigBee.		
III	**Module 3 The Core IoT Functional Stack**	06	C03
	Layer 1 – Things: Sensors and Actuators Layer Layer 2 – Communications Network Layer, Access Network Sublayer, Gateways and Backhaul Sublayer, Network Transport Sublayer, IoT Network Management Sublayer Layer 3 – Applications and Analytics Layer Analytics Vs. Control Applications, Data Vs. Network Analytics, Data Analytics Vs. Business Benefits **Self-Learning Topics:** Smart Services.		
IV	**Module 4 Application Protocols for IoT**	06	CO4
	The Transport Layer. IoT Application Transport Methods. Application Layer Protocol Not Present. IoT Application Layer Protocols – CoAP and MQTT		

	SCADA - Background on SCADA, Adapting SCADA for IP, Tunneling Legacy SCADA over IP Networks, SCADA Protocol Translation **Self-Learning Topics:** SCADA Transport over LLNs with MAP-T,Generic Web-Based Protocols.		
V	**Module 5 Domain Specific IoTs**	08	CO5
	Home Automation – Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors. Cities – Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance. Environment – Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection .Energy – Smart Grids, Renewable Energy Systems, Prognostics. Retail – Inventory Management, Smart Payments, Smart Vending Machines Logistics – Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring Agriculture – Smart Irrigation, Green House Control, Industry – Machine Diagnostics & Prognosis **Self-Learning Topics:** Indoor Air Quality Monitoring, Health & Lifestyle – Health & Fitness Monitoring, Wearable Electronics.		
VI	**Module 6**	07	CO6
	IoT Hardware - Arduino, Raspberry Pi, ESP32, Cloudbit/Littlebits, Particle Photon, Beaglebone Black. IoT Software - languages for programming IoT hardware, for middleware applications and API development, for making front ends, REST and JSON-LD. A comparison of IoT boards and platforms in terms of computing A comparison of IoT boards and platforms in terms of development environments and communication standards. **Self-Learning Topics:** A comparison of boards and platforms in terms of connectivity, A comparison of IoT software platforms.		
	Total	**45**	

Evaluation Scheme and Assessment:

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

B. End Semester Theory Examination:
End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Adrian McEwen & Hakim Cassimally, "Designing the Internet of Things", 1st Edition, Wiley, 2014.
2. Donald Norris, "Raspberry Pi – Projects for the Evil Genius", 2nd Edition, McGraw Hill, 2014.
3. Anand Tamboli ,"Build Your Own IoT Platform", 1st Edition, Apress, 2019.

Text Books:

1. Perry Lea, "Internet of things For Architects", 1st Edition, Packt Publication, 2018
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – Hands-On Approach", 2nd Edition, Universities Press, 2016
3. Hakima Chaouchi, "The Internet of Things - Connecting Objects to the Web", 1st Edition, Wiley, 2010.
4. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, "IoT Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Published by Pearson Education, Inc, publishing as Cisco Press, 2017.

Useful Links:

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

Course Title: Digital Signal & Image Processing												
Semester: VI			**Term: EVEN**				**Course Code: 24CSPEC6012**					
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 the fundamentals of Discrete-Time Signals and Systems.
2. To explore the Discrete Fourier Transform (DFT) and its applications.
3. To learn efficient algorithms for frequency analysis using the Fast Fourier Transform (FFT).
4. To understand the fundamentals of digital image processing.
5. To apply image enhancement techniques in the spatial domain.
6. To explore image segmentation techniques for feature extraction.

Course Outcomes:

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

1. Ability to analyse and represent discrete-time signals and systems mathematically.
2. Apply Discrete Fourier Transform (DFT) for signal analysis.
3. Utilize Fast Fourier Transform (FFT) algorithms for computational efficiency.
4. Understand digital image fundamentals and perform basic image operations.
5. Implement image enhancement techniques in the spatial domain.
6. Apply image segmentation techniques to extract meaningful information from images.

Module	Contents	Hours	COs
I	**Discrete-Time Signal and Discrete-Time System**	11	CO1
	Sampling and Reconstruction, Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals, Signal Manipulations (shifting, reversal, scaling, addition, multiplication). Classification of Discrete-Time Signals, Classification of Discrete-Systems. Linear Convolution formulation for 1-D signal (without mathematical proof), Circular Convolution (without mathematical proof), Linear convolution using Circular Convolution. Auto and Cross Correlation formula evaluation, Concept of LTI system, Output of DT system using Time Domain Linear Convolution. **Self-Learning Topics:** Introduction to Digital Signal Processing		
II	**Discrete Fourier Transform**	06	CO2
	DFT, Relation between DFT and DTFT, IDFT. Properties of DFT without mathematical proof (Scaling and Linearity, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parseval's Energy Theorem). DFT computation using DFT properties. Convolution of long sequences, Introduction to 2-D DFT. **Self-Learning Topics:** Introduction to DTFT		
III	**Fast Fourier Transform**	05	CO3
	Radix-2 DIT-FFT algorithm. DIT-FFT Flow graph for N=4 and 8, Inverse FFT algorithm. Spectral Analysis using FFT. **Self-Learning Topics:** Need of FFT		
IV	**Digital Image Fundamentals**	06	CO4
	Digital Image Processing System, Sampling and Quantization. Representation of Digital Image, Connectivity. Image File Formats: BMP, TIFF and JPEG. **Self-Learning Topics:** Introduction to Digital Image		
V	**Image Enhancement in Spatial domain**	10	CO5
	Gray Level Transformations, Zero Memory Point Operations. Histogram Processing, Histogram equalization. Image averaging, Image Subtraction, Smoothing Filters - Low pass averaging, Sharpening Filters-High Pass Filter, High Boost Filter, Median Filter for reduction of noise **Self-Learning Topics:** Neighborhood processing		
VI	**Image Segmentation**	07	CO6

	Segmentation based on Discontinuities and Similarities. Point, line and Edge Detection, Image edge detection using Robert, Prewitt and Sobel masks, Image edge Detection using Laplacian mask. Region based segmentation: Region Growing, Region Splitting and Merging. **Self-Learning Topics:** Fundamentals		
	Total	**45**	

Evaluation Scheme and Assessment:

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

B. End Semester Theory Examination:
End Semester exam of 60 Marks will be conducted based on entire syllabus.

Reference Books:

1. Sanjit Mitra, **"Digital Signal Processing: A Computer Based Approach"**, 4th Edition, Tata McGraw Hill, 2013
2. S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, **"Digital Signal Processing"**, 2nd Edition, Tata McGraw Hill Publication, 2011.
3. S. Jayaraman, E. Esakkirajan and T. Veerkumar, **"Digital Image Processing"**, 3rd Edition, Tata McGraw Hill Education Private Ltd, 2009.
4. Anil K. Jain, **"Fundamentals of Digital Image Processing"**, 4th Edition, Prentice Hall of India Private Ltd,.1989

Text Books:

1. John G. Proakis, Dimitris and G .Manolakis, **"Digital Signal Processing: Principles, Algorithms, and Applications"**, 4th Edition, Pearson Education, 2007
2. A. Anand Kumar, **"Digital Signal Processing"**, 2nd Edition, PHI Learning Pvt. Ltd. 2014.
3. Rafel C. Gonzalez and Richard E. Woods, **"Digital Image Processing"**, Pearson Education Asia, 4th Edition, 2018.
4. S. Sridhar, **"Digital Image Processing"**, 2nd Edition, Oxford University Press, 2012.

Useful Links:

1. https://nptel.ac.in/courses/108/105/108105055/
2. https://nptel.ac.in/courses/117/105/117105079/

Course Title: Quantitative Analysis												
Semester: VI			**Term: EVEN**				**Course Code: 24CSPEC6013**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA/TW**	**Oral/Pract**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	--	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination

Course Objectives:

1. Introduction to the basic concepts in Statistics
2. Understand concept of data collection & sampling methods.
3. Introduction to Regression,
4. Introduction to Multiple Linear Regression
5. Draw interference using Statistical inference methods
6. Tests of hypotheses

Course Outcomes:

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

1. Recognize the need of Statistics and Quantitative Analysis
2. Apply the data collection and the sampling methods.
3. Analyse using concepts of Regression
4. Analyse using concepts of Multiple Linear Regression
5. Formulate Statistical inference drawing methods.
6. Apply Testing of hypotheses

Module	Contents	Hours	COs
I	**Introduction to Quantitative Analysis and Statistics**	7	CO1
	Quantitative Analysis: Definition, importance and applications in engineering, **Statistics:** Definition, importance, Different types of data, tables, charts, histograms, frequency distributions, Stem-and-Leaf diagram Describing Categorical and Numerical data – Measures of central tendency, Measures of variation, Skewness & Kurtosis, Summary Statistics, Box plot		
II	**Introduction to probability and probability distribution:**	8	CO2
	Probability concepts, conditional probability, bayes theorem Probability distributions – random variable, expected value and variance Discrete distributions – Binomial, Poisson, Continuous distributions –Uniform, Normal		
III	**Introduction to Regression**	7	CO3
	Mathematical and Statistical Equation – Meaning of Intercept and Slope – Error term – Measure for Model Fit –R2 – MAE – MAPE		
IV	**Introduction to Multiple Linear Regression**	8	CO4
	Multiple Linear Regression Model, Partial Regression Coefficients, Testing Significance overall significance of Overall fit of the model, Testing for Individual Regression Coefficients		
V	**Sampling Theory**	8	CO5
	Sampling Distribution (one sample problem), Sampling Distribution (two sample problem), Point Estimation, Point Estimation for missing data		
VI	**Testing of Hypothesis**	7	CO6
	Testing of Hypothesis, Bootstrap Hypothesis Testing, Confidence Interval Estimation, Bootstrap Confidence Interval		
	Total	**45**	

Evaluation Scheme and Assessment:

A. Internal Assessment Examination:

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

B. End Semester Theory Examination:

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

Reference Books:

1. Arora, P.N., SumeetArora, S. Arora (2007):- Comprehensive Statistical Methods. Sultan Chand, New Delhi
2. Montgomery,D.C. ,Peck E.A, & Vining G.G.(2003). Introduction to Linear Regression Analysis. John Wiley and Sons,Inc.NY
3. Mood AM, Graybill FA, and Boes, D.C. (1985), Introduction to the theory of statistics, McGrawhill Book Company, New Delhi.
4. Kapur, J.N. and Saxena, H.C.(1970), Mathematical statistics, Sultan Chand & company, New Delhi.

Text Books:

1. Agarwal, B.L. (2006):-Basic Statistics. Wiley Eastern Ltd., New Delhi
2. Ross, S.M., 2014. Introduction to Probability and Statistics for Engineers and Scientists. Academic Press
3. Gupta, S. P. (2011):-Statistical Methods. Sultanchand &Sons, New Delhi
4. Sivathanupillai, M & Rajagopal, K. R. (1979):-Statistics for Economics Students
5. Hogg, R.V. and Craig, A.T.(2006), An introduction to mathematical statistics, Amerind publications.

Useful Links:

https://archive.nptel.ac.in/courses/111/105/111105077/

Course Title: Employability Enhancement Program - II												
Semester: VI			Term: EVEN				Course Code: 24CSVSE601					
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							
-	-	4	-	-	2	2	-	-	-	50	-	50

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

Course Objectives:

1. Skill Enhancement: Equip students with the essential skill sets required for a successful transition from academic life to professional career.
2. Employability Skills: Enhance students' employability by providing training in key areas demanded by employers.

Course Outcomes:

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

1. Improve accuracy and speed in solving algebraic equations and inequalities.
2. Understand and apply work-time relationships in real-world scenarios. Explain various data structures used for microprocessor design.
3. Develop proficiency in solving permutation, combination, and probability problems.
4. Strengthen their logical reasoning and deduction skills in blood relation and direction sense puzzles and other topics.
5. Enhance their reading comprehension, writing skills, and ability to articulate ideas effectively.
6. Enhance their professional presentation skills through resume building, group discussions, personal interviews, and company-specific training.

Module	Contents	Hours	COs
I	**Module 1 Basic Arithmetic and Algebra**	12	CO1
	Equation Ratio Proportion, Percentage, Profit Loss, Average Mix Alligation, Partnership SI CI **Self-Learning Topics: Practice of above topics**		
II	**Module 2 Time Management**	8	CO2
	Time and Work, Time, Speed, and Distance, Clocks and Calendar **Self-Learning Topics: Practice of above topics**		
III	**Module 3 Advanced Math**	10	CO3
	Geometry and Mensuration, Permutation and Combination, Probability, DI **Self-Learning Topics: Practice of above topics**		
IV	**Module 4 Logical Reasoning**	10	CO 4
	Blood Relation And Direction, Syllogism, Coding Decoding Ns And Ls Input Output And Cubes, Puzzles And Seating Arrangement, Inequality Data Sufficiency **Self-Learning Topics: Practice of above topics**		
V	**Module 5 Verbal Ability**	15	CO 5
	Sentence, Verb And Agreement, Tenses, Voices & Speeches, Para jumble, Articles + Grammar, Vocabs And Close Test, Reading Comprehension **Self-Learning Topics: Practice of above topics**		
VI	**Module 6 PI/GD Communication**	5	CO 6
	Resume /GD / Personal Interview / Company Specific training **Self-Learning Topics: Practice for Mock interviews**		
	Total	**60**	

Evaluation Scheme and Assessment:

A. Continuous Assessment (CA):

Continuous Assessment should consist of the following

Reasoning

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 20 Marks

Group Discussion and personal Interview:

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 20 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

Course Title: Industry Certification

Semester: VI			Term: Even			Course Code: 24CSVSE602						
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 II

Semester: VI			Term: Even			Course Code: 24CSOJT601						
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	1	-	-	-	-	50	50

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.

Bachelor of Technology
In
Computer Engineering

Final Year
Semester – VIII

SJCEM : R - 24

Effective from Academic Year 2024-25

Program Structure for Final Year Computer Engineering

(With Effect from 2024-2025)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24CSPCC801	PCC	Distributed Computing	3	-	2	3	-	1	4
24CSPEC801X	PEC	Department Level Optional Course 5	3	-	2	3	-	1	4
24CSPEC802X	PEC	Department Level Optional Course 6	3	-	2	3	-	1	4
24ILOC802X	OE	Institute Level Optional Course 2	3	-	-	3	-	-	3
24CSVSE801	VSEC	Industry Certification	-	-	-	-	-	1	1
24CSPRJ801	PRJ	Major Project 2 / Internship - III	-	-	10	-	-	5	5
Total			**12**	**0**	**16**	**12**	**0**	**9**	**21**

Course Code	Vertical	Course Name	Evaluation Scheme					
			IAE 1	IAE 2	ESE	CA	OR/PR	Total
24CSPCC801	PCC	Distributed Computing	20	20	60	25	25	150
24CSPEC801X	PEC	Department Level Optional Course 5	20	20	60	25	25	150
24CSPEC802X	PEC	Department Level Optional Course 6	20	20	60	25	25	150
24ILOC802X	OE	Institute Level Optional Course 2	20	20	60	-	-	100
24CSVSE801	VSEC	Industry Certification	-	-	-	-	25	25
24CSPRJ801	PRJ	Major Project 2 / Internship - III	-	-	-	75	50	125
Total			**80**	**80**	**240**	**150**	**150**	**700**

Department Optional Courses

Course Code	Sem. VIII: Department Optional Course- 5	Course Code	Sem. VIII: Department Optional Course – 6
24CSPEC8011	Deep Learning	24CSPEC8021	Optimization in Machine Learning
24CSPEC8012	Digital Forensic	24CSPEC8022	High Performance Computing
24CSPEC8013	Applied Data Science	24CSPEC8023	Social Media Analytics
24CSPEC8014	Data Analysis Using Python	24CSPEC8024	Full Stack Development

Institute Elective Courses

Course Code	Institute Elective Course-II #
24ILO8021	Project Management
24ILO8022	Finance Management
24ILO8023	Entrepreneurship Development and Management
24ILO8024	Human Resource Management
24ILO8025	Professional Ethics and CSR
24ILO8026	Research Methodology
24ILO8027	IPR and Patenting
24ILO8028	Digital Business Management
24ILO8029	Environmental Management

Common with all branches

Syllabus

For
Final Year Computer Engineering
Semester – VIII

(With Effect from 2024-2025)

Course Title: Distributed Computing												
Semester: VIII			**Term: EVEN**				**Course Code: 24CSPCC801**					
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 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 sys- terms.
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 tech- niques for system reliability.
6. Evaluate file models, caching schemes, and replication strategies in distributed file systems.

Module	Contents	Hours	COs
I	**Introduction to Distributed Systems**	5	**CO1**
	Characterization of Distributed Systems: Issues, Goals, Types of distributed systems, Grid and Cluster Computing Models, Middleware: Models of middleware, Services offered by middleware. **Self-Learning Topics:** Hardware and Software Concepts: NOS, DOS.		
II	**Communication**	5	**CO2**
	Inter-process communication (IPC): Remote Procedure Call (RPC), Remote Method Invocation (RMI), Message-Oriented Communication, Stream Oriented Communication, Group Communication. **Self-Learning Topics:** Advanced Communication Protocols such as gRPC and Apache Kafka		
III	**Synchronization**	11	**CO3**
	Clock Synchronization: Physical clock, Logical Clocks, Election Algorithms, Distributed Mutual Exclusion, Requirements of Mutual Exclusion Algorithms and Performance measures. 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: Introduction, Deadlock Detection: Centralized approach, Chandy Misra_Hass Algorithm. **Self-Learning Topics: Consensus Algorithms** (e.g., Paxos and Raft)		
IV	**Resource and Process Management**	8	**CO4**
	Desirable Features of Global Scheduling algorithm, Task assignment approach, Load balancing approach and load sharing approach. Introduction to Process Management, Process Migration, Code Migration. **Self-Learning Topics:** Dynamic Load Balancing Algorithms and Process Check pointing Techniques		
V	**Replication, Consistency and Fault Tolerance**	9	**CO5**

	Distributed Shared Memory: Architecture, design issues. Introduction to replication and consistency, Data-Centric and Cli- ent-Centric Consistency Models, Replica Management, Fault Toler- ance:		
	Self-Learning Topics: Process resilience, Recovery.		
VI	**Distributed File Systems**	7	**CO6**
	Introduction and features of DFS, File models, File Accessing mod- els, File Caching Schemes, File Replication, Case Study: Network File System (NFS) **Self-Learning Topics:** Google Case Study.		
	Total	**45**	

List of Experiments:

Exp. No.	List of Experiment	COs
1	Implement and demonstrate inter-process communication using various IPC tech- niques 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 mul- tiple distributed processes.	**CO2**
4	Implement a clock synchronization algorithm to ensure consistent time across dis- tributed 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	**Case Study: CORBA**: Study and analyze the architecture and functionalities of the Common Object Request Broker Architecture (CORBA).	**CO6**
10	**Case Study: Android Stack**: 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 Edi- tion, Pearson Education, 2005.

Text Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, Distributed Systems: Principles and Paradigms, 2nd edi- tion, Pearson Education. …
2. Mukesh Singhal, Niranjan 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: 25CSPEC8011**					
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
I	**Fundamentals of Neural Network**	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 **Self-Learning Topics:** Hebbian Learning Theory, XOR Problem and its solution using Multilayer Perceptron **(MLP)**		
II	**Training, Optimization and Regularization of Deep Neural Network**	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 **Self-Learning Topics:** Advanced Optimizers: Nadam, AMSGrad Transfer Learning: Concept and Application		
III	**Autoencoders: Unsupervised Learning**	07	CO3
	Introduction, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoders. Denoising Autoencoders, Sparse Autoencoders, and Contractive Autoen- coders. Application of Autoencoders: Image Compression **Self-Learning Topics**: Variational Autoencoders (VAEs), Applications of Autoencoders in Anomaly Detection		
IV	**Convolutional Neural Networks (CNN): Supervised Learning**	08	CO4

	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 Modern Deep Learning Architectures: LeNET: Architecture, AlexNET: Architecture **Self-Learning Topics:** Residual Networks (ResNet) and Skip Con- nections, DenseNet: Densely Connected Convolutional Networks		
V	**Recurrent Neural Networks (RNN)**	09	CO5
	Sequence Learning Problem, Unfolding Computational graphs, Re- current Neural Network, Bidirectional RNN, Backpropagation Through Time (BTT), Vanishing and Exploding Gradients, Trun- cated BTT. Long Short Term Memory: Selective Read, Selective write, Selective Forget, Gated Recurrent Unit **Self-Learning Topics:** Applications of RNNs in Natural Language Processing (NLP), Attention Mechanisms in Sequence Models		
VI	**Recent Trends and Applications**	05	CO6
	Generative Adversarial Network (GAN): Architecture Applications: Image Generation, DeepFake **Self-Learning Topics:** Variational Autoencoders vs. GANs: A Comparative Study, Applications of GANs in Medical Imaging		
	Total	**45**	

List of Experiments:

Sr. No.	Experiment Topic	COs
1	**Based on Module 1 (Any two) using Virtual Lab** 1. Implement Mc-Culloch Pitts model for binary logic functions. 2. Implement Perceptron algorithm to simulate any logic gate. 3. Implement Multilayer Perceptron algorithm to simulate XOR gate. 4. To explore python libraries for deep learning e.g. Theano, TensorFlow etc.	CO1

2	**Module 2 (Any Two)** 5. 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 6. Implement a backpropagation algorithm to train a DNN with at least 2 hidden layers. 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	CO2
3	**Module 3 (Any One)** 8. Design the architecture and implement the autoencoder model for Image Compression. 9. Design the architecture and implement the autoencoder model for Image denoising	CO3
4	**Module 4 (Any One)** 10. Design and implement a CNN model for digit recognition application. 11. Design and implement a CNN model for image classification	CO4
5	**Module 5 (Any Two)** 12. Design and implement LSTM for Sentiment Analysis. 13. Design and implement GRU for classification on text data. 14. Design and implement RNN for classification of temporal data.	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 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:

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												
Semester: VIII			**Term: EVEN**				**Course Code: 25CSPEC8012**					
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 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 inves- tigation
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 environ- ments 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 inci- dents.
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
I	**Introduction to Digital Forensics**	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 **Self-Learning Topics:** Goals of Incident Response in Digital Forensics		
II	**Digital Evidence, Forensics Duplication and Digital Evidence Acquisition**	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 Chal- lenges, Network Acquisition **Self-Learning Topics:** Challenges in Acquiring and Handling Digi- tal Evidence		
III	**Forensics Investigation**	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 **Self-Learning Topics:** Cloud Forensics		
IV	**Windows and Unix Forensics Investigation**	9	CO4
	Investigating Windows Systems - File Recovery, Windows Recycle Bin Forensics, Data Carving, Windows Registry Analysis, USB De- vice Forensics, File Format Identification, Windows Features, Fo- rensics Analysis, Windows 10 Forensics, Cortana Forensics Investigating Unix Systems - Reviewing Pertinent Logs, Performing Keyword Searches, Reviewing Relevant Files,		

	Identifying Unauthorized User Accounts or Groups, Identifying Rogue Processes, Checking for Unauthorized Access Points, Analyzing Trust Relationships **Self-Learning Topics:** Encryption in Digital Forensics Investigations		
V	**Mobile Forensics**	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. **Self-Learning Topics:** Securing Mobile Devices for Forensic Investigations		
VI	**Browser, Email Forensic & Forensic Investigation Reporting**	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 **Self-Learning Topics:** Impact of Privacy Features in Web Browsers on Forensic Investigations		
	Total	**45**	

List of Experiments:

Sr. No.	Title of Experiment	COs
1	Analysis of forensic images using open source tools: • FTK Imager • Autopsy	CO2
2	Explore forensics tools in kali linux for acquiring, analyzing and duplicating data: • Dd • dcfldd	CO2

3	Performing penetration testing using Metasploit - kali Linux.	CO3
4	Performing RAM Forensic to analyze memory images to find traces of an attack.	CO2, CO3
	• Capturing RAM Using the DumpIt Tool • Volatility tool	
5	Network forensics using Network Miner.	CO1, CO2
6	Windows Recycle Bin Forensics	CO2
7	Data Carving using open source tools • Foremost • Scalpel • Jpegcarver	CO2 CO4
8	USB Device Forensics using • USBDeview • USB Detective	CO2
9	Web Browser Forensics using DB Browser for SQLite.	CO5
10	Generate a Timeline Report Using Autopsy	CO6
11	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
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												
Semester: VIII			**Term: EVEN**				**Course Code: 24CSPEC8013**					
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 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	**Introduction to Data Science**	4	CO1
	Introduction to Data Science, Data Science Process **Motivation to use Data Science Techniques:** Volume, Dimensions and Complexity, Data Science Tasks and Examples. Overview of Data Preparation, Modelling, Difference between data science and data analytics **Self-Learning Topics:** Applications of Data Science		
II	**Data Exploration**	8	CO2
	Types of data, Properties of data **Descriptive Statistics:** **Univariate Exploration:** Measure of Central Tendency, Measure of Spread, Symmetry. **Skewness:** Karl Pearson Coefficient of skewness, Bowley's Coefficient, Kurtosis Multivariate **Exploration:** Central Data Point, Correlation, Different forms of correlation, Karl Pearson Correlation Coefficient for bivariate distribution **Inferential Statistics:** 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 **Self-Learning Topics:** Two Way ANOVA		
III	**Methodology and Data Visualization**	8	CO3
	Methodology: Overview of model building, Cross Validation, K-fold cross validation, leave-1 out, Bootstrapping **Data Visualization:** Univariate Visualization: Histogram, Quartile, Distribution Chart Multivariate Visualization: Scatter Plot, Scatter Matrix, Bubble chart, Density Chart Roadmap for Data Exploration **Self-Learning Topics:** Visualizing high dimensional data: Parallel chart, Deviation chart, Andrews Curves.		
IV	**Anomaly Detection**	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 **Self-Learning Topics**: SMOTE dataset balancing Applications		
V	**Time Series Forecasting**	8	CO5

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

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 Practice‖, Elsevier, M.K. Publishers.
2. Steven Skiena, —Data Science Design Manual‖, Springer International Publishing AG
3. Samir Madhavan. —Mastering Python for Data Science‖, PACKT Publishing
4. Dr. P. N. Arora, Sumeet Arora, S. Arora, Ameet Arora, —Comprehensive Statistical Methods‖, S.Chand Publications, New Delhi.

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc22_cs32/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs69/preview

Course Title: Data Analysis Using Python												
Semester: VIII			**Term: Even**				**Course Code: 24CSPEC8014**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	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 studnts with skills for creating advanced data visualizations using Seaborn and Mat- plotlib.
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 tech- niques.

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 Anal- ysis (EDA).
6. Students will gain skills to analyze and manipulate data effectively.

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

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

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

VI	**Pandas Sales Data Analysis**	8	CO6
	Data Unveiling: Import and structure your sales data for analysis. **Sorting & Filtering Mastery**: Organize your sales data like a pro based on key criteria. **Mathematical Insights**: Calculate total sales, averages, and growth trends to uncover key metrics. **Transformation Magic**: Clean and customize sales data with apply(), map(), and lambda functions. **Pivot Power Play**: Analyze and visualize sales trends across categories, regions, and time. **Time-Series Exploration**: Harness DateTime handling and resampling to track sales over time. **Insight Discovery**: Dive deep into exploratory data analysis (EDA) to find hidden sales patterns. **Self-Learning Topics:** 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.		
	Total	**45**	

Exp. No.	List of Experiments	COs
1.	**Budget Tracker**: Track daily expenses by category, allowing users to add, view, and delete expenses.	CO1
2.	**Contact Book**: Store and manage contact information with options to add, delete, and search contacts.	CO1
3.	**Weather Data Prediction**: Simulate and predict weather patterns using random number generation and statistical functions.	CO2
4.	**Stock Price Movement Analysis**: Analyze historical stock prices to identify trends and correlations using NumPy's statistical tools.	CO2
5.	**Sales Performance Dashboard**: Visualize e-commerce sales trends over time using line, bar, and pie charts.	CO3
6.	**Weather Patterns Visualization**: Plot temperature and precipitation trends with line plots and histograms to reveal seasonal patterns.	CO3
7.	**Survey Data Cleaning**: Use pandas to clean and organize survey data by handling missing values, duplicates, and preparing it for analysis.	CO4
8.	**Product Profitability Analysis**: Create Pivot Tables to aggregate product sales and profit data for in-depth profitability analysis.	CO5
9.	**Marketing Campaign Effectiveness**: Analyze marketing campaign data through EDA, identifying key trends, customer engagement, and ROI.	CO5
10.	**Customer Purchase Behavior**: Use mathematical functions to analyze customer data, calculating average purchases and identifying high-value customers.	CO6
11.	**Inventory Forecasting**: 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 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 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: 25CSPEC8021**					
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
I	**Module 1 Introduction and Background to Optimization Theory**	5	CO1
	Basic Ingredients of Optimization Problems, Optimization Problem Classifications, Optima Types, Optimization Method Classes, Overview of Unconstrained and Constrained Optimization, **Self-Learning Topics:** Basics of convex optimization		
II	**Module 2 Derivative based Optimization**	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 **Self-Learning Topics:** Second order optimization: Newton method		
III	**Module 3 Stochastic Methods**	7	CO3
	Noisy Descent, Mesh Adaptive Direct Search, Cross-Entropy Method, Natural Evolution Strategies **Self-Learning Topics:** Covariance Matrix Adaptation		
IV	**Module 4 Convex Optimization**	7	CO4
	Optimization problems, Convex optimization, Linear optimization problems, Quadratic optimization problems, Geometric programming **Self-Learning Topics:** Overview of Generalized inequality constraints and Vector optimization		
V	**Module 5 Evolutionary Methods**	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 **Self-Learning Topics:** 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 **Self-Learning Topics:** Ant System, Ant Colony System		
	Total	**45**	

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: 24CSPEC8022**					
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
I	**Introduction to Parallel Computing**	6	CO1
	Parallelism (What, Why, Applications), Levels of parallelism (instruction, transaction, task, thread, memory, function) 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 **Self-Learning Topics:** Parallelism classification.		
II	**Parallel Programming Platform and Algorithm Design**	12	CO2
	Parallel Programming Platform: Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models. **Self-Learning Topics:** Parallel Programming		
III	**Performance Measures**	05	CO3
	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. **Self-Learning Topics:** Performance and Scalability		
IV	**HPC Programming: OpenMP and MPI**	11	CO4
	OpenMP Introduction: Threads, Share memory Architecture, Multi-core processors and Hyperthreading, Fork and join model. 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 **MPI** Introduction: Processes, Multiprocessor programming model, Distrib- uted system programming model, Inter-process communication using message passing: Asynchronous and Synchronous MPI Program- ming: Hello world problem, mpi_initMPI_sendMPI_Recv, Synchro- nisation: MPI_Barrier Hybrid (MPI + OpenMP) programming, Hardware requirement, Threads inside Processes, Hybrid Matrix multiplication		

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

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/cpuinfoe.vmstat **Hardware/Software Requirement**: Linux Operating System	CO1
2	To setup SSH passwordless logins for two or more Linux based machines and execute commands on a remote machine. **Hardware/Software Requirement:** Linux Operating System, Multi-core com- puter systems	CO1
3	Write a program in C to multiply two matrices of size 10000 x 10000 each and find it's 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. **Hardware/Software Requirement:** Linux Operating System, gcc com- piler,Multi-core computer systems	CO2
4	Write a "Hello World" program using OpenMP library also display number of threads created during execution. **Hardware/Software Requirement:** Linux Operating System, gcc com- piler,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. **Hardware/Software Requirement:** Linux Operating System, gcc com- piler,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. **Hardware/Software Requirement:** Linux Operating System, gcc com-piler,Dual core with HT or Quad-core or higher computer system.	CO4
7	Install MPICH library and write a "Hello World" program for the same. **Hardware/Software Requirement:** Linux Operating System, MPICH, Multi-processor systems or MPI Cluster.	CO4
8	Write a parallel program to multiply two matrices using MPI library and com-pare the execution-time with it's OpenMP and serial version. **Hardware/Software Requirement:** 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. **Hardware/Software Requirement:** Linux Operating System, MPICH, Multi-processor systems or MPI Cluster.	CO5
10	Implement a program to demonstrate balancing workload on MPI platform. **Hardware/Software Requirement:** Linux Operating System, MPICH, Multi-processor 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, Programma- bility‖ 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: CSDC8023**					
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 signifi- cance.
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 me- dia analytics.
6. To acquire the fundamental perspectives and hands-on skills needed to work with social media data.

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

	Self-Learning Topics: Location Analytics and Privacy Concerns.		
V	**Module 5: Social Information Filtering**	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. **Self-Learning Topics:** Traditional Vs social Recommendation Sys- tems		
VI	**Module 6: Social Media Analytics Applications and Privacy**	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. **Self-Learning Topics:** Privacy - Privacy policies		
	Total	**45**	

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

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

V	**Mastering Spring Framework**	12	CO5
	Spring Core Unveiled: Mastering Loose Coupling, IoC, and DI with Bean Configuration **Spring Boot Essentials**: Fast-Track Your Development with Auto-Configuration and Embedded Servers **Spring Data JPA Deep Dive**: Harnessing Repositories, Named Queries, and Transaction Management **Spring Data REST Integration**: Exposing REST APIs with Seamless Repository Management **Spring Security & Microservices**: Building Scalable, Secure APIs with Real-World Demos. **Self-Learning Topics:** **Advanced Dependency Injection Techniques**: Exploring scope, lifecycle, @Scope, @Lazy, and custom scopes. **Spring AOP (Aspect-Oriented Programming)**: Implementing logging, security, and transactions using AOP. **Spring Cloud**: Understanding microservices architecture and tools like Config Server and Eureka. **Spring Reactive Programming**: Building non-blocking, event-driven applications using Spring WebFlux. **Spring Security OAuth2**: Implementing OAuth2 for secure authentication and authorization in applications		
VI	**Angular Framework**	10	CO6
	Angular Framework Essentials: Introduction to Angular, setting up the environment with Angular CLI, project setup, bootstrapping the app, building components, and understanding app structure. **Angular Components and Data Binding**: Creating and nesting components, setting up templates, handling property/event binding, two-way data binding, and managing input/output properties. **Directives and Styles in Angular**: Working with built-in directives, creating custom attribute directives using Renderer and HostListener, applying styles, and using View Encapsulation with Bootstrap integration. **Forms, Pipes, and Dependency Injection**: Understanding template-driven vs reactive forms, built-in and custom validators, creating services, using dependency injection, and implementing pipes. **Routing, HTTP Requests, and Authentication**: Implementing routing with navigation, child routes, passing parameters, making HTTP requests, using observables, and securing routes with JWT and route guards. **Self-Learning Topics:** **Advanced Routing Techniques**: Learn how to handle lazy loading, preloading strategies, and advanced route guards to optimize your Angular application's navigation.		

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

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

Course Title: Project Management												
Semester: VIII			Term: Even			Course Code: 24ILO8021						
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. Understanding the Foundations of Project Management
2. Developing Leadership and Interpersonal Skills
3. Mastering Project Planning and Risk Management
4. Enhancing Monitoring, Evaluation, and Software Proficiency

Course Outcomes:

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

1. Demonstrate an understanding of project management principles and models
2. Exhibit leadership and interpersonal skills
3. Plan and execute projects effectively
4. Utilize advanced scheduling and resource management techniques
5. Implement project monitoring and control mechanisms
6. Leverage software and simulation tools

Course Details:

Module	Contents	Hours	COs
I	**Introduction to project management:** Introduction to project management - I, introduction to project management - II, agile project management, project selection models, examples of project selection models	6	CO1
II	**Role of the Project Manager:** 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	**Comprehensive Project Planning and Risk Management:** 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	**Advanced Scheduling and Resource Optimization Techniques in Project Management:** 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	**Project Monitoring, Control, and Closure: Insights and Case Studies:** 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	**Leveraging Software Tools for Effective Project Management:** Software for project management, demo on project management software, simulations software for project management	5	CO6
	Total	**45**	

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

Course Title: Finance Management												
Semester: VIII			**Term: Even**				**Course Code: 24ILO8022**					
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 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.

Course Details:

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

	Zero-Coupon Bonds, Stock Valuation: Zero Growth, Constant Growth, Differential Growth		
VI	**Cost of Capital and WACC:** Capital Asset Pricing Model (CAPM) and Dividend Discount Model (DDM), Cost of Debt, Equity, and Preferred Stock, Weighted Average Cost of Capital (WACC) **Capital Investment Decisions:** Techniques: NPV, IRR, Payback Period, Comparisons Between Techniques **Dividend and Payout Policies:** Types of Payout: Regular Dividend, Stock Dividend, Stock Splits, Dividend Signaling and Real-World Implications	7	CO6
	Total	**45**	

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

Course Title: Entrepreneurship Development and Management												
Semester: VIII			Term: Even			Course Code: 24ILO8023						
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.

Course Content:

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
	Total	**45**	

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

Course Title: Human Resource Management												
Semester: VIII			Term: Even			Course Code: 24ILO8024						
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 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 organ- izations.
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 organiza- tion's goals and strategy.
4. Develop a framework for designing an effective organizational structure that aligns with the organi- zation'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), includ- ing its scope, importance, and interdisciplinary nature.

Module	Contents	Hours	COs
I	**Introduction to HR** 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. **Self-Learning:** Rightsizing, Empowerment, TQM, Managing ethical issues	8	CO1
II	**Organizational Behaviour (OB)** 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. **Self-Learning:** Case study	8	CO2
III	**Organizational Structure &Design** Structure, size, technology, Environment of organization; Organizational Roles & 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. **Self-Learning:** Tactics and strategies.	8	CO3
IV	**Human resource Planning** Recruitment and Selection process, Job-enrichment, Empowerment - Job- Satisfaction, employee morale Performance Appraisal Systems: Traditional & modern meth- ods, Performance Counselling, Career Planning **Self-Learning:** Training & Development: Identification of Training Needs, Training Methods	7	CO4

V	**Emerging Trends in HR**	7	CO5
	Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development , managing processes & transformation in HR. Organizational Change, Culture, Environment 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 **Self-Learning:** Intra company cultural difference in employee motivation		
VI	**HR & MIS:** Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries **Strategic HRM:** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals **Labor Laws.** **Self-Learning: Industrial Relations:** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act	7	CO6
	Total	**45**	

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, 16th Ed, 2013
2. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015

Text Books:

1. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th 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: 24ILO8025					
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	**Professional Ethics and Business:** The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights **Self-Learning:** Duties of Business	8	CO1
II	**Professional Ethics in the Marketplace:** Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy **Professional Ethics and the Environment:** Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control. **Self-Learning** Ethics of Conserving Depletable Resources	8	CO2
III	**Professional Ethics of Consumer Protection:** Markets and Consumer Protection; Contract View of Business Firm's Duties to Con- sumers; Due Care Theory; Advertising Ethics; Consumer Privacy **Professional Ethics of Job Discrimination:** Nature of Job Dis- crimination; Extent of Discrimination **Self-Learning:** Reservation of Jobs.	8	CO3
IV	**Introduction to Corporate Social Responsibility:** Potential Busi- ness Benefits—Triple bottom line, Human resources, Risk manage- ment, Supplier relations; Criticisms and concerns—Nature of busi- ness; Motives; Misdirection. **Self-Learning:** Trajectory of Corporate Social Responsibility in In- dia	7	CO4
V	**Corporate Social Responsibility:** Articulation of Gandhian Trustee- ship Corporate Social Responsibility and Small and Medium Enter- prises (SMEs) in India, Corporate Social Responsibility. **Self-Learning:** Public-Private Partnership (PPP) in India	7	CO5
VI	**Corporate Social Responsibility in Globalizing India:** Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India. **Self-Learning:** Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.	7	CO6
	Total	**45**	

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

Course Title: Research Methodology												
Semester: VIII			Term: Even			Course Code: 24ILO8026						
Teaching Scheme						Evaluation Scheme						
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA	Oral/Pract/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination
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.

Course Details:

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
	Total	**45**	

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, (2nd ed), Singapore, Pearson Education

Online Reference:

https://onlinecourses.nptel.ac.in/noc25_ge28/preview

Course Title: IPR and Patenting												
Semester: VIII			**Term: Even**				**Course Code: 24ILO8027**					
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 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	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Pa- tents, Trademarks, Copyrights, Industrial Designs, Plant va- riety protection, Geographical indications, Transfer of tech- nology etc. **Importance of IPR in Modern Global Economic Environment:** Theories of IPR, Philosophical aspects of IPR laws **Self-Learning:** Need for IPR, IPR as an instrument of development	8	CO1
II	**Enforcement of Intellectual Property Rights:** Introduc tion, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement. **Indian Scenario of IPR:** Introduction, in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Ma- jor international treaties signed by India, Procedure for sub- mitting patent and Enforcement of IPR at national level etc. **Self-Learning:** History of IPR	8	CO2
III	**Emerging Issues in IPR:** Challenges for IP in digital econ- omy, e-commerce, human genome, biodiversity and tradi- tional knowledge etc. **Self-Learning:** Cross-border IPR Enforcement	8	CO3
IV	**Basics of Patents:** 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, Pa- tent specification Patent claims, Disclosures and non-disclo- sures, Patent rights and infringement. **Self-Learning:** Method of getting a patent	7	CO4
V	**Patent Rules:** Indian patent act, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral trea- ties where India is a member (TRIPS agreement, Paris conven- tion etc.) **Self-Learning:** European patent rules	7	CO5
VI	**Procedure for Filing a Patent (National and Interna- tional):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of pa- tent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement **Self-Learning: Patent databases:** Important websites, Searching international databases	7	CO6
	Total	**45**	

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, 7th 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

Course Title: Digital Business Management												
Semester: VIII			**Term: Even**				**Course Code: 24ILO8028**					
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	**Introduction to Digital Business-** Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business**- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) **Self-Learning:** Opportunities and Challenges in Digital Business	8	CO1
II	**Overview of E-Commerce** **E-Commerce-** Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E- government and learning to C2C, mobile commerce and pervasive computing 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 **Self-Learning:** Legal, Ethics and Societal impacts of EC	8	CO2
III	**Digital Business Support services**: ERP as e –business backbone, knowledge Tope Apps, Information and referral system **Self-Learning: Application Development:** Building Digital business Applications and Infrastructure	8	CO3
IV	**Managing E-Business**-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 **Self-Learning:** Prominent Cryptographic Applications	7	CO4
V	**E-Business Strategy**-E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy **Self-Learning:** E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	7	CO5
VI	**Materializing e-business: From Idea to Realization**-Business plan preparation **Self-Learning:** Case Studies and presentations	7	CO6
	Total	**45**	

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, 6th 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, 2nd Edition, Pearson
2. Trend and Challenges in Digital Business Innovation, VinocenzoMorabito, 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

Course Title: Environmental Management												
Semester: VIII			**Term: Even**				**Course Code: 24ILO8029**					
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
	Total	**45**	

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 (4th edition).

Online Reference:

https://onlinecourses.nptel.ac.in/noc25_ar03/preview

Course Title: Industry Certification												
Semester: VIII			**Term: Even**				**Course Code: 24CSVSE801**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credits**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**OR/PR**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	-	-	-	-	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 willing- ness 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												
Semester: VIII			Term: EVEN				Course Code: 24CSPRJ801					
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

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 aspects.

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: 24CSPRJ801					
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 en- vironment 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 vaca- tion 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.

VISION

Excellence in Engineering Education & Creating Next-Gen Leaders / Managers in the Service of Society"

MISSION

- **To impart quality engineering education for holistic development**
- **To provide conducive environment for joyful learning, innovation and research**
- **To promote innovative technology enabled teaching and learning process**
- **To nurture socially responsible engineers, entrepreneurs and leaders**
- **To enhance employability skills to meet the changing industrial trends**