AUTONOMY SCHEME A.Y 2025-26
SJCEM R-24 Scheme B
EVEN SEMESTER

Sr. No.	Heading	Particulars
1	Title of the Course	**Electronics and Computer Science**
2	Eligibility for Admission	**As per the Institute Examination Ordinance**
3	Theory Passing Marks (IAE / ESE)	**40%**
4	Continuous Assessment (CA) / Oral / Practical	**50%**
5	To be implemented from Academic Year	**With effect from Academic Year:2025-2026**
6	Total Credits	**Maximum 172**
7	Honor / Minor Courses offered	**Internet of Things (IoT)** (Additional Credits: 18)
8	Eligibility Criteria for Honor / Minor	• Students with no backlog in semester I, II and III. • The CGPI based on Semester I, II and III 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 Grant 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 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 Scheme B curriculum will be implemented for Electronics and Computer Science from the academic year 2025-26. It will be carried forward for Final Year Engineering in subsequent academic years.

Nomenclature

Abbreviation	Title
BSC	Basic Science Courses
ESC	EngineeringScienceCourses
PCC	ProgramCoreCourses
PEC	ProfessionalElectiveCourses
MDM	MultidisciplinaryMinor
OE	OpenElective
SC	Skill Courses
LLC	LiberalLearningCourses
VSEC	VocationalandSkillEnhancementCourse
VEC	Value Education Course
SEC	SkillEnhancementCourses
AEC	AbilityEnhancementCourse
IKS	IndianKnowledgeSystem
CC	Co-curricularCourses

Credit Specification:

- Theory: 1 credit = 15 hrs of teaching
- Lab: 1 Credit = 30 hrs of lab work.
- WorkshopBasedActivities:1Credit=30hrsofhands-onactivitiesrelatedto vocation/professional practice/skill based
- Seminar/GroupDiscussion: 1 Credit=15hrs ofparticipation
- CommunityEngagementProjects:1 Credit=30hrsofcontacttimealongwith 15 hrs of activities preparation, report writing, independent reading etc.

Dr. Md. Imaduddin — BoS Chairman

Dr.Kamal Shah — Principal

Bachelor of Technology
In
Electronics and Computer Science

Second Year
Semester–IV

SJCEM R–24 'B' Scheme

(Effective from Academic Year 2025-26)

Program Structure for Second Year Electronics and Computer Science
Semester IV (AY 2025-26)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24ECPCC401B	PCC	Statistical Analysis	2	1	-	2	1	-	3
24ECPCC402B	PCC	Microprocessor and Microcontroller	3	-	2	3	-	1	4
24ECPCC403 B	PCC	Computer Networks	3	-	2	3	-	1	4
24ECPCC404 B	PCC	Sensors Technology and Application	2	-	2	2	-	1	3
24ECAEC401B	AEC	Employability Enhancement Program -II (Communication)	-	-	2	-	-	1	1
24ECVSE401B	VSEC	Employability Enhancement Program -III (Industry Certification)	-	-	2	-	-	1	1
24MDM401XB	MDM	Multidisciplinary Minor	3	-	2	3	-	1	4
24ECOJT401B	OJT	Internship-I	-	-	3	-	-	1	1
		Total	13	1	15	13	1	7	**21**

Course Code	Vertical	Course Name	Evaluation Scheme					
			Theory			Practical		Total
			IAE 1	IAE 2	ESE	CA	Or / Pr / Tut	
24ECPCC401B	PCC	Statistical Analysis	20	20	60	25	-	**125**
24ECPCC402B	PCC	Microprocessor and Microcontroller	20	20	60	25	25	**150**
24ECPCC403 B	PCC	Computer Networks	20	20	60	25	25	**150**
24ECPCC404 B	PCC	Sensors Technology and Application	10	10	30	25	25	**100**
24ECAEC401B	AEC	Employability Enhancement Program -II (Communication)	-	-	-	25	-	**25**
24ECVSE401B	VSEC	Employability Enhancement Program -III (Industry Certification)	-	-	-	-	25	**25**
24MDM401XB	MDM	Multidisciplinary Minor	20	20	60	25	-	**125**
24ECOJT401B	OJT	Internship-I	-	-	-	-	25	**25**
		Total	90	90	270	150	125	**725**

Syllabus
for
Second Year

Electronics and Computer Science

Semester – IV

SJCEM R–24 'B'

(With Effect from A.Y. 2025-26)

Course Title: Statistical Analysis												
Semester: IV			Term: Even			Course Code: 24ECPCC401B						
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE 2	ESE	CA/TW	Oral/Pract/ Tut.	Total
Th	Tu	Pr	Th	Tu	Pr							
2	1	-	2	1	-	3	20	20	60	25	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination
CA: Continuous Assessment, TW: Term Work

Course Pre-requisites:
1. Discrete Mathematics

Course Objectives: The course is aimed
1. To study the basic techniques of statistics like correlation, regression 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 and recurrence relations effectively in various mathematical, computational, and real-world problem-solving contexts.
6. Develop proficiency in applying various graph algorithms.

Course Contents:

Module	Contents	Hours	COs
I	**Statistical Techniques:** Karl Pearson's coefficient of correlation (r), Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks), Lines of regression. **Self-learning:** Curve Fitting, Covariance.	6	1
II	**Probability Theory:** Definition and basics of probability, Discrete and continuous random variable with probability distribution and probability density function, Expectation, Variance and Standard Deviation. **Self-learning:** Cumulative Distribution Function, Skewness and Kurtosis of distribution (data).	5	2
III	**Probability Distribution:** Probability Distribution: Binomial, Poisson and Normal distribution - problems (No derivation for mean and standard deviation) **Self-learning:** Bernoulli's Distribution, Uniform Distribution, Exponential Distribution	4	3
IV	**Sampling Theory:** Introduction, Parameter and Statistics, Test of Hypothesis, Level of Significance, Critical region, One-tailed, and two-tailed test, Degree of freedom. Students' t-distribution (Small sample). Test the significance of mean and Difference between the means of two samples. Chi-Square Test: Independence of attributes. **Self-learning**: Z- Test, Goodness of fit and Yate's Correction.	5	4
V	**Counting** Basic Counting Principle-Sum Rule, Product Rule, Inclusion Exclusion Principle, Recurrence relations -Linear Homogeneous Recurrence Relation **Self-learning:** Pigeonhole Principle, Non-Homogeneous Recurrence Relation.	5	5
VI	**Graph Theory:** Introduction, Simple Graphs, Multigraphs, Isomorphic Graphs, Subgraphs, Complete graph, Regular, Planar graph, Walks, Trials, Path, Cycle, Connected and Disconnected Graph, Bipartite graph, Euler and Hamiltonian Graphs, Components of graph, Weighted graph, Dijkstra's Algorithm. **Self-learning:** Traversal algorithms- breadth-first search, depth-first search,	5	6
Total		**30**	

Evaluation Scheme and Assessment:

Internal Assessment Examination:

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.

End Semester Theory Examination:

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

Continuous Assessment (CA) / Term work (TW):

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: Microprocessor and Microcontroller												
Semester: IV			**Term:** Even				**Course Code:** 24ECPCC402B					
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

Course Pre-requisites:

1. Digital Electronics and Computer Organization

Course Objectives:

1. To understand the concepts of Microprocessor and introducethe 8086 architecture, memory, and modes.
2. To understand the 8086 programming and peripheral interfacing.
3. To Study the evolution and features of Pentium processors.
4. To understand the architecture and instruction set of 8051 microcontroller.
5. To Apply 8051 for peripheral interfacing and applications.
6. To Explore ARM, Cortex, RISC-V, and SoC processors.

Course Outcomes:

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

1. Learn the architecture and pin configuration of 8086 microprocessor.
2. Describe 8086 addressing modes, write assembly language programs and understand interfacing with 8255/8259.
3. Analyze the evolution of microprocessors and evaluate architectural features of Pentium processors in comparison with earlier generations.
4. Apply the 8051 instruction set and memory organization to develop assembly language programs for arithmetic, logical, and control operations.
5. Demonstrate interfacing of 8051 with peripherals such as displays, ADC/DAC, sensors, and motors for real-time applications.
6. Explain the features of ARM-based, Cortex, and RISC-V processors.

Course Contents:

Module	Contents	Hours	COs
I	**The 8086 Microprocessor:** Introduction of 8086 Microprocessor: Architecture, PIN description, Programmers Model, Memory Segmentation, Banking in 8086, Interrupts and Interrupt service routines, Dedicated interrupts, Software interrupts, Minimum and Maximum Mode Timing Diagrams. **Self-Learning**: Classification of Microprocessors	08	1
II	**8086 Programming and Peripheral Interfacing** Addressing modes, Instruction to Set and Assembler Directives. Assembly language programs. 8255-PPI:Functional Block Diagram and description, Operating Modes, 8259- PIC: Functional Block Diagram and description, Cascaded mode of operation, Memory Interfacing - RAM and ROM Decoding **Self-Learning**: I/O Interfacing	08	2
III	**Introduction to Pentium Processors** Evolution of microprocessors: 8086 → 80286 → 80386 → 80486 → Pentium. Pentium processor architecture (superscalar, pipelining, branch prediction). Features: 32-bit data bus, 64-bit internal registers, dual pipelines (U and V). Pentium Family and Transition to Core Processors(Dual Core, Core i-series). Hyper Threading, Turbo Boost, Integrated Graphics. **Self-Learning**: Performance metrics: clock speed, MIPS, SPEC benchmarks.	07	3
IV	**8051 Microcontroller Architecture** 8051 Features & its architecture (ALU, PC, DPTR, PSW, Internal RAM, Internal ROM, Latch, SFRs, General purpose registers, Timer/Counter, Interrupt, Ports). Memory organization (Program and Data memory Map), Timers and Counters, Addressing modes of 8051, Assembler directives of 8051, Instruction Set: Data transfer, Arithmetic, Logical, Branching, Programs related to: arithmetic, logical, Branch & delay. **Self-Learning**: Design Applications for Microcontroller	08	4

V	**8051 Interfacing & Applications** I/O port structure and programming, Timer/Counter and programming, Serial port and programming, Interrupts and programming, Display interfacing: 7-segment LED display, Analog devices interfacing: 8-bit ADC, DAC and Sensor Interfacing. Stepper Motor and DC Motor Interfacing. **Self-Learning**: Different peripheral devices interfacing	08	5
VI	**Advanced Microcontrollers and Emerging Processors** Advanced Microcontrollers (ARM-based). Features of ARM 7, Overview of ARM family. Concepts of Cortex-A, Cortex-R and Cortex-M. RISC-V Architecture (Open-source ISA), System-on-Chip (SoC) & Embedded Processors **Self-Learning**: Case study of a modern SoC	06	6
	Total	45	

Exp. No.	List of Experiments	CO
1	Use of programming tools (Debug/TASM/MASM/8086 kit) to perform basic arithmetic operations on 8-bit data.	CO1
2	Code conversion (Hex to BCD and BCD to Hex)/ (ASCII to BCD and BCD to ASCII)	CO1
3	Assembly programming for 16-bit addition, subtraction, multiplication and division (menu based) 4 Assembly program	CO2
4	Assembly program based on string instructions transfer/ string search/ string length)	CO2
5	To study of block transfer	CO2
6	To Perform Arithmetic and Logical Operations (Using Immediate, Direct and Indirect addressing mode)	CO3
7	Write program for 8051 to find smallest number	CO4
8	Write program to transfer date serially using 8051	CO4
9	Interface and program 7-segment LED display with 8051	C05
10	Write a program to demonstrate timers in 8051	CO5
11	ARM Program- Addition/Count	CO6
12	ARM Program- Factorial/Largest/Smallest	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 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 (10 to 12): 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.
D. Oral and Practical Exam
Based on the entire syllabus, oral (10 marks) & practical/implementation (15 marks) examination will
be conducted.

Reference Books:

1. R. S. Gaonkar, " 8086 Microprocessor: Architecture, Programming and Interfacing",Penram International Publishing
2. Don Anderson & Tom Shanley , "Pentium Processor System Architecture.", Addison-Wesley Professional
3. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and System Design", Pearson, 2005.
4. Ajay V Deshmukh, "Microcontroller Theory And Applications", Tata Mcgraw Hill

Text Books:

1. Kenneth J. Ayala, "The 8086 Microprocessor: Programming and Interfacing the PC", Cengage Learning India Pvt. Ltd, 3rdEdition
2. Douglas Hall, "Microprocessor and Interfacing- Programming and Hardware" Tata McGraw Hill
3. M. A. Mazidi, J. C. Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C" Pearson Education, 2nd Edition.

Online References:

Sr. No.	Website
1	https://www.nptel.ac.in
2	https://www.udemy.com
3	https://www.coursera.org
4	https://www.instructables.com/A-Beginners-Guide-to-Microcontrollers/
5	https://www.classcentral.com/subject/embedded-systems

Course Title: Computer Networks

Semester: IV			**Term:** Even				**Course Code:** 24ECPCC404B					
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

Course Pre-requisite:
Communication Engineering

Course Objectives:

1. Understand the fundamental concepts, architecture, and reference models of computer networks.
2. Analyze and compare various data transmission, switching, and routing techniques used in modern networks.
3. Design and evaluate network protocols, addressing schemes, and congestion control mechanisms for efficient communication.
4. Apply networking principles and simulation tools to implement and troubleshoot real-world network problems.

Course Outcomes:

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

1. Enumerate the layers of OSI model and TCP/IP model and describe their functions.
2. Identify the characteristics of network devices and media used to design networks.
3. Demonstrate the knowledge related to service of the data link layer.
4. Classify the routing protocols and analyze the IP address assignment for a network. And configure the networks using IP addressing and sub-netting / super-netting schemes.
5. To understand Transport layer protocols.
6. Explain the functions of Application layer and Presentation layers, their paradigms and Protocols.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to computer networks** Introduction to computer networks, Network software, Layers and services, Network topologies, protocol hierarchies, design issues for the layers, connection oriented and connectionless services. Reference models: Layer details of OSI, TCP/IP models. Communication between layers, Internet **#Self-Learning**: Comparison of OSI and TCP/IP	06	1
II	**Physical Layer** Transmission Media: Guided media like Coaxial, fiber, twisted pair, and Wireless media. Interconnecting Devices: Hub, Bridges, Switches, Router, Gateway. Transmission Impairments **#Self-Learning**: LLC, MAC layers.	06	2
III	**Data Link Control** Data link services: Framing, Flow control, Error control, ARQ methods, Piggybacking, High Level Data Link Control (HDLC): HDLC configurations, Frame formats, Typical frame exchanges, Medium Access Control Protocols: ALOHA, Slotted ALOHA, CSMA, CSMA/CD. Introduction to wireless LAN: 802.11x **#Self-Learning**: Local Area Networks - Ethernet (802.3).	10	3
IV	**Network layer** Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. Network Layer Protocols: IPv4 Datagram Format, IPv4 Addresses, IPv4 Addressing (classful and classless), Sub-netting and Super-netting design problems, IPv4 Protocol, IPv6 Packet Format, IPv6 Addressing, Transition from IPv4 to IPv6. Routing algorithms: Intra-domain Routing -Shortest Path, Distance Vector Algorithms, Link State Routing, Inter-domain Routing Protocols. **#Self-Learning**: Congestion control algorithms: Open loop congestion control, Closed loop congestion control, QoS parameters.	09	4
V	**Transport Layer** The Transport Service: Connection management (Handshake), TCP state transition, TCP timers, User Datagram Protocol (UDP) - header, Congestion: Effects of congestion, Congestion control methods **#Self-Learning**: Transport service primitives, Berkeley Sockets	07	5
VI	**Application layer** Standard Client Server applications: World Wide Web and HTTP, FTP, Electronic Mail, Domain Name System (DNS), DHCP, Secure Shell (SSH). **#Self-Learning**: TELNET.	07	6
	Total	45	

Exp No.	List of Experiments	CO
1	Study IP Utilities.	CO1
2	Configure and compare different network topologies using Cisco Packet Tracer.	CO1
3	Learn handling and configuration of networking hardware like RJ45 connector, Network cables, crimping tool, etc.	CO1
4	Configure network using Hub, Switch and Router.	CO2
5	Study wireless networks in access point using Cisco packet Tracer.	CO2
6	Study ARQ Methods.	CO3
7	Construct simple LAN and understand the concept and operation of Address Resolution Protocol (ARP).	CO3
8	Perform HDLC bit stuffing and de-stuffing using C++.	CO3
9	Understand the concept and operation of Routing Information Protocol (RIP).	CO4
10	Configure a network with Path Vector Routing Protocol- BGP using Cisco Packet Tracer and check the updated routing tables.	CO4
11	Construct multiple router networks and understand the operation of OSPF Protocol.	CO4
12	Study TCP/UDP.	CO5
13	Simulate DHCP.	CO6
14	Simulate HTTP.	CO6
15	Simulate DNS.	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):

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 (10 to 12): 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. James F. Kurose, K. W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, 3rd Edition, Pearson Education.
2. S. Keshav, An Engineering Approach to Computer Networks, 2nd Edition, Pearson Education.
3. W. A. Shay, Understanding communications and Networks, 3rd Edition, W. A. Shay, Cengage Learning.
4. L. L. Peterson and B. S. Davie, Computer Networks: A Systems Approach, 4th Ed, Elsevier India

Text Books:

1. Andrew S Tanenbaum, Computer Networks -, 4th Edition, Pearson Education
2. Behrouz A. Forouzan, Forouzan Mosharrat, Computer Networks A Top down Approach, McGraw Hill education
3. Ranjan Bose, Information Theory, Coding and Cryptography, Ranjan Bose, Tata McGraw Hill, Second Edition.

Online References:

Sr. No.	Website
1	https://www.udemy.com/topic/computer-network/?srsltid=AfmBOopfh57KZioNIgtY2EoJB5wS8tzGAQOvg_TJK7TO-Zn1R3Dw2o3f
2	https://archive.nptel.ac.in/courses/106/105/106105183/
3	https://onlinecourses.nptel.ac.in/noc22_ee61/preview

Course Title: Sensor Technology and its Applications												
Semester: IV			**Term: Even**				**Course Code: 24ECPCC404B**					
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**							
2	-	2	2	-	1	3	10	10	30	25	25	100

IAE: Internal Assessment Examination
ESE: End Semester Examination

Course Pre-requisites:

Basic Electrical Engineering

Course Objectives:

1. To introduce students to different types of sensors, Actuators, Display and their applications in engineering and industry.
2. To explain sensor materials, MEMS-based sensors, nano material technologies and related interface circuits with signal conditioning technologies.
3. To develop understanding of smart sensor systems and its Control principles.
4. To provide practical skills in microcontroller-based sensor and actuator interfacing with Arduino, ESP32, and Raspberry Pi.

Course Outcomes:

After successful completion of the course students will be able to:

1. Identify and classify various types of sensors and their applications.
2. Analyse MEMS and nano-material concepts to design and implement application-oriented sensor solutions.
3. Analyse smart sensor networks and evaluate the role of industrial communication buses in automation.
4. Apply interface circuit design principles using amplifiers, ADCs, and power management circuits for sensor applications.
5. Analyse and compare different actuators, displays, and motors to recommend suitable devices for specific tasks.
6. Apply microcontroller programming skills to implement sensor-actuator interfacing and analyse simple IoT-based systems using Arduino, ESP32, and Raspberry Pi.

Course Contents:

Module	Contents	Hours	COs
I	**Sensors in Different Applications** Temperature Sensors; Biosensors, Gas sensors. Proximity sensor, Position, Displacement, and Level Sensor; Pressure Sensors. **Self-Learning:**Recent Research Trends in Sensor Technology	4	CO1
II	**Sensor Materials and Technologies** MEMS-cantilever based sensors and their types such as, accelerometer, gyroscopes: Structure, material used (polysilicon, Silicon etc), working principle, applications. Metal oxide semiconductor (nano-particles) based sensors such as gas sensors. **Self-Learning:**Metal oxide semiconductor (nano-particles) based sensors such as biomedical sensors.	6	CO2
III	**Smart Sensors and Energy Harvesting Devices** 4-20 mA Current Loop, Types of smart Sensors, Limitations of single sensor and applicability of Array based sensor technology, Electronic-Nose sensors. Energy Harvesting Devices: Thermoelectric and piezoelectric generators. **Self-Learning:** Industrial buses such as Profibus, CAN bus, etc.	4	CO3
IV	**Interface Electronic Circuits** Input Characteristics of Interface Circuits, Amplifiers (LM358 and AD620), Analog to Digital Converters, Digital to Digital Converters (Buck and Boost Converter), Bridge Circuits (Wheatstone Bridge), Data Transmission, Batteries for Low. **Self-Learning:** Power Sensors (Li-ion / Li-Po Batteries with charging modules (TP4056)).	4	CO4
V	**Actuators, Displays, and Motors** Actuators: Mechanical, Electrical, Pneumatic, Hydraulic. Displays: LED, LCD, OLED, Touchscreens. Motors: DC, Stepper, Servo – principle, control, and applications. **Self-Learning:** Study BLDC motors and modern display technologies (e-paper, AR/VR).	6	CO5
VI	**Microcontrollers for Sensor-Actuator Systems** Introduction to Arduino, ESP32, Raspberry Pi. Interfacing sensors and actuators. Basic coding, PWM control, IoT applications. **Self-Learning:** Explore edge AI with ESP32 and TinyML.	6	CO6
	Total	**30**	

Sr. No.	Exp. No. List of Experiments	CO
1	To measure output voltage w.r.t the displacement of the core on the LVDT kit	CO1, CO4
2	To measure pressure using strain gauge	CO1, CO4
3	To study Temperature sensor with Arduino developing board.	CO1, CO6
4	To study PIR sensor with Arduino developing board.	CO1, CO6
5	To study IR sensors with an Arduino developing board.	CO1, CO6
6	Case Study on Cantilever Based Paper	CO2
7	Case study on Electronics Nose Sensor	CO3
8	To Study Array based sensor using Arduino	CO3
9	To study Analog to Digital Conversion with Arduino developing	CO4
10	Study and test buck/boost converter for powering low-power sensors	CO4
11	Control a servo motor using PWM with Arduino	CO5, CO6
12	To demonstrate electrical energy generation from heat using a thermoelectric element.	CO3
13	Display sensor output on OLED via I2C	CO5
14	Interface DHT11 sensor (temperature + humidity) with ESP32 and display on web server	CO1, CO6
15	Implement IoT-based waste level monitoring using ultrasonic sensor and Raspberry Pi	CO1, CO6
16	To demonstrate electrical energy generation from mechanical stress/vibration using a piezoelectric element.	CO3

Evaluation and Assessment Scheme:

A. Internal Assessment Examination (IAE):

Assessment consists of two class tests, each 10 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 exam of 30 Marks will be conducted based on the entire syllabus.

C. Continuous Assessment (CA):

Continuous Assessment should consist of the following
Experiments / Tutorials (10 to 12): 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 (R):

1. **Zoran Ristic** – *Sensor Technology and Devices*, Artech House Publishers, 1994.
2. **Thomas L. Floyd** – *Electronic Devices: Conventional Current Version*, 9th Edition, Pearson, 2012.
3. **Richard C. Dorf & Robert H. Bishop** – *Modern Control Systems*, 13th Edition, Pearson, 2017.
4. **Jeffrey C. Carver** – *Raspberry Pi IoT Projects: Prototyping Experiments for Makers*, 1st Edition, Apress, 2017.

Text Books(T):

1. **D. Patranabis** – *Sensors and Transducers*, 2nd Edition, Prentice Hall of India, 2003.
2. **Jon S. Wilson** – *Sensor Technology Handbook*, 1st Edition, Elsevier/Newnes, 2005.
3. **C. S. Rangan, G. R. Sarma, V. S. Mani** – *Instrumentation Devices and Systems*, 2nd Edition, Tata McGraw-Hill, 1992.

4. **Simon Monk** – *Programming Arduino: Getting Started with Sketches*, 2nd Edition, McGraw-Hill, 2016.

Online References:

Sr. No.	Website
1	https://onlinecourses.swayam2.ac.in/nou24_bt07/course
2	https://onlinecourses.swayam2.ac.in/aic20_sp04/unit?unit=4&lesson=5
3	https://www.ivytechengineering.com/info/MEMS/cantilever/MEMS%20Cantilevers_Book%201.pdf

Course Title: Employability Enhancement Program -II (Communication)												
Semester: IV			**Term:** Even				**Course Code:** 24ECAEC401B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA/ TW**	**Oral/ Pract/Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	-	2	-	-	1	1	-	-	-	25	-	25

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

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, CO3
7.	Case Study Based GD-1	CO3
8.	Case Study-2	CO3
9.	SWOT Analysis: Personal	CO4
10.	Resume Writing	CO4

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:

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: A Case Study

https://youtu.be/k9KK_0zr3LU

Course Title: Employability Enhancement Program -III (Industry Certification)												
Semester: IV			**Term:** Even				**Course Code:** 24ECVSEC401B					
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

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

Introduction

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

Course Objectives: The objectives of this course are to

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

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

1. Communicate and Collaborate Effectively
2. Acquire Job-Ready Technical Skills
3. Enhanced Critical Thinking and Problem-Solving
4. Understand Ethical and Professional Standards

5. Use Industry Tools and Standards

6. Industry Integration effectively

Certification Guidelines:

The general procedure for organizing certification courses is as follows:

1. Identification of Industry Partners

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

2. Selection of Certification Domain

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

Following combination of domains are offered in the even semesters:

Tracks	Domain 1	Domain 2
Track 1	SQL	Dotnet
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	MERN Stack	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	MERN Stack

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 needsto re-register for the course internally or externally until successfully completed.

Course Title: Internship I												
Semester: IV			**Term:** Even				**Course Code:** 24ECOJT401B					
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	-	-	1	1	-	-	-	-	25	25

Introduction

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

Course 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

Course 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:

- 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 viaconfirmation 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 Engineering
In
Electronics and Computer Science

Third Year
Semester–VI

SJCEM R–24 'B' Scheme

(Effective from Academic Year 2025-26)

Program Structure for Third Year Electronics and Computer Science
Semester VI (AY 2025-26)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24ECPCC601B	PCC	Embedded System and RTOs	3	-	2	3	-	1	4
24ECPCC602B	PCC	Artificial Intelligence & Machine Learning	3	-	2	3	-	1	4
24ECPEC601XB	PEC	Professional Elective III	3	-	2	3	-	1	4
24ECPEC602XB	PEC	Professional Elective IV	3	-	2	3	-	1	4
24OE601XB	OE	Open Elective II	3	-	-	3	-		3
24ECVSE601B	VSEC	Employability Enhancement Program-III (Industry Certification)	-	-	2	-	-	1	1
24ECOJT601B	OJT	Internship – II	-	-	3	-	-	1	1
		Total	15	-	13	15	-	6	**21**

Course Code	Vertical	Course Name	Evaluation Scheme					
			Theory			Practical		Total
			IAE 1	IAE 2	ESE	CA	Or / Pr / Tut	
24ECPCC601B	PCC	Embedded System and RTOs	20	20	60	25	25	150
24ECPCC602B	PCC	Artificial Intelligence & Machine Learning	20	20	60	25	25	150
24ECPEC601XB	PEC	Professional Elective III	20	20	60	25	-	125
24ECPEC602XB	PEC	Professional Elective IV	20	20	60	25	-	125
24OE601XB	OE	Open Elective II	20	20	60	-	-	100
24ECVSE601B	VSEC	Employability Enhancement Program-III (Industry Certification)	-	-	-	-	25	25
24ECOJT601B	OJT	Internship – II	-	-	-	-	25	25
		Total	100	100	300	100	100	**700**

Program Elective Courses (PEC)				
Semester	**Track 1**	**Track 2**	**Track 3**	**Track 4**
	Network Technologies 24ECPECX021B	**Semiconductor Technologies 24ECPECX022B**	**Software Engineering 24ECPECX011B**	**IOT 24ECPECX012B**
Semester V	Internet Communication and Wireless Networks 24ECPEC5021B	Semiconductor and VLSI Design 24ECPEC5022B	Software Engineering and Quality Testing 24ECPEC5013B	IoT Communication Protocols 24ECPEC5014B
Semester VI	Cloud Computing 24ECPEC6021B	Analog IC Design 24ECPEC6022B	Cryptography and system security 24ECPEC6011B	IoT Cloud Processing and Analytics 24ECPEC6012B
Semester VII	Network Security 24ECPEC7021B	Semiconductor Manufacturing 24ECPEC7022B	Blockchain Technology 24ECPEC7011B	Industrial IOT and Security 24ECPEC7012B
	MOOC-Related to selected track			

Open Elective Courses (OE II)				
Semester	**Track 1**	**Track 2**	**Track 3**	**Track 4**
	Entrepreneurship	**Research Methodology**	**Foreign Language**	**Business Management**
Semester VI	24OE6011B Organizational Behaviour	24OE6012B Publication Guidelines and selection of Publishers	24OE6013B Foreign Language - II (Japanese)	24OE6014B Basics of Finance Management

Syllabus
for
Third Year

Electronics and Computer Science

Semester - VI

SJCEM R–24 'B'

(With Effect from A.Y. 2025-26)

Course Title: Embedded System and RTOS												
Semester: VI			**Term:**Even			**Course Code:24ECPCC601B**						
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or/Pr/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	2	3	-	1	4	20	20	60	25	25	150

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

Prerequisite:
Digital Electronics and Computer Architecture, Microprocessor and Microcontroller

Course Objectives:
1. To study concepts involved in Embedded Hardware and Software for System realization.
2. To learn the concepts of modern microcontroller cores like the ARM-Cortex
3. To learn Real-time programming to design time-constrained embedded systems

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

1. Identify and describe various characteristic features and applications of Embedded systems.
2. Analyze and select hardware for Embedded system implementation.
3. Evaluate various communication protocols for Embedded system implementation.
4. Compare GPOS and RTOS and investigate the concepts of RTOS.
5. Evaluate and use various tools for testing and debugging embedded systems
6. Design a system for different requirements based on life-cycle for the embedded system, keeping oneself aware of ethics and environmental issues.

Module	Contents	Hours	COs
I	**Introduction to Embedded Systems** Definition, Characteristics, Classification, Applications , Design metrics of Embedded system, Challenges in optimization of metrics **Self Learning:** Overview of vulnerabilities in embedded systems.	03	CO1
II	**Embedded Hardware Elements** Features of Embedded cores- µC, ASIC, ASSP, SoC, FPGA, RISC and CISC cores. Types of memories, Case Study: ARM Cortex-M3 Features, Architecture, Programmer's model, Special Registers, Operating Modes and States, MPU, Memory map and NVIC, Low power: - Need and techniques, Communication Interfaces: Comparative study of Serial communication Interfaces (RS-232, RS-485), SPI, I2C, CAN, USB (v2.0), Bluetooth, Zig-Bee. (Frame formats of above protocols are not expected) **Self Learning:** Selection criteria of Sensors and Actuators	12	CO2
III	**Embedded Software** Program Modelling concepts: DFG, CDFG, FSM. Real-time Operating system: - Need of RTOS in Embedded system software and comparison with GPOS, Task, Task states, Multi-tasking, Task scheduling, and Algorithms-Preemptive SJF, Round-Robin, Priority, Earliest Deadline First. Inter-process communication: Message queues. Task synchronization: Need, Issues - Deadlock, Race condition, live Lock, Solutions using Mutex, Semaphores. **Self Learning:** Shared data problem, Priority inversion.	12	CO3
IV	**Introduction to Free RTOS** Free RTOS Task Management features, Resource Management features, Task Synchronization features, Event Management features, Calculate the CPU Utilization of an RTOS, Interrupt Management features, Time Management features. **Self Learning:** Round-Robin Scheduling	06	CO4
V	**Testing and Debugging Methodology** Testing & Debugging: Hardware testing tools, Boundary-scan/JTAG interface concepts, Emulator. Software Testing tools, simulator, debugger. White-Box and Black-Box testing.	06	CO5

	Self Learning: Comparison of White-Box and Black-Box testing.		
VI	**System Integration** Embedded Product Design Life-Cycle (EDLC)- Waterfall Model Hardware-Software Co-design , Case studies for Automatic Chocolate Vending Machine, Washing Machine, Smart Card, highlighting i) Specification requirements (choice of components), ii) Hardware architecture iii) Software architecture **Self Learning:** The role of embedded systems in IoT applications and protocols.	06	CO6
	Total	**45**	

Exp. No.	**List of Experiments**
1	Interfacing of LEDs /switches with any embedded core. (8051/ARM/STM32, etc)
2	Interfacing of Temperature sensor with any embedded core. (8051/ARM/STM32, etc)
3	Interfacing of LCD/ Seven segment display with any embedded core. (8051/ARM/STM32,etc)
4	Interfacing of Ultrasonic/Humidity sensor with any embedded core. (8051/ARM/STM32,etc)
5	Interfacing of a relay with any embedded core. (8051/ARM/STM32,etc)
6	Interfacing of a DC motor (speed and Direction control) with any embedded core.(8051/ARM/STM32,etc)
7	Interfacing of a stepper motor (to move by a particular angle) with any embedded core. (8051/ARM/STM32, etc)
8	Implement power management in any embedded core of your choice
9	Implement the I2C communication to connect to DS1307 RTC
10	Porting of FreeRTOS to Arduino/STM32.
11	Write a Program to Create Multiple Tasks and understand the Multitasking capabilities of RTOS(FreeRTOS).
12	Write a Program to illustrate the Queue Management Features of FreeRTOS.
13	Write a Program to illustrate the Event Management Features of FreeRTOS.
14	Write a Program to illustrate the use of Binary and Counting Semaphore for Task Synchronisation using FreeRTOS.
15	Build a Multitasking Real-Time Applications using the above IPC Mechanisms (Message Queue, EventGroup, Semaphores) with FreeRTOS on Arduino/STM32

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.

C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

Experiments / Tutorials (10 to 12): 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.

D. Oral & Practical Exam

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

Reference Books:

1. David Simon, "An Embedded Software Primer", Pearson,2009.
2. Jonathan W. Valvano, "Embedded Microcomputer Systems – Real Time Interfacing", Publisher - Cengage Learning, 2012 3rd Edition.
3. Andrew Sloss, Domnic Symes, Chris Wright, "ARM System Developers Guide Designing and Optimising System Software", Elsevier, 2004.

4. FrankVahid, Tony Givargis, "Embedded System Design – A Unified Hardware/SoftwareIntroduction", John Wiley & Sons Inc., 2002.
5. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, New Delhi,2009

Text Books:

1. Dr. K. V. K. K. Prasad, "Embedded Real Time System: Concepts, Design and Programming", Dreamtech, New Delhi, Edition2014.
2. Rajkamal, "Embedded Systems: Architecture, Programming and Design", McGraw Hill Education (India) Private Limited, New Delhi, 2015, 3rd Edition.
3. Sriram Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata McGraw Hill Publishing Company ltd., 2003.
4. Joseph Yiu, "The Definitive guide to ARM CORTEX-M3 & CORTEX-M4 Processors", Elsevier, 2014, 3rd Edition.

Online References:

Sr. No.	Website
1	https://openlabpro.com/online-courses/embedded-systems
2	https://nptel.ac.in/courses/106105193
3	www.freertos.org

Course Title: Artificial Intelligence & Machine Learning

Semester: VI			**Term:** Even				**Course Code:** 24ECPCC602B					
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

Course Pre-requisite:

Data Structures, Probability & Statistics, Algorithms, Discrete Mathematics

Course Objectives:

1. To understand the fundamental principles and paradigms of Artificial Intelligence and Machine Learning.
2. To apply problem-solving, reasoning, and knowledge representation methods for intelligent systems.
3. To analyze supervised, unsupervised, and reinforcement learning algorithms for predictive modeling.
4. To evaluate AI and ML techniques for real-world decision-making and intelligent applications.

Course Outcomes:

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

1. Apply the concepts of AI and intelligent agents to model real-world problems.
2. Analyze search and optimization techniques for effective problem solving.
3. Represent knowledge and apply reasoning methods for decision making
4. Apply probabilistic and statistical models for learning under uncertainty.
5. Evaluate and implement supervised and unsupervised machine learning algorithms.
6. Design intelligent systems by integrating AI and ML techniques.

Course Contents:

Module	Contents	Hours	COs
I	**Introduction to Artificial Intelligence and Agents** Definition, Evolution, and Applications of Artificial Intelligence, Acting and Thinking: Humanly vs. Rationally, AI Perspectives and Ethics in AI, Intelligent Agents: Architecture, Environment, and Rationality, Types of Agents: Reflex, Model-Based, Goal-Based, Utility-Based, Agent Environments: Deterministic, Stochastic, Static, Dynamic, Observable, Multi-Agent **#Self-Learning**: Case studies of AI applications in Healthcare, Robotics, and Smart Cities, History of AI Milestones (Turing Test, Deep Blue, AlphaGo)	06	1
II	**Problem Solving and Search Techniques** Problem Formulation and State-Space Representation, Uninformed Search: BFS, DFS, Uniform Cost, Depth-Limited, Iterative Deepening, Informed Search: Heuristic Search, Best-First, A*, Hill Climbing, Simulated Annealing, Adversarial Search: Minimax Algorithm and Alpha-Beta Pruning, Optimization using Genetic Algorithms **#Self-Learning**: Implement A* Search Algorithm for 8-Puzzle Problem, Study of Game-Tree Search using Minimax for Tic-Tac-Toe.	08	2
III	**Knowledge Representation and Reasoning** Fundamentals of Knowledge Representation, Propositional Logic: Syntax, Semantics, Truth Tables, Logical Connectives, Predicate Logic: Syntax, Quantifiers, Inference Rules, Forward and Backward Chaining, Resolution in Predicate Logic, Knowledge-Based Systems and Rule-Based Inference **#Self-Learning**: Introduction to PROLOG and basic AI problem solving using PROLOG, Case study: Expert System for Medical Diagnosis.	08	3
IV	**Probabilistic Reasoning and Learning**	07	4

	Need for Handling Uncertainty, Probability Theory in AI, Bayes' Rule and Conditional Probability, Bayesian Networks and Inference, Hidden Markov Models (HMMs) – Basics and Applications, Decision Theory and Utility **#Self-Learning**: Study of Naïve Bayes Classifier for Spam Detection, Implementation of Simple Bayesian Network using Python		
V	**Introduction to Machine Learning and Supervised Learning** Introduction to Machine Learning, Types of Learning: Supervised, Unsupervised, Reinforcement, Steps of Developing a Machine Learning Application, Performance Measures: Accuracy, Precision, Recall, F1-score, Regression Techniques: Linear, Multivariate, and Logistic Regression, Classification Models: Decision Trees, K-Nearest Neighbor, Naïve Bayes, Support Vector Machines (SVM), Overfitting, Underfitting, and Cross Validation **#Self-Learning**: Implement Logistic Regression using Scikit-learn, Compare SVM and Decision Tree Classifiers on Sample Dataset.	09	5
VI	**Neural Networks, Unsupervised Learning & Dimensionality Reduction** Biological vs. Artificial Neural Networks, Perceptron Model, Activation Functions, and Limitations, Multi-Layer Perceptron (MLP) and Backpropagation Algorithm, Clustering Techniques: K-Means, K-Medoids, Hierarchical Clustering, Dimensionality Reduction: PCA, LDA Concepts, Integration of AI and ML for Intelligent Applications (Expert Systems, Recommender Systems) **#Self-Learning**: Implement MLP using TensorFlow or PyTorch, Case Study: AI–ML in Self-Driving Cars or Facial Recognition.	07	6
	Total	45	

Exp No.	List of Experiments	CO
1	Study of AI environments and agent architectures.	CO1
2	Implementation of Uniformed Search Algorithms.	CO2

3	Implementation of Informed Search Algorithms.	CO2
4	Implementation of Adversarial Search (Game Playing).	CO2
5	Knowledge Representation using Propositional Logic.	CO3
6	Inference using Predicate Logic.	CO3
7	Design of Knowledge-Based Expert System.	CO3
8	Probabilistic Reasoning using Bayesian Networks.	CO4
9	Implementation of Naive Bayes Classifier.	CO4
10	Linear Regression and Logistic Regression.	CO5
11	Implementation of Decision Tree Classifier.	CO5
12	Implementation of K-Means Clustering.	CO5
13	Neural Network using Backpropagation.	CO5
14	Dimensionality Reduction using PCA.	CO5
15	Mini Project: AI-ML Integrated System.	CO6

Evaluation and Assessment Scheme:

1. **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.

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

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

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

Continuous Assessment should consist of the following

Experiments / Tutorials (10 to 12): 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. George F. Luger, *AI: Structures and Strategies for Complex Problem Solving*, Pearson.
2. Ian Bratko, *PROLOG Programming for Artificial Intelligence*, Pearson.
3. Shai Shalev-Shwartz & Shai Ben-David, *Understanding Machine Learning*, Cambridge University Press.

Text Books:

1. Stuart Russell & Peter Norvig, *Artificial Intelligence: A Modern Approach*, Pearson.
2. Tom M. Mitchell, *Machine Learning*, McGraw Hill.
3. Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press.
4. Kevin P. Murphy, *Machine Learning – A Probabilistic Perspective*, MIT Press.

Online References:

Sr. No.	Website
1	https://nptel.ac.in/courses/106102220?utm_source=chatgpt.com
2	https://nptel.ac.in/courses/106105077?utm_source=chatgpt.com
3	https://onlinecourses.nptel.ac.in/noc25_ge55/preview?utm_source=chatgpt.com
4	https://onlinecourses.nptel.ac.in/noc25_cs159/preview?utm_source=chatgpt.com
5	https://www.coursera.org/learn/machine-learning?utm_source=chatgpt.com
6	https://www.coursera.org/specializations/machine-learning-introduction?utm_source=chatgpt.com

Course Title: Cloud Computing												
Semester: VI			**Term: Even**				**Course Code: 24ECPEC6021B**					
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	-	125

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

Course Prerequisite:

Computer networks, Basics of operating system (O.S.)

Course Objectives:

1. To provide an overview of cloud computing fundamentals.
2. To make students familiar with the key concepts of virtualization.
3. To explore various cloud computing services.
4. To create an open source cloud and identify risks and provide cloud security.

Course Outcomes:

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

1. Understand cloud computing and different cloud services and deployment models.
2. Implement different types of virtualizations.
3. Use several cloud computing services.
4. Design of open source cloud.
5. Identification of threats and cloud-based risks for cloud security.
6. Understand cloud applications and recent trends.

Module	Contents	Hours	COs
I	**Introduction to Cloud Computing** Basics of operating system (O.S.), ISO-OSI model and its layers Definition of cloud computing and cloud data center, NIST model and cloud cube model, and characteristics of cloud computing. Cloud deployment models (private, public, hybrid, and community) and service models (SaaS, PaaS, and IaaS). Impact of cloud computing on business, key drivers for cloud computing. Advantages and disadvantages of cloud computing. **#Self-learning:** Comparison between cloud service providers with traditional IT service providers.	7	CO1
II	**Virtualization** Introduction and benefits of virtualization, implementation levels of virtualization, VMM. Virtualization at O.S. level, middleware support for virtualization, virtualization structure/tools and mechanisms, hypervisor and xen architecture. CPU virtualization, memory virtualization and I/O virtualization, virtualization in multicore processors, demonstration of virtualization using type II hypervisor. **#Self-learning:** Comparison between virtualization and containerization (docker).	7	CO2
III	**Cloud Computing Services** Exploring different cloud computing services: Software-as-a-Service (SaaS) (e.g., Dropbox, Google Workspace, Salesforce, etc.), Platform-as-a-Service(PaaS) (e.g., AWS , Windows Azure, Heroku, Google App Engine, etc.), Infrastructure-as-a-Service (IaaS) (e.g., Digital Ocean, AWS, Microsoft Azure, Google Compute Engine (GCE), etc.). Anything-as-a-Service or Everything-as-a-Service (XaaS), Security-as-a-Service, Identity Management-as-a-Service, and Database-as-a-Service. Storage-as-a-Service, Collaboration-as-a-Service, Monitoring-as-a-Service, Compliance-as-a- Service, Communication-as-a-Service, Network-as-a-Service , Disaster Recovery-as-a-Service, Analytics-as-a-Service, and Backup-as-a- Service. **#Self-learning:** Explore any 10 services offered by AWS/Microsoft Azure.	9	CO3
IV	**Open Source Cloud Implementation of Open Stack and Eucalyptus** OpenStack Cloud Architecture, Features of OpenStack, Components of OpenStack, Mode of Operations of OpenStack. Eucalyptus Architecture, Features of Eucalyptus, Components of Eucalyptus, Mode of Operations of Eucalyptus. Installation and configuration process of OpenStack and Eucalyptus. **#Self-learning:** Exploreopen source cloud and edge computing platform	8	CO4

	for an enterprise: OpenNebula.		
V	**Cloud Security** Security overview, cloud security challenges and risks, SaaS security, cloud computing security architecture, architectural considerations. General issues in securing cloud, securing data, application, and virtual machine security. AAA model, automatic security establishing trusted cloud computing, secure execution environments and communications, access control, disaster recovery in clouds. **#Self-learning:** Cloud security in AWS/Microsoft Azure/Google Cloud Platform.	8	CO5
VI	**Cloud Applications and Recent Trends** Cloud Applications: Scientific Applications: Healthcare: ECG analysis in cloud IoT-enabled Cloud Applications: Smart Agriculture. Business and Consumer Applications: CRM and ERP, Productivity, networking, media applications, multiplayer online gaming. Recent Trends: Mobile cloud computing, autonomic cloud computing, multimedia cloud, energy aware cloud computing. **#Self-learning:** Jungle computing, Fog computing, Quantum computing	6	CO6
	Total	**45**	

Exp. No.	List of Experiments	CO's Mapped
1. -	To leam basic Linux commands for file and directory navigation. **Commands Used:**pwd, Is, cd, mkdir, rmdir, cp. mv, rm	CO1
2	To perform operations on files and directories. **Commands Used:** cat, touch.echo, more, less, head, tail.	CO1
3	To modify file permissions and ownership.	CO1, CO5
4	To install and manage software packages. **Commands Used:** apt update, apt install, apt remove, yum install	CO1, CO4
5	To monitor running processes and system usage. **Commands Used:**ps, top, htop, df-h, free-m	CO1,CO3
6	To create and manage users and groups **Commands Used:**adduser, passwd, groupadd, usermod, deluser	CO1, CO5
7	Create an AWS Free Tier Account.	CO4

8	Explore AWS Management Console Dasliboard.	CO4
9	Case study on Amazon EC2 to learn about Amazon EC2, Amazon Elastic Compute Cloud is a central part of Amazon.com's cloud computing platform, Amazon Web Services. How EC2 allows users torrent virtual computers on which to run their own computer applications	CO1, CO4
10	Case study on Microsoft azure to learn about Microsoft Azure is a cloud computing platform and infrastructure, created by Microsoft, for building, deploying and managing applications and services through a global network of Microsoft-managed datacenters. How it work, different services provided by it	CO1,CO4,CO6
11	Implementation of Virtualization in Cloud Computing to Learn Virtualization Basics, Benefits of Virtualization in Cloud using Open Source Operating System Use **VirtualBox** or **VMware** to create 2-3 VMs on your system Run different OSs (Ubuntu + Fedora + Windows). **Goal:** Understand how virtualization divides hardware resources.	CO1, CO3

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.

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. Cloud Computing Black Book by Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Deven Shah, Dreamtech Press.
2. Amazon Web Services in Action by Michael Wittig, Andreas Wittig, Manning Publisher.
3. To the cloud: cloud powering an Enterprise, Arora Pankaj, Tata Mc Graw Hill Education.
4. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Kai Hwang, Morgan Kaufmann.

Text Books:

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education
2. Cloud Computing and Services by Arup Vithal, Bhushan Jadhav, Star Edu Solutions, SYBGEN Learning India Pvt. Ltd.
3. Cloud Computing: A Practical Approach for Learning and Implementation by A. Srinivasan, J. Suresh, Pearson.
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing by Ronald L. Krutz, Russell Dean Vines, Wiley & Sons.
5. Cloud Computing Bible by Barrie Sosinsky, Wiley Publishing.

Online References:

Sr. No.	Website
1	NPTEL: https://onlinecourses.nptel.ac.in/noc22_cs20/preview
2	AWS Management Console: https://aws.amazon.com/console/
3	https://ndl.iitkgp.ac.in NOC :Cloud Computing and Distributed Computing – Virtualization https://rb.gy/uuyzq3

Course Title: Analog IC Design

Semester: VI			Term: Even				Course Code: 24ECPEC6022B					
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	-	125

IAE: Internal Assessment Examination
ESE: End Semester Examination

Course Pre-requisites:
Basic Electronic Devices and Circuits**,** Network Theory, Analog Electronics

Course Objectives:

1. Understand the physics and modeling of MOS devices for analog circuit design.
2. Analyze and design single-stage and multi-stage amplifiers using MOSFETs.
3. Examine the operation and performance of differential amplifiers and operational amplifiers.
4. Explore different data converter circuits (ADC/DAC) and their real-world applications.
5. Develop the ability to simulate, design, and optimize analog IC blocks using SPICE and other tools.

Course Outcomes:

After successful completion of the course students will be able to:

1 Describe the fundamental concepts of MOS devices and their small-signal models.
2.Analyze MOS transistors and design single-stage amplifier circuits.
3 Analyze the operation and performance of differential amplifier configurations.
4. Examine the design and performance parameters of operational amplifier topologies.
5. Evaluate the characteristics and performance trade-offs of ADC and DAC architectures.
6. Design and analyze Sigma-Delta converters for high-resolution signal processing.

Module	Contents	Hours	COs
I	**Basic MOS Device Physics** Introduction to Analog IC Design, Threshold voltage, Derivation of I/V characteristics, second order effects, MOS device capacitance, MOS small signal models, MOS SPICE models. **#Self-Learning:**Short Channel Effects in Deep Submicron MOSFETs.	8	CO1
II	**Single stage amplifiers** Basic concept, common source, common source stage with resistive load, common source with diodeconnected, load CS stage with source degeneration, source follower, common gate Stage., CascadeStage. **#Self-Learning:**High-frequency response of MOS amplifiers.	8	CO2
III	**Differential amplifiers** Single ended & differential operation, Basic differential pair, qualitative and quantitative analysis, Common mode response. **#Self-Learning:**Common-mode rejection ratio (CMRR) improvement techniques.	6	CO3
IV	**Operational amplifiers** General Considerations, Theory and Design, Performance Parameters, Single-Stage Op Amps, Two-Stage Op Amps, Design of 2-stage MOS Operational Amplifier, Gain Boosting, Comparison of various topologies, slew rate, Offset effects, PSRR. **#Self-Learning:**Design challenges in low-power Op-Amps for portable devices.	8	CO4
V	**ADC converter and DAC converter** Converting Analog Signals to Digital Signals, Sample and-Hold (S/H) Characteristics, Digital to Analog Converter (DAC) Specifications Analog -to-Digital Converter (ADC) Specifications.	8	CO5

	#Self-Learning: Flash ADC vs. Successive Approximation ADC: Case study.		
VI	**Sigma Delta Converter** The Oversampling ADC, The First-Order Sigma Delta Modulator, The Higher Order Sigma Delta modulator. **#Self-Learning:**Noise shaping and its importance in sigma-delta ADCs.	7	CO6
	Total	**45**	

Exp. No.	**List of Experiments**
1.	NMOS characteristic :- Vds Vs ID for various values of Vgs.
2	PMOS characteristic :- Vds Vs ID for various values of Vgs.
3	Common Source amplifier:- AC analysis Transient analysis
4	Common Drain amplifier:- AC analysis Transient analysis
5	Differential Amplifier :- AC analysis Transfer curve (Vin Vs Vout, DC condition)
6	Op-Amp Design: AC analysis Transient analysis DC analysis
7	SPICE simulation of basic Analog circuits, Analog Circuit simulation Verification of layouts
8	Basic CMOS Comparator Design
9	Source Coupled Pair Differential Amplifier
10	Analysis of ADC, DAC , Sigma delta Convertor .
11	Mini Project

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.

C. Continuous Assessment (CA):
Continuous Assessment should consist of the following
Experiments / Tutorials (10 to 12): 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.

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

Reference Books (R):

2. CMOS Analog Circuit Design, second edition, 2010, P.E. Allen, D.R.Holdberg, Oxford univ. press.
3. Analysis and Design of Analog Integrated Circuits, fifth edition, reprint 2010, Paul B Gray , Hurst , Lewis, Meyer, John Wiley & sons

Text Books(T):

4. Design of Analog CMOS Integrated Circuits, Nineteenth reprint2010, Behzad Razavi, Mc-Graw-Hill.
5. CMOS circuit design, layout, and Simulation', Second edition, reprint 2009, Jacob Baker,WSE

Online References:

Sr. No.	Website
1	https://archive.nptel.ac.in/courses/117/101/117101105/ 2
2	2 https://archive.nptel.ac.in/courses/117/108/117108038/

Course Title: Cryptography and System Security												
Semester: VI			**Term:** Even				**Course Code: 24ECPEC6011B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or/Pr/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	2	3	-	1	4	20	20	60	25	-	125

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

Prerequisite:
Computer Network, Cyber Security , Data Encryption

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, PKI standards and various secure communication standards including Kerberos, IPsec, and SSL/TLS. 4. To develop the ability to use existing cryptographic utilities to build programs for secure communication

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

1. Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.
2. Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication.
3. Apply Message Authentication Codes (MAC) and keyed-hash functions (HMAC, CMAC) for securing communication and verifying message integrity.
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	Content	Hours	COs

1	**Introduction - Number Theory and Basic Cryptography** 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 **Self Learning:**transposition techniques: keyed and keyless transposition ciphers	8	1
2	**Symmetric and Asymmetric key Cryptography and key Management** Block cipher principles, block cipher modes of operation, DES, Double DES, Triple DES, Advanced Encryption Standard (AES), Stream Ciphers: RC4 algorithm. Public key cryptography: Principles of public key cryptosystems- The RSA Cryptosystem, The knapsack cryptosystem. Symmetric Key Distribution: KDC, Needham-schroederprotocol. Kerberos: Kerberos Authentication protocol, Symmetric key agreement: Diffie Hellman **Self Learning:**Digital Certificate: X.509, PKI	8	2
3	**Cryptographic Hash Functions** Cryptographic hash functions, Properties of secure hash function, MD5, SHA-1, MAC, HMAC, CMAC. **Self Learning:**Study about SHA-2 and SHA-3 family and their design principles	6	3
4	**Authentication Protocols & Digital Signature Schemes** User Authentication, Entity Authentication: Password Base, Challenge Response Based, Digital Signature, Attacks on Digital Signature, Digital Signature Scheme: RSA **Self Learning:**Comparison of RSA, DSA, and ECDSA digital signature schemes.	8	4
5	**Network Security and Applications** 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:**AI/ML in detecting network intrusions.	9	5
6	**System Security** Buffer Overflow, malicious Programs: Worms and Viruses, SQL injection **Self Learning:**Ransomware lifecycle and defense strategies.	6	6

Total	45	

Sr No.	List of Experiment	COs
1	Design and Implementation of a product cipher using Substitution and Transposition ciphers.	1
2	Implementation and analysis of RSA crypto system.	2 & 4
3	Implementation of Diffie Hellman Key exchange algorithm	2
4	For varying message sizes, test integrity of message using MD-5, SHA-1, and analyse the performance of the two protocols. Use crypt APIs.	3
5	Study the use of network reconnaissance tools like WHOIS, dig, traceroute, ns lookup to gather information about networks and domain registrars.	5
6	Study of packet sniffer tools: wireshark,: 1. Download and install wireshark and capture icmp, tcp, and http packets in promiscuous mode. 2. Explore how the packets can be traced based on different filters.	5
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.	5
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.	5
9	Simulate DOS attack using Hping, hping3 and other tools.	6
10	Simulate buffer overflow attack using Ollydbg, Splint, Cpp check etc	6
11	a. Set up IPSEC under LINUX. b. Set up Snort and study the logs.	6
12	Explore the GPG tool of linux to implement email security	6

Evaluation and Assessment Scheme:

1. **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.
2. **End Semester Theory Examination (ESE):**
   End Semester exam of 60 Marks will be conducted based on entire syllabus.
3. **Continuous Assessment (CA):**
   Continuous Assessment should consist of the following

Experiments / Tutorials (8 to 10): 10 marks (All COsshould be covered)

Attendance (Theory & Practical): 05 marks
Teacher Assessment Examination (TAE): 10 Marks
List of Teacher Assessment Examination (TAE):

a. Assignment
b. Case Study
c. Debate
d. Solution for Social Problems
e. Field Visit
f. Group Project
g. Flipped Classroom
h. Topic Review
i. Quiz
j. Mind Mapping
k. Any other.

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

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
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: IoT Cloud Processing and Analytics

Semester: VI	Term: Even	Course Code: 24ECPEC6011B

Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	Theory			Tutorial		Total
Th	Tu	Pr	Th	Tu	Pr		IAE1	IAE 2	ESE	CA	Oral/Pract/Tut.	
3	--	2	3	--	1	4	20	20	60	25	--	125

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

Pre-requisite: Sensor Technology, Computer Networks, IoT Communication Protocols

Course Objectives: The course is aimed

4. Introduce the fundamentals of IoT and its overall ecosystem.
5. Explain IoT system architectures and communication protocols.
6. Familiarize students with IoT applications across different domains.
7. Develop knowledge about sensor networks, embedded devices, and cloud-based integration.
8. Provide insights into data analytics and security challenges in IoT systems.
9. Explore recent trends, paradigms, and future directions of IoT for engineering problem-solving.

Course Outcomes:

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

10. Understand the fundamentals of IoT, its ecosystem, and reference architectures
11. Identify and explain the role of sensors, actuators, and development platforms for IoT applications.
12. Apply appropriate communication technologies and networking protocols for IoT system design.
13. Analyze IoT data using preprocessing techniques, analytics tools, and machine learning approaches.
14. Examine IoT security challenges and apply suitable encryption, authentication, and privacy-preserving mechanisms.
15. Demonstrate IoT-based solutions for real-world applications such as smart cities, healthcare, and industry.

Module	Contents	Hours	CO
I	**Introduction to IoT** Definition and characteristics of IoT, Evolution of IoT and enabling technologies, IoT architecture and building blocks, IoT protocols overview (application, transport, network, link layer), IoT standards **Self-learning:** IoT Reference Models	7	CO1
II	IoT Hardware and Software Platforms Sensors, actuators, and embedded devices, microcontrollers and System-on-Chip (SoC) for IoT, IoT development boards (Arduino, Raspberry Pi, ESP32), middleware and IoT operating systems **Self-learning: F**irmware design considerations	7	CO2
III	Networking for IoT IoT connectivity technologies: Wi-Fi, Bluetooth, ZigBee, LoRa, NB-IoT, 5G, wireless sensor networks and communication models, edge computing and fog computing concepts, cloud platforms for IoT integration (AWS IoT). **Self-learning:** Azure IoT, Google Cloud IoT	8	CO3
IV	Data Analytics in IoT Data acquisition and storage in IoT systems, data preprocessing: cleaning, filtering, aggregation, real-time stream analytics and batch analytics, machine learning applications in IoT, visualization tools for IoT data. **Self-learning:** Real-time geospatial visualization of IoT sensor networks	8	CO4
V	Security and Privacy in IoT Security requirements in IoT ecosystems, common threats and vulnerabilities (eavesdropping, spoofing, denial of service), authentication and access control methods, data encryption techniques for IoT, privacy-preserving frameworks and policies. **Self-learning:** Zero-trust security models tailored for IoT environments	8	CO5
VI	IoT Applications and Case Studies Smart homes and smart cities, industrial IoT and Industry 4.0, healthcare and wearable devices, intelligent transportation and agriculture, case studies of successful IoT deployments. **Self-learn** Continuous health monitoring using bio-integrated IoT nanosensors	7	CO6
Total		**45**	

Exp. No.	List of Experiments
1	**IoT Device Discovery and MQTT Basics** – Use Eclipse Mosquitto (open-source MQTT broker) and MQTT Explorer to simulate IoT device publishing and subscribing.
2	**IoT Protocol Comparison** – Implement a simple data transmission using CoAP (libcoap) vs MQTT and analyze message overhead.
3	**Arduino Sensor Data Acquisition** – Interface DHT11/DHT22 (temperature-humidity sensor) with Arduino IDE and visualize data on the serial monitor.
4	**Raspberry Pi GPIO Control with Python** – Build a basic IoT actuator setup (LED/Buzzer) controlled via Flask web server running on Raspberry Pi.
5	**Wi-Fi vs LoRa Communication Test** – Send temperature sensor data via ESP32 (Wi-Fi) and LoRa modules, compare range, latency, and reliability.
6	**IoT Edge Gateway with Node-RED** – Deploy Node-RED on Raspberry Pi to collect, filter, and forward sensor data to ThingsBoard (open-source IoT platform).
7	**Real-Time Data Streaming** – Use Apache Kafka or Mosquitto MQTT to stream sensor data, then process with Apache Spark Streaming.
8	**IoT Data Visualization** – Send sensor data from Arduino/ESP32 to InfluxDB and create real-time dashboards in Grafana.
9	**IoT Secure Communication with TLS** – Configure ESP8266/ESP32 to publish MQTT messages securely using TLS/SSL with Mosquitto broker.
10	**Anomaly Detection in IoT Data** – Apply open-source Python libraries (Scikit-learn, PyOD) on a public IoT dataset (like Intel Berkeley Lab sensor data) to detect spoofed/noisy signals.
11	**Smart Home Prototype** – Build a simple home automation system (lights/fan) using ESP32 + Blynk (open-source IoT platform).
12	**Smart Agriculture Monitoring** – Deploy soil-moisture and temperature sensors on Arduino/ESP32, push data to ThingsBoard, and visualize crop condition dashboards.
13	**Case Study: Barcelona Smart City** – Analyze open-source datasets and dashboards from FIWARE/LoRaWAN implementations; evaluate smart lighting and parking solutions.
14	**Case Study: Philips Healthcare Remote Monitoring** – Study wearable IoT patient data flows using OpenMHealth standards; simulate RPM alerts with sample datasets.

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.

C. Continuous Assessment (CA):

Continuous Assessment should consist of the following

Experiments / Tutorials (10 to 12): 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 (R):

1. Ovidiu Vermesan and Peter Friess, *Internet of Things – From Research and Innovation to Market Deployment*.
2. Pethuru Raj and Anupama Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*.
3. Dieter Uckelmann, Mark Harrison, and Florian Michahelles, *Architecting the Internet of Things*.
4. Various IEEE, ACM, and Springer research papers on IoT case studies and applications.

Text Books (T):

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things – A Hands-on Approach*, Universities Press.
2. Rajkumar Buyya and Amir Vahid Dastjerdi, *Internet of Things: Principles and Paradigms*, Morgan Kaufmann.

Useful Links :

1. IOT data analytics: 34 Internet of Things -- Introduction to Data Analytics For IoT - YouTube
2. IoT hardware and software: IoT - Hardware and Software
3. Challenges in IoT: https://www.youtube.com/watch?v=4bPUztus1Mc
4. Harnessing the Power of Industry 4.0: Transforming Manufacturing with Smart Technologies
5. Smart Agriculture: https://www.youtube.com/watch?v=G12jYQfFtLQ

Course Title: Organizational Behaviour												
Semester: VI			**Term:** Even				**Course Code: 24OE6011B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or/Pr/ 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 fundamentals and scope of Organisational Behaviour and its importance in business.
2. To analyse individual differences and behavioural aspects such as motivation, personality, and perception.
3. To evaluate the influence of group behaviour, leadership, conflict, and stress on organisational effectiveness.
4. To apply concepts of organisational culture, change, and development for effective management.

Course Outcomes:

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

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

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

Text Books:

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

Useful Links:

1. https://onlinecourses.nptel.ac.in/noc25_mg80/preview
2. https://onlinecourses.nptel.ac.in/noc24_mg45/preview
3. https://www.coursera.org/learn/managing-people-iese
4. https://www.udemy.com/topic/organizational-behavior/?srsltid=AfmBOoqnqkmy7IS_9U0iGMzGxhEhHsciebpf_d_eb2xwkQwkRZ_pXRrE

Course Title: Publication Guidelines and Selection of Publishers												
Semester: VI			**Term:** Even			**Course Code: 24OE6012B**						
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or/Pr/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
03	-	-	03	-	-	03	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination

CA: Continuous Assessment

Course Objectives:

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

Course Outcomes:

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

1. Explain the publication process, ethics, and structure of scholarly articles.
2. Identify appropriate journals and publishers based on indexing, scope, and impact factors.
3. Prepare a research manuscript adhering to standard publication guidelines.
4. Analyze different types of open access and subscription-based publishing models.
5. Evaluate journal quality using metrics such as Scopus, Web of Science, SJR, and CiteScore.
6. Demonstrate awareness of predatory journals, plagiarism, and intellectual property considerations in publishing.
7.

Module	Content	Hours	COs
1	**Introduction to Research and Publication Ethics** Definition and importance of research publications.Types of research outputs – journal papers, conference papers, patents, books, chapters, Ethics in research and publication – plagiarism, fabrication, falsification, authorship ethics, Role of UGC-CARE, COPE, and other ethical bodies **Self-Learning Topics:**Case studies of publication misconduct, Tools for plagiarism checking (Turnitin, iThenticate)	8	1
2	**Structure and Components of a Research Paper** IMRaD format (Introduction, Methods, Results, and Discussion), Title, abstract, keywords, and references, Writing style, clarity, and technical presentation, Common errors in manuscript writing **Self-Learning Topics:**Review of high-quality papers in one's own domain, Practice: Drafting an abstract and title for a sample research topic	8	2
3	**Journal Selection and Publisher Identification** Understanding journal scope and aims, Parameters for journal selection: indexing, impact factor, acceptance rate, review process, Publisher types: academic, society, and commercial publishers, Overview of major publishers (Elsevier, Springer, IEEE, Taylor & Francis, Wiley, etc.) **Self-Learning Topics:**Identifying suitable journals using Scopus, Web of Science, or DOAJ , Exploring publisher portals for submission guidelines	7	3
4	**Indexing, Impact Metrics, and Quality Evaluation** Indexing databases: Scopus, Web of Science, PubMed, Google Scholar, Impact metrics: Impact Factor, SJR, CiteScore, h-index, Understanding quartiles (Q1–Q4) , Identifying predatory journals and fake publishers **Self-Learning Topics:**Checking authenticity of journals via Scopus or UGC-CARE List, Comparing journals using SJR or CiteScore	7	4
5	**Open Access and Copyright in Scholarly Publishing** Open Access models: Gold, Green, Hybrid, Publication charges (APC), institutional repositories, Copyright, licensing (Creative Commons), and author rights, Retraction and corrections in publications **Self-Learning Topics:**Study of Creative Commons licenses, Explore open access repositories (arXiv, SSRN, ResearchGate)	8	5
6	**Manuscript Submission, Review, and Post-Publication Process** Journal submission systems (Editorial Manager, ScholarOne, etc.), Peer review process: types, timelines, reviewer feedback, Revision and resubmission process, Promoting research visibility: ORCID, ResearchGate, Google Scholar, LinkedIn, Citation management tools (Mendeley, EndNote, Zotero) **Self-Learning Topics:**Creating and maintaining a professional research profile (ORCID, Google Scholar), Simulated peer-review exercise	7	6
Total		**45**	

Evaluation and Assessment Scheme:

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.

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

Reference Books:

1. **Santosh Kumar Yadav,** *Research and Publication Ethics,* Springer Nature Year: 2023
2. **Maria Bonn, Josh Bolick & Will Cross (eds.),** *Scholarly Communication Librarianship and Open Knowledge,* Association of College & Research Libraries (ALA) / ALA Editions Year: 2023
3. **Patrick Gamsby,** *The Discourse of Scholarly Communication,* Lexington Books Year: 2023

Text Books:

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

Useful Links:

https://onlinecourses.swayam2.ac.in/nou25_ge91/preview

https://onlinecourses.swayam2.ac.in/cec24_ge17/preview

Course Title:Foreign Language - II (Japanese)												
Semester: VI			**Term: Even**				**Course Code:** 24OE6013B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-		3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

Course Objectives:

1. To give basic introduction of Japanese language
2. How to introduce yourself in Japanese
3. Perceive greetings
4. Learn Hiragana and Katakana scripts
5. Count 0 to 99999
6. Basic vocabulary
7. Basic grammar
8. Basic sentence formatting

Course Outcomes:

After successful completion of the course students will be able to:

1. Understand basic Japanese language rules
2. Self-introduction
3. Daily use greetings as per occasions
4. Read and write Hiragana and Katakana scripts
5. Counting till 99999.
6. To gain understanding of basic vocabulary, grammar, and sentence formatting

Module	Contents	Hours	COs
I	**Basic Introduction to Japanese language, Greetings, Scripts** Self-introduction /Basic Japanese language rules / Daily use greetings /Countries, nationality, languages / Hiragana and Katakana scripts / Revision Self Learning: Practice, revision by students and homework.	8	CO1
II	**Script, Basic vocabulary, Basic grammar pattern, Particles, Simple sentence formation** Katakana script continues / 20 basic simple vocabulary / Basic grammar patterns / Particles wa, ka, mo, no / Simple sentence formation using basic grammar pattern Present positive / Present negative / Past positive / Past negative tenses (Desu / Dewa arimasen / Deshita / Dewa arimasenDeshita) / Revision Self Learning: Practice, revision by students and homework.	7	CO2
III	**Numbers, Months, Days of the week, Lesson 1** 1-100 numbers / 12 months /07 days / Lesson 1 vocabulary, grammar, lesson 1 reading and exercises / Revision Self Learning: Practice, revision by students and homework.	7	CO3
IV	**Grammer and Reading** Vocabulary, grammar, lesson 2 reading and exercises Self Learning: Practice, revision by students and homework.	7	CO4
V	**Numbers** 101-9999 numbers / Lesson 3 vocabulary, Kanjis, grammar, lesson reading and exercises Self Learning: Practice, revision by students and homework.	8	CO5
VI	**Numbers** 10000-99999 numbers / Lesson 4 vocabulary, Kanjis, grammar, lesson reading and exercises / Revision Self Learning: Practice, revision by students and homework.	6	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.

Text Books(T):

1. Nihongo Shoho Part 1

Online References:

Sr. No.	Link Address
1	https://youtu.be/eSJbukpiNIk?si=QfRa3ZJsH50e2h1A
2	https://youtu.be/98rDSRw7sv0?feature=shared
3	https://youtu.be/R5Sv7EqeZwQ?si=AFFpYhDl-J5yvoCE

Course Title: Basics of Finance Management												
Semester: VI			**Term: Even**				**Course Code:** 24OE6014B					
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: EndSemesterExamination
CA: Continuous Assessment

Course Objectives:

1. To gain knowledge of the structure, components, and key financial instruments within the Indian financial system.
2. To learn to measure returns and risks, apply financial ratio analysis, and understand corporate finance decisions like investment, financing, and dividends.
3. To acquire skills to evaluate investment opportunities, manage working capital, and optimize financial resources.
4. To analyze long- and short-term funding options, understand capital structure theories, and evaluate the impact of dividend policies on corporate value.

Course Outcomes:

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

1. Understand the key components and functions of India's financial system.
2. Learn methods to measure returns and risks, including the time value of money.
3. Analyze core corporate finance functions and financial health through ratio analysis.
4. Apply investment appraisal techniques and manage working capital effectively.
5. Explore financing options and assess optimal capital structures for businesses.
6. Evaluate dividend decisions and their impact on corporate value and shareholder returns.

Course Details:

Module	Contents	Hours	COs
I	**Overview of Indian Financial System** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. **FinancialMarkets:**Meaning,CharacteristicsandClassificationofFinancialMarkets— Capital Market, Money Market and Foreign Currency Market **FinancialInstitutions:**Meaning,CharacteristicsandClassificationof Financial Institutions—CommercialBanks,Investment-MerchantBanksandStockExchanges. **Self-Learning:** Emerging Trends in Fintech and Digital Financial Services.	7	CO1
II	**Concepts of Returns and Risks** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due;PresentValueofaLumpSum,OrdinaryAnnuity,andAnnuityDue ;Continuous CompoundingandContinuousDiscounting. **Self-Learning:** Introduction to Behavioral Finance and Investor Psychology	7	CO2
III	**OverviewofCorporateFinance** ObjectivesofCorporateFinance;FunctionsofCorporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **FinancialRatioAnalysis:**OverviewofFinancialStatements—BalanceSheet,Profitand LossAccount,andCashFlowStatement;PurposeofFinancialRatioAnalysis; Liquidity Ratios;EfficiencyorActivityRatios;ProfitabilityRatios;CapitalStructureRatios;Stock MarketRatios;LimitationsofRatioAnalysis. **Self-Learning:** Sustainable and Ethical Corporate Finance.	10	CO3
IV	**Capital Budgeting**	11	CO4

	Meaning and Importance of Capital Budgeting; Inputs for Capital BudgetingDecisions;InvestmentAppraisalCriterion—AccountingRateofReturn, PaybackPeriod,DiscountedPaybackPeriod,NetPresentValue(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) **WorkingCapitalManagement:**ConceptsofMeaningWorkingCapital;Importanceof Working Capital Management; Factors Affecting an Entity's Working CapitalNeeds; EstimationofWorkingCapitalRequirements;ManagementofInventories;Management ofReceivables;andManagementofCashandMarketable Securities. **Self-Learning:** Fintech Innovations in Capital Budgeting and Working Capital Management.		
V	**Sources of Finance** Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance. **CapitalStructure:**FactorsAffectinganEntity'sCapitalStructure;OverviewofCapital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach;TraditionalApproach,andModigliani-MillerApproach.Relationbetween CapitalStructureandCorporateValue;ConceptofOptimalCapitalStructure. **Self-Learning:** Impact of ESG (Environmental, Social, and Governance) Factors on Capital Structure Decisions.	6	CO5
VI	**DividendPolicy** MeaningandImportanceofDividendPolicy;FactorsAffectinganEntity's Dividend Decision; Overview of Dividend Policy Theories and Approaches— Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach. **Self-Learning:** The Role of Share Buybacks in Corporate Financial Strategy.	4	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. FundamentalsofFinancialManagement,13th Edition(2015)byEugeneF.BrighamandJoel F.Houston;Publisher:CengagePublications,NewDelhi.
2. AnalysisforFinancialManagement,10th Edition(2013)byRobertC.Higgins;Publishers: McGraw Hill Education, New Delhi.
3. IndianFinancialSystem,9th Edition(2015)byM.Y.Khan;Publisher:McGrawHill Education, New Delhi.
4. FinancialManagement,11th Edition(2015)byI.M.Pandey;Publisher:S.Chand(G/L)& Company Limited, New Delhi.

Text Books:

1. "Principles of Corporate Finance" by Richard A. Brealey, Stewart C. Myers, and Franklin Allen, 12th Edition, McGraw-Hill Education.
2. "Financial Management: Theory & Practice" by Eugene F. Brigham and Michael C. Ehrhardt, 16th Edition, Cengage Learning.
3. "Investment Analysis and Portfolio Management" by Frank K. Reilly and Keith C. Brown, 11th Edition, Cengage Learning.
4. "Financial Institutions, Markets, and Money" by David S. Kidwell, David W. Blackwell, and David A. Whidbee, 12th Edition, Wiley.
5. "Fundamentals of Financial Management" by James C. Van Horne and John M. Wachowicz Jr., 13th Edition, Prentice Hall.

Online References:

Sr. No.	Website
1	https://archive.nptel.ac.in/courses/110/107/110107073/
2	https://archive.nptel.ac.in/content/syllabus_pdf/110107144.pdf
3	https://www.coursera.org/learn/financial-markets-global
4	https://www.coursera.org/learn/wharton-finance

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

Semester: VI	Term: Even	Course Code: 24ECVSE601B

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	-	-	-	-	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	Dotnet
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
Track 13	Microsoft Tools	AI-IBM
Track 14	Augmented Reality	Virtual Reality
Track 15	Professional Edge Training(PET)	

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: 24ECOJT601B**					
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	-	-	1	1	-	-	-	-	25	25

Introduction

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

Objectives:

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

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

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

INTERNSHIP GUIDELINES:

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

Final Year
Semester–VIII

SJCEM R–24 'B' Scheme
(Effective from Academic Year 2025-26)

Semester VIII (AY 2025-26)

Course Code	Vertical	Course Name	Contact Hrs			Credit Allotted			Total Credits
			Th	Tut	Pr	Th	Tut	Pr	
24ECPCC801B	PCC	Robotics	3	-	2	3	-	1	4
24ECPEC801XB	PEC	Department Level Optional Course -V	3	-	2	3	-	1	4
24ECPEC802XB	PEC	Department Level Optional Course -VI	3	-	-	3	-	-	3
24ILO802XB	OE	Institute Level Optional Course -II	3	-	-	3	-	-	3
24ECVSE801XB	VSEC	Industry Certification	-	-	-	-	-	1	1
24ECPRJ801B	PRJ	Major Project II /Internship III	-	-	10	-	-	5	5
		Total:	12	0	16	12	0	8	20

Course Code	Vertical	Course Name	Evaluation Scheme					
			Theory			Practical		Total
			IAE 1	IAE 2	ESE	CA	Or / Pr / Tut	
24ECPCC801B	PCC	Robotics	20	20	60	25	25	150
24ECPEC801XB	PEC	Department Level Optional Course -V	20	20	60	25	25	150
24ECPEC802XB	PEC	Department Level Optional Course -VI	20	20	60	-	-	100
24ILO802XB	OE	Institute Level Optional Course -II	20	20	60	-	-	100
24ECVSE801XB	VSEC	Industry Certification	-	-	-	-	25	25
24ECPRJ801B	PRJ	Major Project II / Internship-III	-	-	-	75	50	125
		Total:	80	80	240	100	150	650

DLOC V (24ECPEC801X)		DLOC VI (24ECPEC802X)	
Code	Course	Code	Course
24ECPEC8011B	MEMS Technology	24ECPEC8021B	Advanced Networking Technologies
24ECPEC8012B	Natural Language Processing	24ECPEC8022B	Multimedia and Virtual Reality
24ECPEC8013B	3-D Printing and Design	24ECPEC8023B	Quantum Computing
24ECPEC8014B	Advanced Algorithms	24ECPEC8024B	System Security

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

Syllabus
for
Final Year

Electronics and Computer Science

Semester – VIII

SJCEM R–24 'B'

(With Effect from A.Y. 2025-26)

Course Title: Robotics												
Semester: VIII			**Term: Even**				**Course Code: 24ECPCC801B**					
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

Course Objectives:

1. 1. To get acquainted with the basics of robotics.
2. To familiarize students with kinematics & dynamics of robots.
3. To familiarize students with Trajectory & task planning of robots.
4. To familiarize students with robot vision

Course Outcomes:

After successful completion of the course students will be able to:

1. Describe the basics of Robotics.
2. Describe and derive kinematics and dynamics of stationary and mobile robots.
3. Apply trajectory planning algorithms.
4. Describe concepts of robot motion planning algorithms.
5. Apply image processing in robotic vision.
6. Identify suitable Robot language based on applications

Course Contents

Module	Contents	Hours	COs
I	**Fundamentals of Robotics** Robot Classification, Robot Components, Robot Specification, Joints, Coordinates, Coordinate frames, Workspace, Specification Notations, Applications. Self-Learning: Explore collaborative robots (cobots) and their industrial applications	5	CO1
II	**Direct Kinematics** Dot and Cross Products, Co-ordinate frames, Rotations, Homogeneous Co-ordinates, Link Co-ordinates, Arm Equation (3 axis and 4 axis Robots) **Self-Learning:**Study Denavit–Hartenberg (D-H) representation method for robot kinematics	9	CO2
III	**Inverse Kinematics and Work Space Analysis** General properties of solutions, Tool Configuration, Inverse kinematics of 3 axis, 4 axis and 5 axis Robots, Work Space Analysis of 3 axis and 4 axis Robots, Work Envelope. **Self-Learning:** Research numerical and iterative methods for solving inverse kinematics	8	CO3
IV	**Trajectory planning** Basics of Trajectory planning, Joint-space trajectory planning, Pick and place operations, Continuous path motion, Interpolated motion, Straight line motion **Self-Learning:** Explore motion planning for autonomous mobile robots	5	CO4
V	**Task Planning** Task level programming, Uncertainty, Configuration Space, Gross motion Planning; Grasp planning, Fine-motion Planning, Simulation of Planer motion, Source and goal scenes, BUG 1, BUG 2 and Tangent Bug Algorithms **Self-Learning:** Study modern AI-based path planning (A*, D*, and RRT algorithms)	8	CO5
VI	**Robot Vision and Robot Languages** Image representation, Template matching, Polyhedral objects, Shape analysis, Segmentation, Iterative processing, Perspective transform. Robot language, Classification of Robot languages, Computer control and Robot software, Variable Assembly Language system and language **Self-Learning:** Self-learn deep learning applications in robot vision (CNNs, OpenCV, TensorFlow)	10	CO6
	Total	**45**	

Exp No.	List of Experiments	CO
1.	Study/Demo of 4 axis robotic arm	CO1
2.	Study/Demo of 5 axis robotic arm	CO1
3.	Forward kinematics	CO2
4.	Inverse kinematics	CO2
5.	Joint-space trajectory	CO3
6.	Cartesian-space trajectory	CO4
7.	Template matching	CO4
8.	Iterative processing	CO5
9.	Segmentation	CO5
10.	Mini project	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 exam of 60 Marks will be conducted based on the entire syllabus.

Reference Books (R):

1. Robin R. Murphy – *Introduction to AI Robotics*, 2nd Edition, MIT Press, 2019
2. Rafael C. Gonzalez & Richard E. Woods – *Digital Image Processing*, 4th Edition, Pearson, 2018
3. Mikell P. Groover – *Industrial Robotics: Technology, Programming, and Applications*, McGraw-Hill, 1986

Text Books(T):

1. John J. Craig – *Introduction to Robotics: Mechanics and Control*, 3rd Edition, Pearson, 2005
2. Richard D. Klafter, Thomas A. Chmielewski, Michael Negin – *Robotic Engineering: An Integrated Approach*, Prentice Hall, 1989
3. Saeed B. Niku – *Introduction to Robotics: Analysis, Control, Applications*, 2nd Edition, Wiley, 2011

Online References:

Sr. No.	Website
1	https://onlinecourses.nptel.ac.in/noc25_me166/unit?unit=17&lesson=18
2	https://onlinecourses.nptel.ac.in/noc25_me161/unit?unit=18&lesson=19

Course Title: MEMS Technology

Semester: VIII			Term: Even				Course Code: 24ECPEC8011B					
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

Pre-requisite: Microelectronics & VLSI Fundamentals, Control Systems

Course Objectives:

1. To provide knowledge of MEMS fabrication steps.
2. To provide knowledge of MEMS Materials with respect to applications.
3. To demonstrate the use of semiconductor-based fabrication processes for sensors and actuators
4. To provide an understanding of basic design and operation of MEMS sensors, actuators and passive structures.

Course Outcomes:

After successful completion of the course students will be able to:

1. Understand the different MEMS devices, working principles, materials and their properties.
2. Design and simulate MEMS devices using standard simulation tools.
3. Develop different concepts of MEMS sensors and actuators for real-world applications.
4. Understand the rudiments of Micro-fabrication techniques.
5. Ilustrate the construction, working, and fabrication steps of MEMS devices
6. Evaluate the reliability of MEMS devices by analyzing common failure mechanisms

Module	Contents	Hours	COs
I	**Introduction to MEMS** Introduction to MEMS and Micro Electronics Technologies. MEMS in Real world applications such as Air-Bag, DMD, Pressure Sensors, MEMS Challenges, MEMS Sensors in Internet of Things (IoT), Bio-medical applications. **Self Learning**:Study of MEMS in consumer electronics	7	CO1
II	**MEMS Materials and Their Properties** Use of Si, SiO2, SiN, SiC, Cr, Au, Al, Ti, SU8, PMMA, Pt in building MEMS applications.Material properties such as Young modulus, Poisson's ratio, density, piezoresistive coefficients, TCR, Thermal Conductivity, Thermoelectricity. **Self Learning**:Comparison of Silicon vs. Polymers in MEMS fabrication	8	CO2
III	**MEMS Sensors and Actuators** Types MEMS Sensing (Capacitive, Piezo electric Piezo resistive) Micro Actuation Techniques (Thermal, Piezo electric, Electro static), Shape Memory Alloys, Micro Grippers, Micro Gears, Micro Motors, Micro Valves, Micro Pumps. **Self Learning:**Capacitive MEMS Accelerometers	8	CO3
IV	**MEMS Fabrication Processes** MEMS Processes & Process parameters: Bulk & Surface Micromachining, High Aspect Ratio MEMS (LIGA) X-Ray Lithography, Photolithography, PVD, Wet etching, Dry etching, Plasma etching, DRIE, Etch Stop Techniques, Die, Wire & Wafer Bonding, Dicing, Packaging. **Self Learning:**Deep Reactive Ion Etching (DRIE) process	7	CO4
V	**MEMS Devices** Construction and working and applications of basic Cantilever structure, Micro heaters, Accelerometers, Pressure Sensor, Micromirrors in DMD, Inkjet printer, Steps involved in fabrication of above devices. **Self Learning:**MEMS Inkjet Printer Head – fabrication steps and working principle	8	CO5
VI	**MEMS Reliability** Reliability and various failure mechanisms for MEMS. Reliability curve.. **Self Learning:**Stiction problem in MEMS devices	7	CO6
	Total	**45**	

Expt No	Experiment Name

7	Hardware experiment on MEMS devices.
8	Hardware experiment on MEMS devices
9	Case study on advance topic
10	Case study of recent development in the subject.

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 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 (10 to 12): 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 (R):

1. Fundamentals of Micro-fabrication - by M. Madou; Publisher: CRC Press; 2nd edition.

2. Micro machined Transducers Sourcebook - by G. Kovacs; Publisher: McGraw-Hill

Text Books(T):

1. An Introduction to Micro-electromechanical Systems Engineering; 2nd Ed - by N. Maluf, K Williams; Publisher: Artech House Inc.
2. Micro-system Design - by S. Senturia; Publisher: Springer.
3. Introduction to Electromechanical system design –by James J Allen. Taylor & Francis Group, LLC publication

Online References:

Sr. No.	Website
1	https://engineering.purdue.edu/online/courses/fundamentals-mems?utm_source=chatgpt.com
2	https://scme-support.org/?utm_source=chatgpt.com

Course Title: Natural Language Processing												
Semester: VIII			**Term: Even**				**Course Code:** 24ECPEC8012B					
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	-	-		20	20	60	25	25	150

IAE: Internal Assessment Examination
ESE: End Semester Examination

Course Objectives:

1. To understand natural language processing and to learn how to apply basic algorithms in this field.
2. To get acquainted with the basic concepts and algorithmic description of the main language levels :morphology andSyntax.
3. To get acquainted with the basic concepts and algorithmic description of the main language levels semanticsand pragmatics.
4. To design and implement applications based on natural language processing

Course Outcomes:

After successful completion of the course students will be able to:

1. Have a broad understanding of the field of natural language processing.
2. Understand the mathematical and linguistic preliminaries necessary for various processes in NLP
3. Be able to Design, implement and test algorithms for NLP problems
4. Perform Word-Level, Syntax-Level and Semantic-Level Analysis
5. Develop basic understanding of Pragmatics in NLP
6. Be able to apply NLP techniques to design real world NLP applications

Module	Contents	Hours	Cos
I	**Introduction to Natural Language Processing** The need of NLP. Generic NLP system, Levels of NLP , Stages in building a Natural Language Processing System. Challenges and ambiguities in NLP Design Self Learning Recent trends: Large Language Models (LLMs) like GPT, BERT	7	CO1
II	**Mathematical and Linguistic Preliminaries** Probability Theory, Conditional Probability and Independence, Bayes Rule, Random Variables, Probability Distributions, Statistics, Counting, Frequency, Mean and Variance English Grammar, Parts of Speech, Phrase Structures Self Learning: Entropy and mutual information	7	CO2
III	**Word Level Analysis** Tokenization, Segmentation, Lemmatization, Edit Distance, Collocations, Porter Stemmer, N-gram Language Model, Morphological Analysis, Derivational and Reflectional Morphology Self Learning: Comparison of stemming algorithms (Porter, Lancaster, Snowball)	7	CO3
IV	**Syntax-Analysis** Tag set for English, Penn Tree bank, Introduction to Parts of Speech Tagging (POST), Markov Processes, Hidden Markov Models (HMM), Parts of Speech Tagging using Hidden Markov Models, Viterbi Algorithm Self Learning: Context-Free Grammar (CFG) and Probabilistic CFG (PCFG)	9	CO4
V	**Semantic Analysis** Lexical Semantics, ambiguous words, word senses, Relations between senses: synonym, antonym, reversives, hyponym, hypernym, meronym, structured polysemy, metonymy, zeugma, Introduction to WordNet, gloss, synset, sense relations in WordNet. Cosine distance between documents. Word sense disambiguation Self Learning: Word embeddings (deep dive): Word2Vec, GloVe, FastText	9	CO5
VI	**Pragmatics and applications of NLP** Reference resolution: Discourse model, Reference Phenomenon, Syntactic and Semantic Constraints on co reference, Applications of NLP: Categorization, Summarization, Sentiment Analysis, Named Entity Recognition, Machine Translation, Information Retrieval, Question Answer System Self Learning: Ethical considerations in NLP applications (e.g., fake news detection, privacy)	6	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):
The End Semester exam of 60 Marks will be conducted based on the entire syllabus.

Reference Books (R):

1. Steven Bird, Ewan Klein, Natural Language Processing with Python, O'Reilly
2. Alexander Clark (Editor), Chris Fox (Editor), Shalom Lappin (Editor), The Handbook of Computational Linguisticsand Natural Language Processing

Text Books(T):

1. Daniel Jurafsky, James H. Martin, Speech and Language Processing Second Edition, Prentice Hall.
2. Christopher D. Manning & Hinrich Schutze, Foundations of Statistical Natural Language Processing, MIT Press.

Online References:

Sr. No.	Website
1	Course: Natural Language Processing By Prof. Pawan Goyal, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc21_cs102/preview
2	Course: Applied Natural Language Processing By Prof. Ramaseshan R, CMI https://onlinecourses.nptel.ac.in/noc20_cs87/preview

Course Title: 3D Printing and Design												
Semester: VIII			Term: Even				Course Code: 24ECPCC8013B					
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

Course Objectives:

1. To Understand the concept of Additive Manufacturing
2. To Classify the Various different AM Processes
3. To Demonstrate the concept of Direct Digital Manufacturing
4. To Implement the Concept of Design for Additive Manufacturing and RE Technologies

Course Outcomes:

After successful completion of the course students will be able to:

1. Repeat the concept of Additive Manufacturing
2. Describe the Various different AM Processes
3. Demonstrate the concept of Direct Digital Manufacturing
4. Demonstrate the Concept of Design for Additive Manufacturing
5. Understand Rapid Proto-typing
6. Implement RE Technologies

Module	Content	Hours	COs
1	**Introduction** Additive Manufacturing Fundamentals, Historical Development, Commonly Used Terms, Definitions, AM Manufacturing Process, Classification of AM processes (As per ASTM F42 and ISO TC 261). Subtractive Manufacturing vs Additive manufacturing. Benefits of Additive Manufacturing. AM technology in Product Development Applications of AM : Engineering, Planning, Aerospace, Automotive, Jewellery, Architecture. Self Learning: Arts, Medical, Bio Engineering	8	1
2	**Additive Manufacturing systems** Vat Polymerisation, Powder Bed Fusion Based AM, Material Extrusion based, Material Jetting Based, Binder Jetting Based, Sheet Lamination based. Self Learning: Direct Energy Deposition based	6	2
3	**Direct Digital Manufacturing** Direct Digital Manufacturing(DDM) : Concept of DDM, Applications with Case Studies, DDM Drivers, Cost estimation: Cost Model, Build Time Model, Life-cycle costing. Self Learning: Future of DDM	6	3
4	**Design for Additive Manufacturing** Design for Additive Manufacturing AM unique Capabilities : Shape Complexity, Heirarchical Complexity, Functional Complexity and Material Complexity. Core DFAM Concepts and Objective : Complex Geometry, Integrated Assemblies, Customised Geometry, Multi-functional Design. Self Learning: Eliminnaaton of Conventional Design for Manufacturing Constraints	8	4
5	**Rapid Proto-typing** Rapid Prototyping Data Formats : STL, File Format Problems and Limitations, Consequence of Building valid and Invalid Tessellated model, STL File repair, Newly Proposed File Formats. Self Learning: RapidProto-typing software Features of various Software	8	5
6	**Reverse Engineering (RE):** Introduction to Generic RE Process, RE Hadware and Software. Integration of RE and RP for Layer Based Model Generaion, Application and Case Studies of RE in Automotive, Aerospace, Medical, Architectural industry, Barriers for adopting RE Other Related technologies: Reverse Engineering , Computer Aided Engineering. Self Learning: Haptic Feedback Based CAD	9	6
Total		**45**	

Sr No.	List of Experiment	Cos
1	Study of Additive Manufacturing (AM) Processes	1
2	Comparison between Additive and Subtractive Manufacturing	1
3	Study and Demonstration of 3D Printing Machine (Material Extrusion Based)	2
4	Preparation of CAD Model for 3D Printing	2
5	Conversion of CAD Model to STL Format and Analysis	3
6	Slicing and Toolpath Generation for 3D Printing	3
7	Fabrication of a Physical Prototype using 3D Printer	4
8	Case Study on Direct Digital Manufacturing (DDM)	4
9	Design for Additive Manufacturing (DFAM) Exercise	5
10	Reverse Engineering using 3D Scanner or Photogrammetry	5
11	Integration of Reverse Engineering and Rapid Prototyping	6
12	Study of Advanced File Formats and AM Software Tools	6

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 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 should be covered)

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

1. Assignment
2. Case Study

3. Debate
4. Solution for Social Problems
5. Field Visit
6. Group Project
7. Flipped Classroom
8. Topic Review
9. Quiz
10. Mind Mapping
11. Any other.

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

Text Books

1. Understanding Additive Manufacturing, Andreas Gebhardt, Hanser Publication, ISBN-13:978-1-56990-507-4
2. Rapid Manufacturing : An Industrial Revolution of the Digital Age, N. Hopkins, R.J.M. Hague and P.M. Dickens (Eds.), John Wiley and Sons, 2006
3. Rapid Proto-typing Principles and Applications, Chua C. K., Leong K. F., and Lim C.S. , 2nd edition , World Scientific, 2003
4. Rapid Proto-typing Theory and Practice, Ali Kamrani and EmadAbouel Nasr (Eds.), Springer,2006

Reference Books

1. Fundamentals of Digital Manufacturing science, Zude Zhou, Shane (Shengquan) Xie, Dejun Chen, Springer 2012
2. Additive Manufacturing Technologies, Ian Gibson, David Rosen, Brent Stucker, Spinger

Useful Links:

1. *https://onlinecourses.nptel.ac.in/noc21_me115/preview*

Course Title: Advanced Algorithm												
Semester: VIII			Term: Even				Course Code: 24ECPCC8014B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	IAE 1	IAE2	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

Course Pre-requisite: Data structure concepts, Discrete structures

Course Objectives:

1. To provide mathematical approaches for Analysis of Algorithms.
2. To understand and solve problems using various algorithmic approaches
3. To analyse algorithms using various methods.

Course Outcomes:

After successful completion of the course students will be able to:

1. Analyze and evaluate the efficiency of algorithms using asymptotic analysis, recurrences, and complexity classes.
2. Design and optimize efficient solutions using the divide-and-conquer strategy for computational problems.
3. Evaluate greedy algorithm techniques and justify their correctness for optimization problems.
4. Design optimal solutions for complex problems using dynamic programming principles.
5. Analyze and design network flow algorithms to solve optimization and matching problems.
6. Evaluate and design algorithmic solutions for classical and NP-hard problems.

Module	Content	Hours	COs
1	**Introduction to analysis of algorithm** Mathematical background for algorithm analysis, Growth of function – Big – Oh, Omega, Theta notation, Complexity derivations, Solving recurrences using Substitution Method, Recursion tree method and Master method. Complexity Classes: P, NP, NP Hard, NP Complete. Amortised Analysis -Aggregate Method, Accounting Method, Potential Method. **Self-Learning:**Advanced recurrence solving techniques and limitations of Master's theorem, Smoothed analysis and probabilistic analysis of algorithms.	9	1
2	**Divide and Conquer approach** General method, Binary Search, Merge Sort, Quick Sort, Randomized quick sort, and Min-max algorithm. **Self-Learning:**Randomized divide-and-conquer strategies, Cache-efficient divide-and-conquer algorithms.	5	2
3	**Greedy Algorithms** General Method, Knapsack Problem, Huffman's Codes, Minimum Spanning Tree, Kruskal's Algorithm, Prim's Algorithm, Dijkstra's Algorithm. **Self-Learning:**Proof techniques for greedy-choice property, Limitations of greedy algorithms.	7	3
4	**Dynamic Programming Approach** General Method, Making coin change, Principle of optimality, Knapsack Problem, Matrix Chain Multiplication, Activity Selection Problem, longest common subsequence, All pair shortest path algorithm. **Self-Learning:**Space optimization in dynamic programming,Application of DP in bioinformatics and text processing.	9	4
5	**Maximum Flow** Flow networks, Ford Fulkerson method, Max bipartite matching, Push relabel algorithm, The relabel to front algorithm. **Self-Learning:**Network flow applications in scheduling and routing, Comparison of Ford–Fulkerson and Push–Relabel algorithms.	8	5

Module	Content	Hours	COs
6	**Classical Problems in Algorithms** Travelling Salesman problem, Subset Sum Problem, Matrix Multiplication, 15 puzzle, N-queens problem. **Self-Learning:**Approximation algorithms for NP-hard problems, Heuristic and metaheuristic.	7	6
Total		**45**	

Sr No.	List of Experiment	Cos
1	Implement and compare time complexity of iterative vs recursive algorithms using Big-O analysis	1
2	Solve recurrence relations programmatically and validate results using empirical data	1
3	Perform amortized analysis on stack operations (push, pop, multipop)	1
4	Implement Binary Search, Merge Sort, and Quick Sort and analyze their performance	2
5	Compare deterministic and randomized Quick Sort using different input sizes	2
6	Design a Min–Max algorithm using divide-and-conquer and compare with brute force	2
7	Implement Knapsack (Greedy vs Dynamic Programming) and compare results	3
8	Construct Huffman codes and analyze compression efficiency	3
9	Implement Kruskal's and Prim's algorithms and compare their MST construction	3
10	Implement Matrix Chain Multiplication and analyze cost optimization	4
11	Solve Longest Common Subsequence problem using DP	4
12	Implement All-Pairs Shortest Path algorithm and analyze time-space trade-offs	4
13	Implement Ford–Fulkerson algorithm for maximum flow problems	5
14	Solve maximum bipartite matching using flow networks	5
15	Implement Push–Relabel algorithm and compare performance	5
16	Implement N-Queens problem using backtracking	6
17	Solve Travelling Salesman Problem using heuristic methods	6

18	Implement Subset Sum problem and analyze computational complexity	6

Evaluation and Assessment Scheme:

D. 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.

E. End Semester Theory Examination (ESE):
The End Semester exam of 60 Marks will be conducted based on the entire syllabus.

F. Continuous Assessment (CA):
Continuous Assessment should consist of the following

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

Attendance (Theory & Practical): 05 marks

Teacher Assessment Examination (TAE): 10 Marks

List of Teacher Assessment Examination (TAE):

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

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

Reference Books

1. M.R. Garey and D.S. Johnson, Computers and Intractability: A Guide to the Theory of NP-Completeness, Freeman, 1979.
2. E. Horowitz and S. Sahni, Fundamentals of Computer Algorithms, Computer Scien

Text Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, The MIT Press, 2009.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", John Wiley and Sons, 2002.
3. Sanjoy Dasgupta, Christos Papadimitriou and Umesh Vazirani, "Algorithms", Tata McGraw-Hill, 2009
4. R.K. Ahuja, TL Magnanti and JB Orlin, "Network flows: Theory, Algorithms, and Applications", Prentice Hall Englewood Cliffs, NJ 1993.

Online References:

1. NPTEL course:https://nptel.ac.in/courses/106105164
2. Coursera link:https://www.coursera.org/specializations/algorithms

Course Title: Advanced Algorithms

Semester: IV			Term: Even				Course Code:24ECPEC8014B					
Teaching Scheme							Evaluation Scheme					
Contact Hrs.			Credit Allotted			Total Credit	Theory			Tutorial		Total
Th	Tu	Pr	Th	Tu	Pr		IAE1	IAE2	ESE	CA	Oral/Pract/Tut.	
3	--	2	3	--	1	4	20	20	60	25	25	150

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

Pre-requisite: Data structure concepts, Discrete structures

Course Objectives:
The course is aimed
1. To provide a mathematical foundation for analyzing algorithm efficiency.
2. To develop problem-solving skills using various algorithmic approaches.
3.To understand and apply paradigms such as Divide and Conquer, Greedy, and Dynamic Programming.
4.To introduce advanced concepts like Amortized Analysis, Flow Networks, and NP-Completeness.

Course Outcomes:
After completion of the course, learner 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, greedy and dynamic programming strategy.
3. Identify appropriate data structures and design techniques for different problems
4. Differentiate polynomial and non-deterministic polynomial algorithms.
5. Analyze various algorithms.
6. Implement and analyze algorithms for matrix multiplication and related computational problems.

Module	Contents	Hours	CO
I	**Introduction to analysis of algorithm** Mathematical background for algorithm analysis, Growth of function – Big – Oh, Omega, Theta notation, Complexity derivations, solving recurrences using Substitution Method, Recursion tree method and Master method, Complexity Classes: P, NP, NP Hard, NP Complete Selfstudy : Amortised Analysis -Aggregate Method, Accounting Method, Potential Method	8	CO1
II	**Divide and Conquer approach** General method,Binary Search, Merge Sort, Quick Sort, Randomized quick sort. Selfstudy: Min-max algorithm	7	CO2
III	**Greedy Algorithms** General Method, Knapsack Problem, Huffman's Codes , , Prim's Algorithm , Dijkstra's Algorithm. Selfstudy: Minimum Spanning Tree, Kruskal's Algorithm	8	CO3
IV	**Dynamic Programming Approach** General Method, Making coin change, Principle of optimality, Knapsack Problem, Matrix Chain Multiplication, Activity Selection Problem, Selfstudy :Longest common subsequence, All pair shortest path algorithm	8	CO4
V	**Maximum Flow** Flow networks, Ford Fulkerson method, Max bipartite matching , Push relabel algorithm. Selfstudy: The relabel to front algorithm	8	CO5
VI	**Classical Problems in Algorithms** Travelling Salesman problem, Subset Sum Problem, Matrix Multiplication Selfstudy: 15 puzzle , N-queens problem	6	CO6
Total		**45**	

Exp. No.	List of Experiments
1	Implementation of Merge and Quick sort using divide and conquer approach
2	Implementation of Fractional Knapsack
3	Implementation of Djikstras's algorithms
4	Implementation of 0/1 Knapsack using dynamic programming
5	Implementation of Longest Common Subsequence
6	Implementation of Floyd's Warshall's algorithm
7	Implementation of Ford Fulkerson algorithm
8	Implementation of Maximum Bipartite matching algorithm
9	Implementation of n-queen using backtracking
10	Implementation of sum of subsets algorithm
11	Implementation of 15 puzzle problem
12	Implementation of Travelling salesman's problem.
13	Implementation of Matrix Chain Multiplication using Dynamic Programming
14	Implementation of Huffman Coding using Greedy Approach

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 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 (10 to 12): 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 needed.

Reference Books (R):

1. M.R. Garey and D.S. Johnson, Computers and Intractability: A Guide to the Theory of NP-Completeness, Freeman, 1979.
2. 2. E. Horowitz and S. Sahni, Fundamentals of Computer Algorithms, Computer Science Press,1978.

Text Books (T):

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, The MIT Press, 2009.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet Examples", John Wiley and Sons, 2002.
3. Sanjoy Dasgupta, Christos Papadimitriou and Umesh Vazirani, "Algorithms", Tata McGraw-Hill, 2009 4. R.K. Ahuja, TL Magnanti and JB Orlin, "Network flows: Theory, Algorithms, and Applications", Prentice Hall Englewood Cliffs, NJ 1993.

Useful Links :

1. NPTEL course: https://nptel.ac.in/courses/106105164
2. Coursera link: https://www.coursera.org/specializations/algorithms

Course Title: Advanced Networking Technologies												
Semester: VIII			**Term: Even**				**Course Code:24ECPEC8021B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

Course Pre-requisite: Computer Networks

Course Objectives:

1. Understand the characteristic features of Various Wireless networks.
2. Understand the characteristic features of Optical Networking
3. Introduce the need for network security and safeguards
4. Introducing Multimedia Information and Network Design.

Course Outcomes:

After successful completion of the course students will be able to:

1. Appreciate the need for Wireless networks and study the IEEE 802.11 Standards
2. Comprehend the significance of Asynchronous Transfer Mode(ATM).
3. Analyze the importance of Optical networking
4. Demonstrate knowledge of network design and security and management
5. Understand the concept of multimedia networks.
6. Analysing the applications of networking

Module	Contents	Hours	COs
I	Wireless LAN and WAN Technologies Introduction to Wireless networks : Infrastructure networks, Ad-hoc networks, IEEE 802.11 architecture and services,Medium Access Control sub-layers ,CSMA/CA, Physical Layer, 802.11 Security considerations, Asynchronous Transfer Mode (ATM): Architecture, ATM logical connections, ATM cells , ATM Functional Layers Self Learning: Congestion control and Quality of service	8	CO1
II	Optical Networking SONET : SONET/SDH, Architecture, Signal, SONET devices, connections, SONET layers, SONET frames, STS Multiplexing, SONET Networks , WDM, DWDM: Frame format, DWDM architecture ,Optical Amplifier , Optical cross connect Performance and design considerations. Self Learning:Comparison of SONET and DWDM architectures for high-speed communication networks.	7	CO2
III	Routing in the Internet Intra and inter domain Routing, Unicast Routing Protocols: RIP, OSPF, BGP , Multicast Routing Protocols ,Drawbacks of traditional Routing methods Self Learning:Case study on OSPF vs BGP	8	CO3
IV	Network Security Security goal, Security threats, security safeguards, firewall types and design, IPTABLES Internet Security: Network Layer Security, Transport Layer Security, Application Layer Security Self Learning:Firewall design and IPTABLES configuration for securing enterprise networks.	8	CO4
V	Multimedia Information and Networking Compression Fundamentals, Digital Representation, Compression techniques , Multimedia Communication across networks, RTP, RTSP, SIP,H..323 Self Learning:Real-Time Transport Protocol (RTP) in video conferencing applications.	8	CO5
VI	Network Design 3 tier Network design layers: Application layer, Access layer , Backbone layers, Ubiquitous computing and Hierarchical computing Self Learning:3-tier hierarchical network design model for scalable enterprise networks.	6	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 (R):

1. K. R. Rao et al: Multimedia Communication Systems, Prentice-Hall of India
2. Deven Shah , Ambavade, "Advanced Communication Networking"
3. Beherouz A Forouzan , "TCP /IP Protocol Suite" , Tata McGraw Hill Education ,4th edition

Text Books(T):

1. Behrouz A. Forouzan, "Data communication and networking ", McGraw Hill Education, Fourth Edition
2. J F. Kurose & KW. Ross: Computer Networking- A Top-down Approach featuring the Internet, 3rd edition
3. Darren L. Spohn , "Data Network Design" , McGraw Hill Education ,Third edition
4. William Stallings, "Data and Computer communications", Pearson Education, 10th Edition

Online References:

Sr. No.	Website
1	https://regis.brightspace.com/d2l/lor/viewer/viewFile.d2lfile/6606/922/Syllabus.html?utm_source=chatgpt.com
2	https://www.rfc-editor.org/rfc/rfc3550

Course Title: Multimedia System and Virtual Reality												
Semester: VIII			**Term: Even**				**Course Code: 24ECPEC8022B**					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Oral/Pract/ Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination
ESE: End Semester Examination

Course Pre-requisites:
Computer Fundamentals, Graphics, Communication Theory, ISO-OSI Model, Java Classes.

Course Objectives:

1. To introduce students about basic fundamentals and key aspects of the multimedia system.
2. To provide knowledge of compression techniques of different multimedia components.
3. To discuss the multimedia authoring tools and security in multimedia systems.
4. To comprehend and analyze the fundamentals of virtual reality systems.

Course Outcomes:

After successful completion of the course students will be able to:

1. Apply the basics of multimedia and multimedia system architecture.
2. Analyze file formats and compression algorithms for different multimedia components.
3. Implement multimedia authoring systems and apply different security techniques in multimedia environments.
4. Evaluate virtual reality and its related technologies.
5. Apply and Demonstrate typical rendering pipeline and modelling technique.
6. Design and Develop applications with the principles of virtual reality

Module	Contents	Hours	COs
I	**Introduction to Multimedia** Definition of Multimedia, Characteristics of Multimedia System, History of Multimedia System, Difference between Multimedia and Hypermedia, Objects and Elements of Multimedia, Applications of Multimedia. Multimedia System Architecture: Workstation Architecture, IMA Architectural Framework, Network Architecture for Multimedia Systems, Types of Medium (Perception Media, Representation Media, Presentation Media, Storage Media,Transmission Media, Information Exchange Media). **#Self Learning:** Interaction Techniques	9	CO1
II	**Multimedia Types, File Formats and Compression Techniques** Digital Image: Representation (2D format, resolution), Types of Images (monochrome, gray, color), File formats like BMP, JPG, Compression Techniques: fundamentals (coding, interpixel and psychovisual redundancies),Types –lossless and lossy, Lossless Compression; Algorithms– Shannon-Fano, CCITT Group 4 2D, Lossy Compression Algorithm – JPEG. Digital Audio: Computer representation of sound, File Formats – WAV, MPEG Audio, Compression: PCM, DM, DPCM. Digital Video: Digitization of Video, types of video signals (component, composite and S-video), File Formats: MPEG Video, H.261. **#Self Learning:** Compression: MPEG	10	CO2
III	**Multimedia Authoring and Security** Authoring System: Overview, Introduction to Authoring Tools, Features of Authoring Tools, Design Issue of Multimedia Authoring, Types of Authoring Systems. Digital Watermarking: Concept, Visible and Invisible Watermarks, Watermarking Classification (Spatial Domain, Transform Domain, Feature Domain). Steganography: Concept and Types. Image Authentication: Issues and Digital Signature Based Image Authentication **#Self Learning:** Digital Watermarking Applications	9	CO3
IV	**Introduction to Virtual Reality** Definition of Virtual Reality (VR), Classical Components of VR System, Important factors in a VR System, Types of VR Systems, VR Advantages, VR Input Output Devices, Applications of VR System. **#Self Learning:** Explore input and output devices used in VR applications	7	CO4
V	**VR Rendering Pipeline and Modelling**	6	CO5

	Graphical Rendering Pipeline, Haptic Rendering Pipeline, OpenGL Rendering Pipeline, Geometric Modelling, Kinematic Modelling, Physical Modelling, Behaviour Modelling **#Self Learning:** Study the stages of the VR graphical rendering pipeline		
VI	**VR Programming** VRML, Extensible 3D (X3D), Java 3D, OpenGL **#Self Learning:** Compare VRML and X3D in terms of features and applications	4	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):

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

Reference Books (R):

1. Steinmetz Ralf and NahrstedtKlara, "Multimedia: Computing, Communications and Applications",Pearson, 2008
2. AtulPuri, "Multimedia Systems, Standards, and Networks", 1st Edition, CRC Press, 2000.
3. Frank Y. Shih, "Multimedia Security: Watermarking, Steganography and Forensics", CRC Press, 2013.
4. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", 2nd Edition, Wiley, 2003.
5. John Vince, "Virtual Reality Systems", Pearson, 2002

Text Books(T):

1. Prabhat K. Andleigh&KiranThakrar, "Multimedia System Design", Pearson, 2015
2. Rajesh K. Maurya, "Computer Graphics with Virtual Reality Systems", 3rd Edition, Wiley, 2018
3. K.R.Rao,D.Milovanovic, Multimedia Communication Systems: Techniques, Standards and Networks,Pearson, 2012.

4. Koegel Buford, "Multimedia Systems", Pearson, 2002.

Online References:

Sr. No.	Website
1	Multimedia Systems: https://nptel.ac.in/courses/117105083
2	Virtual Reality: https://nptel.ac.in/courses/106106138
3	VirtualRealitySpecialization: https://www.coursera.org/specializations/virtualreality

Course Title: Quantum Computing

Semester: VIII	**Term: Even**	**Course Code:** 24ECPEC8023B
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

Course Pre-requisites:

1. Digital Electronics and Computer Organization,
2. Engineering Mathematics-III,
3. Data Structures and Algorithm,
4. Python Programming

Course Objectives:

1. To understand the fundamentals of quantum computing and its mathematical foundations.
2. To explore the building blocks and hardware principles of quantum computing.
3. To study key quantum algorithms and their applications
4. To learn and apply tools and platforms used for quantum computing.

Course Outcomes:

After successful completion of the course students will be able to:

1. Explain basic concepts of quantum computing
2. Explain mathematical fundamentals required for quantum computing.
3. Explain building blocks of quantum computing through architecture and programming models.
4. Explain quantum algorithms.
5. Explain quantum hardware building principles.
6. Explain usage of tools for quantum computing.

Module	Contents	Hours	COs
I	**Introduction to Quantum Computing** Motivation for studying Quantum Computing, Origin of Quantum Computing, Quantum Computer vs. Classical Computer, Introduction to Quantum mechanics, Overview of major concepts in Quantum Computing, Qubits and multi-qubit states Bloch Sphere representation Quantum Superposition, Quantum Entanglement. **Self-Learning:** Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.)	09	CO1
II	**Mathematical Foundations for Quantum Computing** Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors. **Self-Learning:** Linear Operators in Hilbert Space – Understanding how operators act on qubits and their role in quantum state transformations.	06	CO2
III	**Building Blocks for Quantum Program** Architecture of a Quantum Computing platform, Details of q-bit system of information representation: Block Sphere Multi-Qubits States Quantum -superposition of qubits (valid and invalid superposition) Quantum Entanglement Useful states from quantum algorithmic perceptive e.g. Bell State Operation on qubits: Measuring and transforming using gates. Quantum Logic gates and Circuit No Cloning Theorem and Teleportation, Programming model for a Quantum Computing Program, Steps performed on a classical computer. **Self-Learning:** Steps performed on Quantum Computer Moving data between bits and qubits.	10	CO3
IV	**Quantum Algorithms and Error Correction** Quantum Algorithms Shor's Algorithm Grover's Algorithm Deutsch's Algorithm Deutsch -Jozsa Algorithm, Quantum error correction using repetition codes, 3-qubit codes. **Self-Learning:** Shor's 9 qubit error correction Code	07	CO4
V	**Quantum Hardware**	10	CO5

	Ion Trap Qubits The DiVincenzo Criteria Lagrangian and Hamiltonian Dynamics in a Nutshell: Dynamics of a Translating Rotor, Quantum Mechanics of a Free Rotor: A Poor Person's Atomic Model: Rotor Dynamics and the Hadamard Gate, Two-Qubit Gates The Cirac-Zoller Mechanism: Quantum Theory of Simple Harmonic Motion, A Phonon-Qubit Pair Hamiltonian, Light-Induced Rotor-Phonon Interactions, Cavity Quantum Electrodynamics (cQED): Eigenstates of the Jaynes-Cummings Hamiltonian Circuit QED (cirQED): Quantum LC Circuits, Artificial Atoms, Superconducting Qubits , Quantum computing with spins: Quantum inverter realized with two exchange coupled spins in quantum dots. **Self-Learning:** Trapped Ion Qubits, Mølmer-Sørenson Coupling, A 2-qubit spintronic universal quantum gate.		
VI	**OSS Toolkits for implementing Quantum program** IBM Quantum Experience, Microsoft Q, RigettiPyQuil (QPU/QVM) **Self-Learning:** Google Cirq – An open-source Python framework for designing.	03	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):
The End Semester exam of 60 Marks will be conducted based on the entire syllabus.

Reference Books (R):

1. The Second Quantum Revolution: From Entanglement to Quantum Computing and Other Super-Technologies, Lars Jaeger
2. La Guardia, Giuliano Gladioli "Quantum Error correction codes" Springer,2021
3. Supriyo Bandopadhyay and Marc Cahy, "Introduction to Spintronics", CRC Press, 2008.
4. Michael A. Nielsen and Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 2010.
5. Phillip Kaye, Raymond Laflamme, and Michele Mosca, *An Introduction to Quantum Computing*, Oxford University Press, 2007.

Text Books(T):

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley,2008
3. Qiskit textbook https://qiskit.org/textbook-beta/
4. Vladimir Silva, Practical Quantum Computing for Developers,2018
5. Bernard Zygelman, A First Introduction to Quantum Computing and Information,2018

Online References:

Sr. No.	Website
1	https://nptel.ac.in/courses/106106232
2	https://www.youtube.com/watch?v=-t8IvCAzeKY&list=PLNrdQx59gmEWV7eLbqDWeI_B72-0MXiyt

Course Title: System Security

Semester: VIII	Term: Even	Course Code: 24ECPEC8024B
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

Course Pre-requisites:

7. Computer Network
8. Cyber Security
9. Data Encryption

Course Objectives:

6. Understand the vulnerabilities and threats at system and software level.
7. Analyze common system attacks and their techniques (buffer overflow, malware, SQLi).
8. Apply defensive mechanisms and mitigation techniques in system security.
9. Develop secure programming practices and basic vulnerability testing.

Course Outcomes:

After successful completion of the course students will be able to:

5. Understand the fundamental concepts of information and system security, including goals such as confidentiality, integrity, availability, authentication, and non-repudiation.
6. Analyze how attackers exploit memory corruption vulnerabilities using techniques
7. Identify and classify different types of malware including viruses, worms, Trojans, spyware, adware, rootkits, and ransomware.
8. Apply security measures such as input validation, secure coding practices, and Web Application Firewalls (WAF) to mitigate web threats.
9. Evaluate overall system and network security posture to recommend measures for mitigating threats and vulnerabilities.
10. Critically analyze real-world system-level security incidents and remedial strategies.

Module	Contents	Hours	COs
I	**Introduction to System Security** Fundamentals of Information and System Security, Security goals: Confidentiality, Integrity, Availability, Authentication, Non-repudiation, Threats, vulnerabilities, and risks, Trusted computing base and security models (Bell-LaPadula, Biba, Clark-Wilson), Secure coding principles **Self Learning:** Explore and implement simple secure coding exercises in Python	07	CO1
II	**Program and Memory Security** Buffer overflow attacks: stack smashing, heap overflow, Memory corruption vulnerabilities: integer overflow, format string attacks, Exploit techniques and shellcode basics, Protection mechanisms: stack canaries, DEP, ASLR, Case studies of buffer overflow incidents **Self Learning:** Explore ASLR and DEP via virtual lab simulations	08	CO2
III	**Malicious Software** Types of malware: viruses, worms, Trojans, spyware, adware, rootkits, ransomware, Malware life cycle and propagation techniques, Case studies: ILOVEYOU, Conficker, WannaCry, Detection and defense: anti-virus, endpoint security, sandboxing, Malware analysis: static and dynamic approaches **Self Learning:** Explore anti-malware and endpoint protection software functionalities	07	CO3
IV	**Web and Database Security** Common web application vulnerabilities, SQL Injection: types, techniques, prevention, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), Authentication and session hijacking attacks, Web Application Firewalls (WAF), Case study: SQL Injection on Sony Pictures **Self Learning:** Explore and configure a Web Application Firewall (WAF) in a virtual lab.	08	CO4
V	**Operating System & Network Security** OS hardening: patching, configuration, access control, Privilege escalation, sandboxing, Intrusion Detection & Prevention Systems (IDS/IPS), Network attacks: sniffing, spoofing, DoS/DDoS, Firewalls: packet filtering, stateful, application-level, next-gen firewalls **Self Learning:** Explore network attacks.	07	CO5
VI	**Advanced System Security**	08	CO6

	Security in distributed systems, cloud, and virtualization, Container and IoT security challenges, Digital forensics and incident response, Advanced Persistent Threats (APT) and zero-day exploits, Post-quantum system security trends **Self Learning:** Explore cloud and virtualization security best practices.		
	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):

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

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
3. Behrouz A. Forouzan &DebdeepMukhopadhya "Cryptography and Network Security" 3rd Edition, McGraw Hill

Online Reference:

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: Project Management												
Semester: VIII			**Term: Even**				**Course Code:** 24ILO8021B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

Course Objectives:

1. 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

Module	Contents	Hours	COs
I	**Introduction to project management:**	6	CO1
	Introduction to project management - I, introduction to project management - II, agile project management, project selection models, examples of project selection models		

II	**Role of the Project Manager:**	8	CO2
	Project manager, attributes of effective project manager, managing for stakeholders, resolving conflicts, negotiation, project in the organization structure, human factors and the project team		
III	**Comprehensive Project Planning and Risk Management:**	8	CO3
	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)		
IV	**Advanced Scheduling and Resource Optimization Techniques in Project Management:**	9	CO4
	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		
V	**Project Monitoring, Control, and Closure: Insights and Case Studies:**	9	CO5
	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.		
VI	**Leveraging Software Tools for Effective Project Management:**	5	CO6
	Software for project management, demo on project management software, simulations software for project management		
	Total	**45**	

Self-Learning Topics: PM knowledge areas as per Project Management Institute (PMI), Project proposal, Effective project team, Stages of teamdevelopment&growth(forming,storming,norming& performing),team dynamics, Risk response strategies forpositive and negative risks,ProjectContractingProjectprocurementmanagement,contractingandoutsourcing,Managingwit

houtauthority.

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:

1. https://onlinecourses.nptel.ac.in/noc25_mg71/preview

Course Title: Finance Management												
Semester: VIII			**Term: Even**				**Course Code:** 24ILO8022B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

Course Objectives:

1. 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 Analyse 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 Analyse 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. Analyse financial decisions, evaluate risks, and apply valuation techniques for bonds and stocks.
6. Compute WACC, evaluate capital investments, and Analyse dividend policies in real-world scenarios.

Module	Contents	Hours	COs
I	**Introduction to Financial and Cost Accounting:**	7	CO1
	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		
II	**Preparation of Financial Statements:**	9	CO2
	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		
III	**Introduction to Cost Accounting:**	9	CO3
	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		
IV	**Break-Even Analysis:**	7	CO4
	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		
V	**Capital Structure and Valuation Basics:**	6	CO5
	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 Zero-Coupon Bonds, Stock Valuation: Zero Growth, Constant Growth, Differential Growth		
VI	**Cost of Capital and WACC:**	7	CO6
	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		
	Total	**45**	

Self-Learning Topics : Meaning, Characteristics and Classification of Financial Institutions—CommercialBanks,Investment-MerchantBanksandStock Exchanges, ContinuousCompoundingandContinuousDiscounting., CapitalStructureRatios;StockMarketRatios;LimitationsofRatioAnalysis, ManagementofReceivables;andManagementofCashandMarketableSecurities, ConceptofOptimalCapitalStructure, Walter'sApproach,andModiglianiMillerApproach

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:

1. https://onlinecourses.nptel.ac.in/noc25_ec02/preview

Course Title: Entrepreneurship Development and Management												
Semester: VIII			**Term: Even**				**Course Code:** 24ILO8023B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

Course Objectives:

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

Module	Contents	Hours	COs
I	**Overview Of Entrepreneurship:**	7	CO1
	Introduction to Entrepreneurship, What is Entrepreneurship GDC Program, Hand holding for Entrepreneurship GDC start-up stories		
II	**Business Plans And Importance Of Capital To Entrepreneurship:**	9	CO2
	Entrepreneurship Types, Team Building, Innovation and Entrepreneurship, Solar Oven case-study Paradigm shift from Design to Entrepreneurship		
III	**Women'sEntrepreneurshipDevelopment :**	9	CO3
	Bio- Med Innovation and Entrepreneurship, New-age Entrepreneurship		
IV	**IndianEnvironmentforEntrepreneurship:**	7	CO4
	Business Model Canvas, Technology led Entrepreneurship		
V	**Effective Management of Business:**	6	CO5
	Entrepreneurship as Academic Program - IITH case study, Creativity and Generating Product Ideas, From Idea to Proof of Concept, Network Entrepreneurship		
VI	**Achieving Success InThe Small Business:**	7	CO6
	Learning from examples Start-up PITCHES - Using Lean Canvas Model Part 1, Learning from examples Start-up PITCHES - Using Lean Canvas Model Part 2		
	Total	**45**	

Self-Learning Topics : Contribution of Government Agencies in Sourcing information for Entrepreneurship, Business Growth and the Entrepreneur Law and its Relevance to Business Operations, EDPcell, Responsibilities of various government organisations, departments, banks etc., Supplychainmanagement,linkagewithlargeindustries),exercises,e-Marketing, Critical Success factors of small business.

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

B. End Semester Theory). Each test will have a duration of one hour.

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:

1. https://onlinecourses.nptel.ac.in/noc25_de07/preview

Course Title: HumanResourceManagement												
Semester:VIII			**Term: Even**				**Course Code:** 24ILO8024B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination

ESE: EndSemesterExamination

CA: Continuous Assessment

Course Objectives:

1. Tointroducethestudentswithbasicconcepts,techniquesandpracticesofthehumanresource management
2. ToprovideopportunityoflearningHumanresourcemanagement(HRM)processes,relatedwith the functions, and challenges in the emerging perspective of today's organizations
3. Tofamiliarizethestudentsaboutthelatestdevelopments,trends&differentaspectsofHRM
4. To acquaint the student with the importance of inter-personal & inter-group behavioural skills in an organizational setting required for future stable engineers, leaders and managers

Course Outcomes: Learner will be able to…

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

Module	Contents	Hours	COs
I	**IntroductiontoHR**	8	CO 1
	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 resourcePlanning,Technologicalchange,Restructuring. **Self-Learning:**Rightsizing, Empowerment,TQM,Managingethicalissues		
II	**OrganizationalBehaviour(OB)**	8	CO 2
	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 andstagesofgroupdevelopment,TeamEffectiveness:Highperforming teams, Team Roles, cross functional and self-directed team. **Self-Learning:**Casestudy		
III	**OrganizationalStructure&Design**	8	CO 3
	Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. Leadership:Conceptsandskillsofleadership,Leadershipandmanagerialroles, Leadership styles and contemporary issues in leadership. Power and Politics: Sources and uses of power; Politics at workplace, **Self-Learning:** Tactics and strategies.		
IV	**HumanresourcePlanning**	7	CO 4
	RecruitmentandSelectionprocess,Job-enrichment,Empowerment-Job-Satisfaction, employee morale Performance Appraisal Systems: Traditional & modern methods, Performance Counselling, Career Planning **Self-Learning:** Training&Development:IdentificationofTrainingNeeds,TrainingMethods		
V	**EmergingTrendsinHR**	7	CO

			5
	Organizational development; Business Process Re-engineering (BPR), BPR asa tool for organizational development , managing processes &transformationin 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**	7	CO 6
	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 **StrategicHRM:**RoleofStrategicHRMinthemodernbusinessworld,Conceptof Strategy, StrategicManagementProcess,ApproachestoStrategicDecisionMaking;Strategic Intent – Corporate Mission, Vision, Objectives and Goals**Labor Laws &** **Self-Learning: Industrial Relations:** Evolution of IR, IR issues in organizations, OverviewofLaborLawsinIndia;IndustrialDisputesAct,TradeUnionsAct, Shops and Establishments Act		
	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. StephenRobbins,OrganizationalBehavior,16th Ed,2013
2. VSPRao,HumanResourceManagement,3rd Ed,2010,Excelpublishing
3. Aswathapa,Humanresourcemanagement:Text&cases,6th edition,2011
4. C.B.MamoriaandSVGankar, DynamicsofIndustrialRelationsinIndia,15th Ed,2015, Himalaya Publishing, 15th edition, 2015

Text Books:

1. P.SubbaRao,Essentialsof HumanResourcemanagementandIndustrialrelations,5th Ed,2013, Himalaya Publishing
2. LaurieMullins,Management&OrganizationalBehavior,LatestEd,2016,PearsonPublications

Links for online NPTEL/SWAYAM courses:

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

Course Title: ProfessionalEthicsandCSR												
Semester: VIII			**Term: Even**				**Course Code:** 24ILO8025B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination

ESE: EndSemesterExamination

CA: Continuous Assessment

Course Objectives:

1. Tounderstandprofessionalethicsinbusiness
2. Torecognizedcorporatesocialresponsibility

Course Outcomes: Learner will be able to…

1. Understandrightsanddutiesofbusiness
2. Understand professional ethics in the marketspace
3. Demonstrateprofessional ethics of consumer protection
4. Understandlegalaspectsofcorporatesocialresponsibility
5. Understand Public-PrivatePartnership in India
6. Analyse Corporate Social Responsibility in Globalizing India

Module	Contents	Hours	COs
I	**Professional Ethics and Business:**	8	CO1
	The Nature of Business Ethics; Ethical IssuesinBusiness;MoralResponsibilityandBlame;Utilitarianism:Weighing SocialCostsandBenefits;Rights **Self-Learning:**DutiesofBusiness		
II	**ProfessionalEthicsintheMarketplace:**	8	CO2
	PerfectCompetition;Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy **ProfessionalEthicsandtheEnvironment:**DimensionsofPollutionandResourceDepletion;EthicsofPollutionControl. **Self-Learning**EthicsofConservingDepletableResources		
III	**Professional Ethics of Consumer Protection:**	8	CO3

	Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy **ProfessionalEthicsofJobDiscrimination:**NatureofJobDiscrimination; ExtentofDiscrimination; **Self-Learning:** ReservationofJobs.		
IV	**Introduction to Corporate Social Responsibility:**	7	CO4
	Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. **Self-Learning:**TrajectoryofCorporateSocialResponsibilityin India		
V	**Corporate Social Responsibility:**	7	CO5
	Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India,CorporateSocialResponsibility. **Self-Learning:** Public-PrivatePartnership(PPP)in India		
VI	**Corporate Social Responsibility in Globalizing India:**	7	CO6
	Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs,GovernmentofIndia. **Self-Learning:**LegalAspectsofCorporateSocial Responsibility—CompaniesAct,2013.		
	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. BusinessEthics:TextsandCasesfromtheIndianPerspective(2013)byAnandaDasGupta; Publisher: Springer.
2. CorporateSocial Responsibility: Readings and Cases in a Global Context (2007)byAndrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.

Text Books:

1. BusinessEthics:ConceptsandCases,7thEdition(2011)byManuelG.Velasquez;Publisher: Pearson, New Delhi.

2. CorporateSocialResponsibilityinIndia(2015)byBidyutChakrabarty,Routledge,NewDelhi.

Links for online NPTEL/SWAYAM courses:

https://onlinecourses.nptel.ac.in/noc21_mg54/preview

Course Title: Research Methodology												
Semester: VIII			**Term: Even**			**Course Code:** 24ILO8026B						
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	-	-	3	-	-	3	20	20	60	-	-	100

IAE: Internal Assessment Examination

ESE: End Semester Examination

CA: Continuous Assessment

Course Objectives

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

Module	Contents	Hours	COs
I	**IntroductionandBasicResearchConcepts:**	8	CO1
	A group discussion on what is research; overview of research, literature survey, experimental skills		
II	**ResearchDesign**	8	CO2
	Data analysis, modelling skills; technical writing; technical presentations; creativity in research		
III	**SampleDesign**	8	CO3
	Creativity in research; group discussion on ethics in research, design of experiments		
IV	**Research Methodology**	7	CO4
	Intellectual property		
V	**FormulatingResearchProblem**	7	CO5
	Department-specific research discussions		
VI	**OutcomeofResearch**	7	CO6
	Case study/Research paper writing		
	Total	**45**	

Self-Learning Topics : IssuesandProblemsinResearch CharacteristicsofResearch: Systematic,Valid,Verifiable,Empiricaland Critical, QualitativeandQuantitativeApproaches, Sampling methods/techniques Sampling Errors, PreparationofResearchReport, Generalization and Interpretation of analysis, SuggestionsandRecommendation.

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:

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

Course Title: IPRandPatenting												
Semester: VIII			**Term: Even**				**Course Code:** 24ILO8027B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination

ESE: EndSemesterExamination

CA: Continuous Assessment

Course Objectives:

1. Tounderstandintellectualpropertyrightsprotectionsystem
2. TopromotetheknowledgeofIntellectualPropertyLawsofIndiaaswellasInternationaltreaty procedures
3. TogetacquaintancewithPatentsearchandpatentfilingprocedureandapplications.

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 EmergingIssuesinIPR
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)**:	8	CO 1
	Meaning of IPR,Different category of IPR instruments - Patents, Trademarks, Copyrights, IndustrialDesigns,Plantvarietyprotection,Geographicalindications, Transferof technology etc. **ImportanceofIPRinModernGlobalEconomicEnvironment:**Theoriesof		

	IPR, Philosophical aspects of IPR laws, **Self-Learning:** Need for IPR, IPR as an instrument of development		
II	**Enforcement of Intellectual Property Rights:**	8	CO 2
	Introduction, 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 lawsinIndia,IndianIPR,AdministrativeMachinery,Majorinternationaltreaties signedbyIndia,ProcedureforsubmittingpatentandEnforcementofIPRatnationalleveletc. **Self-Learning:** History of IPR		
III	**EmergingIssuesinIPR:**	8	CO 3
	ChallengesforIPindigitaleconomy,e-commerce, humangenome,biodiversityandtraditionalknowledgeetc. **Self-Learning:** Cross-border IPR Enforcement		
IV	**Basics of Patents:**	7	CO 4
	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, PatentspecificationPatentclaims,Disclosuresandnon-disclosures,Patentrights andinfringement. **Self-Learning:** Methodofgettingapatent		
V	**PatentRules:**	7	CO 5
	Indianpatentact,USscenario,Australia scenario,Japanscenario,Chinesescenario,MultilateraltreatieswhereIndiais a member(TRIPSagreement,Parisconventionetc.) **Self-Learning:**Europeanpatent rules		
VI	**Procedure for Filing a Patent (National and International):**	7	CO 6
	Legislation and Salient Features, Patent Search, Drafting and Filing PatentApplications, Processing of patent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement **Self-Learning:Patentdatabases:**Importantwebsites,Searchinginternationaldatabases		
	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 byNationalWorkingGroup on Patent Laws
3. TSengupta,2011,IntellectualPropertyLawinIndia,KluwerLawInternational
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: CurrentTrends and Future Scenario, Cambridge University Press
5. Cornish,WilliamRodolph&Llewelyn,David.2010,IntellectualProperty:Patents,Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell

Text Books:

1. EntrepreneurshipDevelopmentand IPRUnit,BITSPilani,2007,AManualon IntellectualPropertyRights,
2. MathewYMaa,2009,FundamentalsofPatentingandLicensingforScientistsandEngineers, 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:** 24ILO8028B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
3	--	--	3	--	--	3	20	20	60	--	--	100

IAE: Internal Assessment Examination

ESE: EndSemesterExamination

CA: Continuous Assessment

Course Objectives:

1. Tofamiliarizewithdigitalbusinessconcept
2. ToacquaintwithE-commerce
3. TogiveinsightsintoE-businessanditsstrategies

Course Outcomes: Learner will be able to…

1. Identifydriversofdigitalbusiness
2. IllustratevariousapproachesandtechniquesforE-businessandmanagement
3. Understand DigitalBusinessSupportservices
4. Understand ManagingE-Business
5. Understand E-Business Strategy
6. Materializing e-business from idea to realization

Module	Contents	Hours	COs
I	**IntroductiontoDigitalBusiness-**	8	CO 1
	Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Differencebetweenphysicaleconomyanddigitaleconomy, **Drivers of digital business-** Big Data & Analytics, Mobile, Cloud Computing,Socialmedia,BYOD,andInternetof Things(digitallyintelligentmachines/services) **Self-Learning:**OpportunitiesandChallengesinDigitalBusiness		
II	**OverviewofE-Commerce**	8	CO 2
	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 pervasivecomputing EC Strategyand Implementation-EC strategyand 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		
III	**DigitalBusinessSupportservices**:	8	CO 3
	ERPase–businessbackbone, knowledge Tope Apps, Information and referral system **Self-Learning:** **ApplicationDevelopment:**BuildingDigitalbusinessApplicationsandInfrastructure		
IV	**ManagingE-Business-**	7	CO 4
	ManagingKnowledge,Managementskillsfore- 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 SecurityControl, Public Key Infrastructure (PKI) for Security, **Self-Learning:** Prominent Cryptographic Applications		
V	**E-Business Strategy-**	7	CO 5
	E-business Strategic formulation- Analysis of Company'sInternalandexternalenvironment,Selectionofstrategy,		

	Self-Learning: E-businessstrategyintoAction,challengesandE-Transition (Process of Digital Transformation)		
VI	**Materializing e-business: FromIdeato Realization-**	7	CO 6
	Business plan preparation **Self-Learning:CaseStudiesandpresentations**		
	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. AtextbookonE-commerce,ErArunrajanMishra,DrWKSarwade,NehaPublishers& Distributors, 2011
2. E-commercefromviontofulfilment,EliasM.Awad,PHI-Restricted,2002
3. DigitalBusinessandE-CommerceManagement,6th Ed,DaveChaffey,Pearson,August2014
4. IntroductiontoE-business-ManagementandStrategy,ColinCombe,ELSVIER,2006

Text Books:

1. DigitalBusinessConceptsandStrategy,EloiseCoupey,2nd Edition,Pearson
2. TrendandChallengesinDigitalBusinessInnovation,VinocenzoMorabito,Springer
3. DigitalBusinessDiscourseErikaDarics,April2015,PalgraveMacmillan

Links for online NPTEL/SWAYAM courses:

https://onlinecourses.nptel.ac.in/noc19_mg54/preview

Course Title: Environmental Management												
Semester: VIII			**Term: Even**				**Course Code:** 24ILO8029B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / 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.

Module	Contents	Hours	COs
I	**Introduction and Definition of Environment:**	7	CO1
	Introduction to Environment Management & EIA, Legal, Policy & Regulatory Framework		
II	**Global Environmental concerns :**	8	CO2
	EIA Procedure - Scoping & Screening and Establishing Baseline Conditions, EIA Methodologies		
III	**ConceptsofEcology:**	8	CO3
	Connectedness: connected spaces and subspaces, Connectedness of the real line, Intermediate value theorem, EIA Methods, Tools and Techniques		
IV	**Scope of Environment Management:**	8	CO4
	Public Involvement in EIA , Impact Management - Mitigation & Preparation of Environment Management Plans (EMP)		
V	**TotalQualityEnvironmentalManagement:**	7	CO5
	EIA Reporting & Review of EIA Quality, Decision Making & Project Management		
VI	**General overview of major legislations**	7	CO6
	Implementation & follow up, EIA Case Examples		
	Total	**45**	

Self-Learning Topics: The Energyscenario, Atomic/Biomedicalhazards, habitats, Corporate environmental Responsibility, EMScertification, FactoriesAct.

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:

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

Course Title: Industry Certification												
Semester: VIII			**Term: Even**				**Course Code:** 24ECVSE801B					
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
-	-	-	-	-	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:

SQL + Dotnet	AR-VR	Angular API Development	Metaverse	Software Testing	Data Analytics with Power BI	Flutter

					&Advance MS Excel	
Mernstack	Applied Machine Learning with Python	Prompt Engineering & AI	Generative AI & LLM Application	IOT	Cyber Security	CCNP
Robotics and AI	**SolidWorks**	**Creo**	Digital Twin	Electrical Vehicles	BIM	Revit

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: Major Project II												
Semester: VIII			**Term:** Even			**Course Code:** 24ECPRJ801B						
Teaching Scheme							**Evaluation Scheme**					
Contact Hrs.			**Credit Allotted**			**Total Credit**	**IAE 1**	**IAE 2**	**ESE**	**CA**	**Or / Pr / Tut.**	**Total**
Th	**Tu**	**Pr**	**Th**	**Tu**	**Pr**							
--	--	10	--	--	5	5	--	--	--	75	50	125

IAE: Internal Assessment Examination

ESE: EndSemesterExamination

CA: Continuous Assessment

Course Objectives:

The Project work facilitates the students to develop and prove Technical, Professional and Ethical skills and knowledge gained during graduation program by applying them from problem identification to successful completion of the project by implementing the solution.

Course Outcomes:

1. Students will be able to implement solutions for the selected problem by applying technical and professional skills.
2. Students will be able to Analyse impact of solutions in societal and environmental context for sustainable development.
3. Students will be able to collaborate best practices along with effective use of modern tools.
4. Students will be able to develop proficiency in oral and written communication with effective leadership and teamwork.
5. Students will be able to nurture professional and ethical behavior.
6. Students will be able to gain expertise that helps in building lifelong learning experience.

1. Guidelines:

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

o Results and Discussion

- Conclusion and Future Work
- References
- Appendix – List of Publications or certificates

3. 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.

4. Continues Assessment:

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.

5. Oral & Practical:

Oral &Practical examination (Final Project Evaluation) of MajorProject-II should be conducted by Internal and External examiners at the end of the semester.

6. Suggested quality evaluation parameters are as following:

1. Relevance to the specialization / industrial trends
2. Modern tools used
3. Innovation
4. Quality of work and completeness of the project
5. Validation of results
6. Impact and business value
7. Quality of written and oral presentation
8. Individual as well as team work