Academic Program: UG

Academic Year 2025-26

Syllabus

VII & VIII Semester B.E.

Electronics & Communication Engineering

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution Approved by AICTE & Affiliated to VTU, Belagavi)

Accredited by NBA under Tier-1 2023-2026

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SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for VII & VIII semester of UG program in Electronics and Communication Engineering is recommended by Board of Studies of Electronics and Communication Engineering Department and approved by the Academic Council, SDM College of Engineering & Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2025-26 till further revision.

Chairman BOS & HOD Principal

SDM College of Engineering & Technology, Dharwad-02

Department of Electronics & Communication Engineering

College – Vision and Mission

VISION:

To develop competent professionals with human values

MISSION:

1. To have contextually relevant Curricula.
2. To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
3. To enhance Research Culture.
4. To involve Industrial Expertise for connecting classroom content to real life situations.
5. To inculcate Ethics and impart soft-skills leading to overall Personality Development.

SDMCET- Quality Policy

- In its quest to be a role model institution, committed to meet or exceed the utmost interest of all the stake holders.

SDMCET- Core Values

- Competency
- Commitment
- Equity
- Team work and
- Trust

Department- Vision and Mission

Vision

Fostering excellence in the field of Electronics & Communication Engineering, showcasing innovation, research and performance with continuous Industry – Institute Interaction with the blend of Human values.

Mission

M1: To provide quality education in the domain of Electronics & Communication Engineering through state of the art curriculum, effective teaching learning process and the best of laboratory facilities.

M2: To encourage innovation, research culture and team work among students.

M3: Interact and work closely with industries and research organizations to accomplish knowledge at par.

M4: To train the students for attaining leadership with ethical values in developing and applying technology for the betterment of society and sustaining the global environment.

Program Educational Objectives (PEOs)

The Graduates, after a few years of Graduation will be able to:

I. **Apply** the latest in-depth knowledge in the field of Electronics and Communication Engineering with Mathematical applications to address real life challenges.
II. **Exhibit** the confidence for independent working and / or spirit to work cohesively with group.
III. **Readily** be accepted by the Industry globally.
IV. **Develop** design skills, fault diagnosis skills, communication skills and create research orientation.
V. **Inculcate** professional, social ethics and to possess awareness regarding societal responsibility, moral and safety related issues

Programme Outcomes (POs):

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to

comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

13. Design economically and technically sound analog and / or digital systems based on the principles of signal processing, VLSI and communication Engineering (PO-13)

14. Integrate hardware – software and apply programming practices to realize the solutions in electronics domain. (PO-14)

SDM COLLEGEOF ENGINEERING AND TECHNOLOGY, DHARWAD
Department of Electronics and Communication Engineering
VII Semester
Scheme of Teaching and Examinations 2025 – 26

Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	22UECC700	Wireless Communication	ECE	4	0	0	03	50	100	100	4
2	PEC	22UECE7XX	Program Elective Course-IV		3	0	0	03	50	100	100	3
3	PEC	22UECE7XX	Program Elective Course-V		3	0	0	03	50	100	100	3
4	OEC	22UECO7XX	Open Elective Course-II		3	0	0	03	50	100	100	3
5	PCCL	22UECL701	Communication Networks Laboratory		0	0	2	03	50	50	100	1
6	PROJ	22UECL702	Major Project-I		0	0	12	03	50	50	100	6
								Total	**300**	**500**	**600**	**20**

Program Elective Course-IV												
	PEC-IV	22UECE740	ASIC Design		3	0	0	03	50	100	100	3
	PEC-IV	22UECE741	Low Power VLSI Design		3	0	0	03	50	100	100	3
Program Elective Course-V												
	PEC-V	22UECE750	Optical Fiber Communication		3	0	0	03	50	100	100	3
	PEC-V	22UECE751	Artificial Intelligence and Machine Learning		3	0	0	03	50	100	100	3
Open Elective Course-II												
	OEC-II	22UECO760	Computer Architecture		3	0	0	03	50	100	100	3
	OEC-II	22UECO761	Wireless Sensor Networks		3	0	0	03	50	100	100	3

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. PEC: Program elective course, OEC: Open elective course, PROJ: Project. TD: Teaching department, PSB: Paper setting Board.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum numbers of students' strength for offering Open Elective Course are as prescribed by the DAP.

Open Elective Courses (OEC): Students belonging to a particular stream of Engineering and Technology are entitled

to opt for the open electives offered by their parent Department and other departments provided that they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course are as prescribed by the DAP.

Major Project-I: The objective of the project work is to encourage development of independent learning, innovative attitude, communication skills, organisation, time management, presentation skills, teamwork, punctuality, setting and meeting deadlines. In Major project the students are expected to identify the state-of-the-art technology in their domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The project shall consist of a team of students not more than 2-4. Each batch shall be assigned with a faculty member. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE. There is SEE, a viva voce examination which shall be examined by two examiners constituted by the HoD. The rubrics of evaluation includes objectives defined, literature review, demonstration of the project work carried out, report, project presentation, communication skill and question and answer session.

AICTE activity point: Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the program. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

SDM COLLEGEOF ENGINEERING AND TECHNOLOGY,DHARWAD

Department of Electronics and Communication Engineering

VIII Semester

Scheme of Teaching and Examinations 2025 – 26

Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	TS	22UECL800	Technical Seminar/Independent study		0	0	2	-	50	-	50	1
2	PROJ or INT	22UECL801	Major Project-II/Internship		12 Weeks			03	50	50	100	10
3	INT	22UECL802	Summer Internship		4 Weeks			03	50	50	100	3
								Total	**150**	**100**	**150**	**14**
L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.												

TD: Teaching department, PSB: Paper setting Board.
Technical Seminar/Independent study (TS): Students are expected to learn how to conduct a literature survey to identify the state-of-the-art technology in their chosen engineering domain. They are required to select an emerging topic beyond the syllabus relevant to their branch of study, understand the concept, analyse it, and present it effectively with technical innovations or novel work in a 15–20minute session, followed by a 5-minute question and answers with their classmates and faculty. Additionally, students must develop effective communication skills and understand the modalities of technical interactions. They are required to submit a seminar report following the format provided by the DUGC. The technical seminar is evaluated for CIE based on the rubrics prescribed by the DUGC.
Summer Internship : Students must undergo an internship in private industries, R&D organizations, Center of Excellence, laboratories of reputed institutions, government and semi-government organizations, PSUs, construction companies, or entrepreneurial organizations to gain exposure to the external professional environment. The internship should be completed over a period of four weeks during the summer vacation after the IV or VI semester and must be completed before the VII semester. Students are required to prepare a report on the work carried out during the internship and submit both the report and the internship certificate during the VIII semester. The internal faculty will monitor student performance and award CIE marks in the VIII semester. Additionally, there will be a SEE, in which students must present their work before a panel of two examiners constituted by the HoD during the SEE of the VIII semester.
Major Project-II : This project work is intended for students who do not undertake an internship. The objective of the project is to foster independent learning, an innovative mindset, communication skills, organization, time management, presentation skills, teamwork, punctuality, and the ability to set and meet deadlines. In this project, students are expected to conduct an extensive literature survey to identify state-of-the-art technology in their domain of interest, select a topic from an emerging area relevant to their branch or an interdisciplinary field, and define the problem for their project work. Each project team shall consist of 2 to 4 students and will be assigned a faculty mentor. The department shall conduct three project reviews as per the schedule provided by DAP, which must be recorded as part of the project evaluation for CIE, along with marks awarded

by the faculty guide. A committee constituted by the HoD, consisting of a minimum of two faculty members, shall conduct the reviews and evaluate the CIE. For SEE, students must appear for a viva-voce examination, which will be assessed by a panel of two examiners—one internal and one external—constituted by the HoD. The rubrics of evaluation includes objectives defined, literature review, demonstration of the project work carried out, report, project presentation, communication skill and question and answer session.

Internship: The internship is intended for students who do not undertake a project. Students must undergo an internship in private industries, R&D organizations, Center of Excellence, laboratories of reputed institutions, government and semi-government organizations, PSUs, construction companies, or entrepreneurial organizations to gain exposure to the external professional environment. The internship shall be for a duration of 12 weeks during the VIII semester, either through placement or on an individual basis. Students are required to prepare a report on the work carried out during the internship and submit both the report and the internship certificate during the VIII semester. The department shall conduct three project reviews as per the schedule provided by DAP, which must be recorded as part of the project evaluation for CIE.A committee constituted by the HoD, consisting of a minimum of two faculty members, shall conduct the reviews and evaluate the CIE. For SEE, students must appear for a viva-voce examination, which will be assessed by a panel of two examiners—one internal and one external—constituted by the HoD. The rubrics of evaluation includes objectives defined, literature review, demonstration of the work carried out, report, project presentation, communication skill and question and answer session.

AICTE activity point: Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the program. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

VII Semester

22UECC700	Wireless Communication	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The course aims to build a strong foundation in wireless fundamentals, covering cellular concepts, channel impairments and their mitigation along with multicarrier modulation techniques. It enables students to understand the evolution of mobile systems from 1G to LTE-Advanced, focusing on requirements, enabling technologies, and broadband features. Students will also learn LTE network and protocol architecture, channel structures, transport channel processing including coding, modulation, and physical signals. The course also introduces 5G spectrum, use cases, advanced modulation and multiple access schemes, and analyzes 5G core and RAN architectures with network slicing.

Co**urse Outcomes (COs):**

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Analyze** cellular concepts and wireless channel impairments, and **apply** multicarrier modulation techniques to modern wireless communication systems.	1,2	3,4	
CO-2	**Explain** the evolution of cellular technologies from 1G to LTE-Advanced, **identify** key enabling technologies, and **analyze** the requirements and features of modern broadband wireless systems.	3,4	1,2	6,7,12,13, 14
CO-3	**Describe** LTE network and protocol architecture, **differentiate** between logical, transport, and physical channels, and **analyze** resource allocation	1,2	3,4	6,7,12,13, 14

	in downlink OFDMA and uplink SC-FDMA systems.			
CO-4	**Explain** LTE downlink and uplink transport channel processing, **interpret** the functions of control, broadcast, multicast, and shared channels, and **analyze** the role of physical signals in reliable communication.	1,2	3,4	6,7,12,13, 14
CO-5	**Examine** the spectrum and architectural components of 5G networks, **differentiate** between various 5G use cases, **analyze** advanced modulation and multiple access schemes, and **evaluate** the role of core/RAN architecture, interfaces, and network slicing in enabling 5G services.	1,2	3,4	6,7,12,13, 14

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.8	2.8	2.2	2.2	-	1	1	-	-	-	-	1	1	1

Pre-requisites: Digital Communication.

Contents:

Unit-I

Wireless Fundamentals: Cellular Systems: The Cellular Concept, Analysis of Cellular Systems, Sectoring, The Broadband Wireless Channel: Path Loss, Shadowing, Fading; Modeling Broadband Fading Channels, Mitigation of Narrowband Fading, Mitigation of Broadband Fading.

Multicarrier Modulation: The Multicarrier concept, OFDM basics, OFDM Block Diagram, Single Carrier Frequency Domain Equalization(SC_FDE), Multiple Access for OFDM systems, OFDMA, SC-FDMA. **10 Hrs**

Unit-II

Evolution of Cellular Technologies: Introduction, Evolution of Mobile Broadband: First Generation Cellular Systems, 2G Digital Cellular Systems, 3G Broadband

Wireless Systems, Beyond 3G, The case for LTE/SAE, LTE Requirements, Key Enabling Technologies and Features of LTE, LTE Advanced Requirements, LTE Advanced Technological Components. **10 Hrs**

Unit-III

Long Term Evolution (LTE): Introduction, LTE Network Architecture, LTE Protocol Architecture, Radio Interface Protocols, Hierarchical Channel structure of LTE, Logical Channels, Transport Channels, Physical Channels, Channel mapping, Downlink OFDMA Radio Resources: Frame structure, Physical Resource Blocks, Resource Allocation, Uplink SC-FDMA Radio Resources: Frame structure, Physical Resource Blocks, Resource Allocation. **10 Hrs**

Unit-IV

LTE Downlink Transport Channel Processing: Downlink Transport Channel Processing Overview: Channel Coding Processing, Modulation processing; Downlink shared channels, Downlink Control Channels, Broadcast channels, Multicast channels, Downlink Physical Signals, Uplink Transport Channel processing. **10 Hrs**

Unit-V

5G Networks: Spectrum, Technology Components, use cases: Extreme mobile broadband, Massive machine-type communication, Ultra-reliable machine-type communication with examples, Modulation Schemes: Filter Bank Multi-Carrier(FBMC), Universal Filtered Multicarrier(UFMC), Single Carrier DFTS-OFDM, Non-orthogonal schemes for efficient multiple access: Non-orthogonal multiple access (NOMA), Sparse code multiple access (SCMA), Interleave division multiple access (IDMA), 5G Architecture: Core Architecture, RAN Architecture, Interfaces and Protocols, Network Slicing, Interworking with LTE. **12 Hrs**

Reference Books:

1) Arunabha Ghosh, Jun Zhang, Jeffrey G. Andrews, Rias Muhamed, “Fundamentals of LTE”, Pearson India Education Services pvt.ltd, 2020.
2) Farooq Khan, “LTE for 4G Mobile Broadband”, Cambridge University Press, 2010.
3) Afif Osseiran, Jose F, Monserrat, Patrick Marsch, “5G Mobile and Wireless Communications Technology”, Cambridge University Press, 2016.
4) Harri Holma, Antti Toskala, Takehiro Nakamura, “5G Technology 3GPP NEW RADIO”, John Wiley & Sons First Edition, 2020.

22UECL701	Communication Networks Laboratory	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The course focuses on the process of data communication in computer network and other communication networks through the layered architecture. It also deals with the IEEE standards and various protocols at different layers of operation of Networks. It also focuses on compiling programs for various protocols and usage of Simulation Tools for Simulating various networks protocols.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Illustrate** the importance of High-Level Data Link Control.	-	1	4
CO-2	**Demonstrate** various functionalities of Network Layer and usage of algorithms for routing strategies, packet management.	1,4	-	-
CO-3	**Demonstrate** the performance of various protocols and algorithms for Framing, Flow control, Error control and media access control.	1,2	3,14	11
CO-4	**Apply** high-level programming language and techniques to **realize** various protocols of Networking	-	3,14	1,2
CO-5	**Apply** network simulation tools to **analyse** and **understand** various modern communication networks	2,3	14	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.25	2.23	2.23	2.0		-	-	-	-	-	1	-	-	2

Pre-requisites: Computer Communication Networks, C/C++ Programming and Compilation, Usage of Simulation Tools

List of Experiments:

1. Realization of process of Error Detection using Cyclic Redundancy Check using C Programming.
2. Realization of process of Bit Stuffing and Framing using C Programming.
3. Realization of Go Back N Protocol using C Programming.
4. Realization of Shortest Path Algorithm using C Programming.
5. Realization of process of Encryption/Decryption using Block Transposition method through C Programming.
6. Understand the working of basic networking commands - Ping, Route Add/Delete/Print, ACL using NetSim.
7. Plot the characteristic curve of throughput versus offered traffic for a Pure and Slotted Aloha system using Nesim.
8. Understanding Public IP Address & NAT (Network Address Translation) using NetSim.
9. Simulate Pathloss, Shadowing and Fading using NetSim.
10. Simulate LTE Handover using NetSim.

Reference Books:

1. Behrouz A. Forouzan, **"**Data Communication and Networking**"**, 5th Edition, McGraw Hill, 2012..
2. James F. Kurose, KeithW. Ross, "Computer Networks", Pearson education,2nd Edition, 2003.
3. Wayne Tomasi, "Introduction to Data communication and Networking", Pearson Education,2007.

22UECL702	Major Project-I	(0-0-12) 6

Contact Hours: 156

Course Learning Objectives (CLOs):

The objectives of final year project during phase-I are to:

- Allow the students to demonstrate the skills learnt during their course of study by asking them to deliver a product that has passed through design, analysis, testing and evaluation stages.
- Encourage multidisciplinary research through the integration of material learnt in number of courses.

- Allow students to develop problem solving, analysis, synthesis and evaluation skills.
- Encourage teamwork and improve students' communication skills through project reports and presentations of their work.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** societal problems and analyze from engineering view point.	1,2	-	6,7
CO-2	**Perform** extensive literature survey on the identified problem and **explore** possible technical solutions.	1,2,3,4	5	13,14
CO-3	**Implement** and provide feasible solution for the identified problem.	1,2,3,4	5	13
CO-4	**Develop** presentation skills of summarizing technical contents and **organize** the study material in the form of a report.	10	11	-
CO-5	**Inculcate** professional ethics, moral responsibilities and develop the spirit of team work.	8,9	12	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3	3	3	3	2	1	1	3	3	3	2	2	1	1

Major Project-I The objective of the project work is to encourage development of independent learning, innovative attitude, communication skills, organisation, time management, presentation skills, teamwork, punctuality, setting and meeting deadlines. In Major project the students are expected to identify the state-of-the-art technology in their domain of interest by an extensive literature survey and select a

topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The project shall consist of a team of students not more than 2-4. Each batch shall be assigned with a faculty member. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE. There is SEE, a viva voce examination which shall be examined by two examiners constituted by the HoD. The rubrics of evaluation includes objectives defined, literature review, demonstration of the project work carried out, report, project presentation, communication skill and question and answer session.

22UECE740	**ASIC Design**	**(3-0-0) 3**

Contact Hours:39

Course Learning Objectives (CLOs):

The course focuses on ASIC design flow, challenges in the design, verification phase, and various circuit examples and widely used ASIC tools.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Interpret** the types of ASIC design flow and its concepts.	-	1	-
CO-2	**Analyze** the challenges in designing complicated digital circuits and its CMOS Implementations.	-	1,2	3
CO-3	**Apply** the Partitioning & Floor-planning Techniques	3	4	-
CO-4	**Evaluate** placement and routing techniques for ASIC.	5	-	1,2

CO-5	**Design** of SOC based Architectures and its applications.	13,14	12	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.66	1.5	2	2	3	-	-	-	-	-	-	2	3	3

Pre-requisites: Digital and Analog Circuits, Basic PLD knowledge and HDL.
Contents:

Unit-I

Introduction To ASICs: ASIC Design flow and its Applications, Types of ASICs, Full-Custom ASICs, Standard cell based ASICs, Gate array based ASICs, Channelled gate array, channel-less gate array, structured gate array, Programmable logic devices (PLD), Field–programmable gate arrays (FPGA), Economics of ASICs with Example. **7 Hrs**

Unit-II

Logic Design: CMOS Implementations, Transistor Sizing, Logical Effort: Predicting delays, logical areas and logical efficiency, logical paths, Multi stage cells, Optimum delay, Optimum number of stages, RTL design, Concept of RTL Linting, Clock domain Crossing. **7 Hrs**

Unit-III

Partitioning & Floor-planning: Partitioning Methods, Measuring Connectivity, Constructive and Iterative Partitioning, The Kernighan–Lin Algorithm, The Ratio-Cut Algorithm**.** Floor-planning goals and objectives, floor planning tools, I/O and power planning, clock system planning. **9 Hrs**

Unit-IV

Placement & Routing: placement goals and objectives, placement algorithms, Iterative placement algorithm types, Eigen Value Placement Algorithm, Time Driven Placement Algorithm, Global routing and types, detailed routing: Left edge Algorithm and special routing**.** **9 Hrs**

Unit- V

System-On-Chip Design: SoC Design Flow, Platform-based and IP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures, On-Chip

Communication Architecture Standards, Low-Power SoC Design**.** **7 Hrs**

Activity beyond Syllabus: Seminar on Fabrication Techniques

Reference Books:

1) M. J. S. Smith, “Application Specific Integrated Circuits”, Pearson Education,1/e 2002.
2) Jose E. France, Yannis Tsividis, “Design of Analog–Digital VLSI Circuits for Telecommunication and Signal Processing, Prentice Hall, 2/e 1993.
3) Hoi-Jun Yoo, Kangmin Lee and Jun Kyong Kim, “Low-Power NoC for High-Performance SoC Design”, CRC Press, 2008

22UECE741	**Low Power VLSI Design**	**(3-0-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on basics and advanced techniques in the low power design. Describe the various power reduction and the power estimation methods and also explain the power dissipation at all layers of design hierarchy. Apply State-of-the art approaches to power estimation and reduction. Practice the low power techniques using current generation design style and process technology.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** the sources of power dissipation in CMOS circuits.	-	-	1,2
CO-2	**Perform** power analysis using simulation based and probabilistic approaches.	-	4,5	-
CO-3	**Use** optimization and trade-off techniques to reduce power dissipation of the digital circuits.	5	-	13,14
CO-4	**Apply** practical low power design techniques and their analysis at various levels of design abstraction in the latest design automation environments.	5	13,14	-
CO-5	**Build** power efficient systems using advanced techniques.	5	13,14	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1	1	-	2	2.75								1.6	1.6

Prerequisites: Basics of CMOS digital circuits and Analog Mixed Mode Design.

Contents:

Unit-I

Introduction: Need for low power VLSI chips, charging and discharging capacitance, short circuit current in CMOS circuit, CMOS leakage current, static current, basic principles of low power design, low power figure of merits. **6 Hrs**

Unit-II

Simulation power analysis: SPICE circuit simulation, discrete transistor modeling and analysis, gate level logic simulation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.

Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy. **9 Hrs**

Unit-III

Circuit: Transistor and gate sizing, equivalent pin ordering, network restructuring and reorganization, special latches and flip flops, low power digital cell library, adjustable device threshold voltage. **7 Hrs**

Unit-IV

Logic: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic. **7 Hrs**

Unit-V

Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation. **6 Hrs**

Advanced Techniques: Adiabatic computation, pass transistor logic synthesis, Asynchronous circuits. **4 Hrs**

Reference Books:

1) Gary K Yeap, “Practical low power digital VLSI Design”, Kluwer Academic, 1998.

2) Jan M. Rabaey, Massoud Pedram, “Low power design methodologies”, Kluwer Academic, 2010.

3)Kaushik Roy, Sharat Prasad, “Low power CMOS VLSI circuit design”, Wiley 2000.
4) A.P. Chandrasekaran and R. W. Broadersen, “Low power digital CMOS design”, Kluwer Academic, 1995.

22UECE750 Optical Fiber Communication (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on principles of Optical Fiber Communication, devices involved in communication system and challenges in Optical Fiber Communication networks.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Classify** the structures of Optical fiber and types and Calculate their different parameters in single mode and Multimode operation.	13	-	1
CO-2	**Illustrate** the optical fiber channel impairments and analyze various types of optical fiber coupling losses.	4, 13	2,3	1
CO-3	**Discuss** different Optical sources and detectorwith their principles and **analyze** link power and rise time budget schemes for optical fiber links.	4, 13	2	5
CO-4	**Describe** the working principles of WDM with different active and passive devices of optical fiber link.	3,13	1,2	-
CO-5	**Explain** concepts, working principles of different types of optical networks and their structures.	-	3, 13	1,2,12

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	1.5	1.75	2.33	1.5	-	-	-	-	-	-	-	1	2.8	-

Pre-requisites: Optical physics, Analog Communication, Digital Communication

Contents:

Unit-I

Optical fiber Communications: Historical development, The general system, Advantages of optical fiber communication, Optical fiber wave guides: Ray theory transmission, Modes in planar guide, Phase and group velocity, And Cylindrical fiber: Modes, Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Fiber Materials, Photonic crystal fibers (PCF). **9 Hrs**

Unit-II

Transmission characteristics of optical fiber: Attenuation, Material absorption losses, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion, Chromatic dispersion, Intermodal dispersion: Multimode step index fiber. Optical Fiber Connectors: Fiber alignment and joint loss, Fiber splices, Fiber connectors, Fiber couplers **9 Hrs**

Unit-III

Optical sources: Energy Bands, Direct and Indirect Band gaps, Light Emitting diodes: LED Structures, Light Source Materials, Quantum Efficiency and LED Power, Modulation. Laser Diodes: Modes and Threshold conditions, Rate equation, External Quantum Efficiency, Resonant frequencies, Laser Diode structures and their principles.

Photo detectors: Physical principles of Photodiodes, Photo detector noise, Detector response time. **7 Hrs**

Unit-IV

Optical Receiver: Optical Receiver Operation: Error sources, Receiver sensitivity, Quantum Limit, Introduction, point–to–point links, System considerations, link power budget, rise-time budget calculations. Short wavelength band and transmission distance for single mode fibers, Power penalties, nodal noise and chirping.

Analog Links: Analog links – Introduction, overview of analog links, CNR, multichannel transmission techniques, key link parameters, Radio over fiber links, microwave photonics. **7 Hrs**

Unit-V

WDM Concepts and Components: Overview of WDM, Operational Principles of WDM, WDM standards, Multiplexers, Isolators and Circulators, Fiber grating filters, Dielectric Thin-Film Filters, Diffraction Gratings, Active Optical Components, Tunable light sources.

Optical Networks: Optical Networks concepts, Network Topologies, Introduction to SONET/SDH networks, Optical Add/Drop Multiplexing, Wavelength Division Multiplexing (WDM) Concepts. Revolution of optical networks in India. **7 Hrs**

Reference Books:

1) Gerd Keiser, "Optical Fiber Communication",5th Edition,McGraw Hill Education (India) Private Limited,2015.
2) John M Senior, "Optical Fiber Communications, Principles and Practice",3rd Edition, Pearson Education, 2010.
3) Rama Swamy & Sivarajan, "Optical Networks",2nd edition,Elsevier publishers, 2010.
4) Govind P. Agarwal, "Fiber Optic Communication Systems",3rd edition,John Wiley India, 2001.

22UECE751 Artificial Intelligence and Machine Learning (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

Students will understand the basic concepts, theories and state-of-the-art techniques of artificial intelligence and machine learning. It covers mathematical aspects, algorithms required for problem solving, data handling, etc. It covers the applications of machine learning and AI algorithms in different fields.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the search techniques for real time problems.	1	2,3,4	12
CO-2	**Represent** knowledge using logic and rules, **understand** how to write facts using predicate logic, and **apply** different reasoning methods like forward and backward reasoning to solve problems in AI.	3	1,2,4	6,7,12,13
CO-3	**Apply** regression and classification techniques to analyze and solve real-world data-	1	2,3,4	6,7,12,13

	driven problems.			
CO-4	**Demonstrate** the ability to **apply** unsupervised learning techniques to solve real world problems.	3	1,2,4	6,7,12,13
CO-5	**Apply** machine learning techniques to design, implement, and evaluate solutions for complex real-world problems across various domains.	1,2,4	3	12

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.6	2.3	2.4	2.2	-	1	1	-	-	-	-	1	1	-

Pre-requisites: Probability theory

Contents:

Unit - I

Introduction: AI problems, underlaying assumptions, AI techniques, criteria for success.

State Space Search & Heuristic Search Techniques: Defining the problems as a state space search, production systems, searching techniques: informed and uniformed search.

Heuristic Search Techniques: Generate and Test, Hill Climbing, Best-First Search, Problem reduction, constraint satisfaction and means-ends analysis.

8 Hrs

Unit – II

Knowledge Representation Issues: representations and mappings, approaches to knowledge representation, issues in knowledge representation.

Using Predicate Logic: Representing simple facts in logic, Computable Functions and Predicates, Resolution.

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Forward versus Backward Reasoning. **8 Hrs**

Unit – III

Linear Regression: Multivariate regression, Logistic regression, Polynomial regression.

Linear Models for Classification: Decision Trees, Regression Trees, K-nearest neighbors (KNN) algorithm, Bayes Theorem. **8 Hrs**

Unit-IV

Unsupervised learning and clustering – k-means clustering, hierarchical clustering, generative adversarial network, dimensionality reduction. **7 Hrs**

Unit-V

Perceptron: Neural Networks – Introduction, Early Models, Perceptron Learning, Back propagation, Initialization, Training & Validation, Support Vector Machines, Introduction, Early Models. **8 Hrs**

Reference Books:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, “Artificial Intelligence”, Tata McGraw Hill, 3/e, 2009.
2. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2009.
3. Tom M. Mitchell, “Machine Learning”, Mc Graw Hill, 1997.
4. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach, 3/e, Prentice Hall, 2009.
5. Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman, “The Elements of Statistical Learning”, Springer, 2017.

22UECO760	**Computer Architecture**	**(3-0-0) 3**

Contact Hours: 39

Course Learning Objectives (CLOs):

The course deals with understanding quantitative principles guiding computer system design. It focuses on enhancing performance by addressing parallelism at different levels such as Instruction, thread, task, and job. Evaluates memory hierarchy, speculations, ISA, ALU architectures.

Course Outcomes:

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Understand the fundamental concepts of parallel computing models, including multiprocessors,	1	2	4

	multi-computers, multi-vector, and SIMD computers.			
CO-2	Apply scalable performance principles, demonstrate proficiency in performance metrics and parallel processing applications, explain advanced technologies like superscalar processors, vector processors, memory hierarchy, and virtual memory.	1	3	14
CO-3	Describe bus, cache, and shared memory, and evaluate their impact on data access in parallel systems.	4	2	14
CO-4	Apply pipeline and superscalar techniques, showcasing expertise in linear and nonlinear pipeline processors, instruction pipeline design, and arithmetic pipeline design.	4	1,3	6
CO-5	Explain large-scale multiprocessors, covering system interconnects, cache coherence, synchronization mechanisms, and message-passing mechanisms across three generations of multi-computers.	6	1,2	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3	3	2	2.33	-	2	-	-	-	-	-	-	-	1

Course Contents:

Unit-I

Parallel Computer Models: The State of Computing, Multiprocessors and Multi-computer, Multi-vector and SIMD Computers, PRAM and VLSI Models.

Program and Network Properties: Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms.

8 Hrs

Unit-II

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws.

Processors and Memory Hierarchy: Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology. **8 Hrs**

Unit-III

Hardware and Software Technology: Bus, Cache and Shared Memory, Bus systems, Cache Memory Organizations, Shared-Memory Organizations, Sequential and Weak Consistency Models. **8 Hrs**

Unit-IV

Pipelining and Superscalar Techniques: Linear Pipeline Processors, Nonlinear Pipeline Processors, Instruction Pipeline Design, Arithmetic Pipeline Design. **8 Hrs**

Unit-V

Large Scale Multiprocessors: Multiprocessors and Multicomputers, Multiprocessor system Interconnects, Cache Coherence and Synchronization Mechanisms, Three Generations of Multicomputers, Message-Passing Mechanisms. **7 Hrs**

Reference Books

1. Kai Hwang, “Advanced Computer Architecture: Parallelism, Scalability, Programmability”,1993, McGraw-Hill.
2. John L. Hennessy and David A. Patterson “Computer Architecture A Quantitative Approach”, 6th edition, 2019, Morgan Kaufmann
3. William Stallings “Computer Organization and Architecture Designing for Performance”,11th edition, 2022, Pearson.
4. Hesham El-Rewini and Mostafa Abd-El-Barr “Advanced Computer Architecture And Parallel Processing”, 2005, Wiley.

22UECO761	Wireless Sensor Networks	(3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on architecture of Wireless sensor nodes, Operating systems used in WSN, Medium Access Control Protocols, Networks Protocols, Power Management, Time Synchronization, Localization and security issues in WSN.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Identify** various parts of WSN and **explain** their construction and operation	1	6	7
CO-2	**Select** and **apply** suitable medium access control technique for a given application of WSN.	-	1	2
CO-3	**Select** and **apply** suitable data dissemination and routing protocol for a given application of WSN.	1	2	-
CO-4	**Apply** various techniques and **solve** the problems related to power efficiency and synchronization in WSN.	2	1	-
CO-5	**Apply** the techniques and **determine** solutions various issues related to localization and security issues in WSN	-	3	1

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	2.2	2.0	2.0	-	-	2.0	1.0	-	-	-	-	-	-	-

Pre-requisites: Sensors and Actuators, Wireless Communication, Microcontrollers, Communication Network protocols.

Contents:

Unit - I

Wireless Sensor Network Basics: Motivation, Definitions and Background, Challenges and Constraints, Areas of Applications, Node Architecture, Sensing Subsystem, Processor Subsystem, Communication Interfaces, Operating Systems, Functional and Non functional aspects of OS. **8 Hrs**

Unit - II

Medium Access Control: Medium Access Control, Overview, Wireless MAC Protocols, Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC protocols, Contention based MAC protocols, Hybrid MAC protocols. **8 Hrs**

Unit-III

Network Layer: Overview, Routing Metrics, Flooding and Gossiping, Data-centric Routing, Proactive Routing, On-Demand Routing, Hierarchical Routing, Location based Routing, QoS based routing protocols. **8 Hrs**

Unit-IV

Power Management and Time Synchronization: Local Power Management Aspects, Dynamic Power Management, Conceptual Architecture, Clocks and synchronization problem, Time synchronization in WSN, Basics of Time synchronization, Time synchronization protocols. **8 Hrs**

Unit-V

Localization and Security: Overview, Ranging Techniques, Range based Localization, Range-Free Localization, Event Driven Localization, Fundamentals of Network Security, Challenges of Security in WSN, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security. **7 Hrs**

Reference Books:

1) Waltenegus Dargie, Christian Poellabauer, “Fundamentals of Wireless Sensor Networks”, Wiley Publications, 2014.
2) Kazem Sohraby, Daniel Minoli, TaiebZnati “Wireless Sensor Networks”, Wiley Publications, 2015.
3) Jun Zeng, Abbas Jamalipour "Wireless Sensor Networks", Wiley Publications, 2014.
4) S. Swapnakumar, " A Guide to Wireless Sensor Networks”, Laxmi Publications , 2013.

VIII Semester

22UECL800	Technical Seminar/Independent Study	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The objective of the seminar is to prepare the students for independent study of state-of-the-art topics in the broad areas of interest. The students are exposed to various aspects of seminar such as literature survey, organization of the material, technical writing and presentation skills.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Read and understand** technical topics from technical journals/ magazines.	-	1,2	6,7,12
CO-2	**Analyze** technical content and extract necessary information.	1,2	-	-
CO-3	**Organize** the topic in a systematic manner and **prepare** the report in a specific format	-	5	-
CO-4	**Present** the topic in a convincing manner	9,10	-	13
CO-5	**Inculcate** professional ethics and moral responsibilities	8	-	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.5	2.5	-	-	-	1	1	3	3	3	-	1	1	-

Technical Seminar/Independent study (TS): Students are expected to learn how to conduct a literature survey to identify the state-of-the-art technology in their chosen engineering domain. They are required to select an emerging topic beyond the syllabus relevant to their branch of study, understand the concept, analyse it, and present it effectively with technical innovations or novel work in a 15–20 minute session, followed by a 5-minute question and answers with their classmates and faculty. Additionally, students must develop effective communication skills and understand the modalities of technical interactions. They are required to submit a seminar report following the format provided by the DUGC. The technical seminar is evaluated for CIE based on the rubrics prescribed by the DUGC.

22UECL801	Major Project-II/Internship	10

Contact Hours: 12 Weeks

Course Learning Objectives (CLOs):

The objectives of the final year project are to:

- Allow students to demonstrate a wide range of skills learned during their course of study by asking them to deliver a product that has passed through the design, analysis, testing and evaluation stages.
- Encourage multidisciplinary research through the integration of material learned in a number of courses.
- Allow students to develop problem solving, analysis, synthesis and evaluation skills.
- Encourage teamwork.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Arrive** at an optimal solution towards the problem identified	1,2,3,9	4	5,12
CO-2	**Implement** proposed solution in the form of development of software and/ or hardware prototype.	3,4,9,13, 14	5,6,7	12

CO-3	**Organize** the topics in a systematic manner and **prepare** report in a specific format	9,10,11	-	12
CO-4	**Present** the work in a systematic way	-	1,6,10	-
CO-5	**Adopt** professional ethics and responsibilities	8	11,12	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3	3	3	2.5	1	2	2	3	3	2.5	2.5	1.3	3	3

Major Project-II: This project work is intended for students who do not undertake an internship. The objective of the project is to foster independent learning, an innovative mindset, communication skills, organization, time management, presentation skills, teamwork, punctuality, and the ability to set and meet deadlines. In this project, students are expected to conduct an extensive literature survey to identify state-of-the-art technology in their domain of interest, select a topic from an emerging area relevant to their branch or an interdisciplinary field, and define the problem for their project work. Each project team shall consist of 2 to 4 students and will be assigned a faculty mentor. The department shall conduct three project reviews as per the schedule provided by DAP, which must be recorded as part of the project evaluation for CIE, along with marks awarded by the faculty guide. A committee constituted by the HoD, consisting of a minimum of two faculty members, shall conduct the reviews and evaluate the CIE. For SEE, students must appear for a viva-voce examination, which will be assessed by a panel of two examiners—one internal and one external—constituted by the HoD. The rubrics of evaluation includes objectives defined, literature review, demonstration of the project work carried out, report, project presentation, communication skill and qInternship: The internship is intended for students who do not undertake a project. Students must undergo an internship in private industries, R&D organizations, Center of Excellence, laboratories of reputed institutions, government and semi-government organizations, PSUs, construction companies, or entrepreneurial organizations to gain exposure to the external professional environment. The internship shall be for a duration of 12 weeks during the VIII semester, either through placement or on an individual basis. Students are required to prepare a report on the work carried out during the internship and submit both the report and the internship certificate during the VIII semester. The department shall conduct

three project reviews as per the schedule provided by DAP, which must be recorded as part of the project evaluation for CIE.A committee constituted by the HoD, consisting of a minimum of two faculty members, shall conduct the reviews and evaluate the CIE. For SEE, students must appear for a viva-voce examination, which will be assessed by a panel of two examiners—one internal and one external—constituted by the HoD. The rubrics of evaluation includes objectives defined, literature review, demonstration of the work carried out, report, project presentation, communication skill and question and answer session.

22UECL802	Summer Internship	3

Contact Hours: 4 weeks

Course Learning Objectives (CLOs):

By the end of this internship, students will be able to effectively apply the knowledge and skills acquired during their academic studies to real-world workplace scenarios. They will demonstrate the ability to work collaboratively within an interdisciplinary team, utilizing strong communication skills to contribute to team objectives and solve complex problems. Additionally, students will develop professional competencies that will enhance their future career prospects and workplace performance.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Acquire** practical experience in an organizational setting	1,2	-	-
CO-2	**Apply** the knowledge and skill set in engineering design processes appropriate to the internship program.	1,2,3,4	5	-
CO-3	**Apply** modern tools and processes to solve the live problems.	5	3,4	-
CO-4	**Get** an opportunity to learn new skills	10	11	-
CO-5	**Learn** strategies like time management, multi-tasking, communication and team work skills in an industrial setup.	8,9	12	-

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping Level	3	3	2.5	2.5	2.5	-	-	3	3	3	2	2	-	-

Students must undergo an internship in private industries, R&D organizations, Center of Excellence, laboratories of reputed institutions, government and semi-government organizations, PSUs, construction companies, or entrepreneurial organizations to gain exposure to the external professional environment. The internship should be completed over a period of four weeks during the summer vacation after the IV or VI semester and must be completed before the VII semester. Students are required to prepare a report on the work carried out during the internship and submit both the report and the internship certificate during the VIII semester. The internal faculty will monitor student performance and award CIE marks in the VIII semester. Additionally, there will be a SEE, in which students must present their work before a panel of two examiners constituted by the HoD during the SEE of the VIII semester.

CIE and SEE Evaluation (from 2025-26 batch)

Courses with LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

Continuous Internal Evaluation (CIE):

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub-divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.
- Course Teacher Assessment (CTA): Minimum two components such as
- quiz, seminar, written assignment, any technical activity related to course each of 5marks. Total CTA marks-10.
- CIE = 40 (from tests) + 10 (from CTA) = 50 marks.

Semester End Examination (SEE):

- SEE is conducted for 100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub-divisions.
- Two questions are to be set from each unit with built in choice, for example Q.1 or Q.2 in unit -I, Q.3 or Q.4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

ASC(IC)/PCC with LTP 2-0-2, 3-0-2 and 2-2-2

Continuous Internal Evaluation (CIE):

Theory CIE component:

- Two Internal Assessment and one Improvement test each of 20 marks and
- one hour duration.
- Two higher scores from three tests are taken representing 40 marks.

- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub-divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.
- Course Teacher Assessment (CTA): Totally based on conduction of experiments as set by the course teacher.

Laboratory component assessment:

- 5 marks: for conduction, regularity, involvement, journal writing, etc. Minimum 75% of attendance is compulsory. If the performance is not satisfactory in laboratory the student shall be detained and required to reregister for the course as a whole whenever offered next.
- 5 marks: Lab Test. A Lab test as per the class time table has to be
- conducted at the end for 50 marks and scale down to 5 marks.
- CIE for integrated course = 40 (from IA tests) + 10 (from CTA i.e. lab component) = 50 marks.
- There will not be any remuneration for Final Lab Test since it is CTA of
- integrated course.
- Copy of the Marks list to be sent to the concerned course instructor immediately after the completion of test for that batch. Original Marks list to be maintained in the department.
- CIE= 40(from tests) + 10 (from CTA i.e. lab component) = 50 marks.

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each
- question with maximum of three sub divisions.
- Two questions are to be set from each unit with built in choice, for example
- Q.1 or Q.2 in unit -I, Q.3 or Q.4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

AEC/HSMS/UHV Courses with LTP 1-0-0:

Continuous Internal Evaluation (CIE):

- Two Internal Assessment and one Improvement test each of 20 marks and
- one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: MCQ 20 questions.
- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course etc. each of 5marks. Total CTA marks-10.
- CIE = 40(from tests) +10(from CTA) =50 marks.

Semester End Examination (SEE):

- SEE is conducted for 50 marks of 1 hour duration. There will be 50 MCQs.
- Question Paper pattern for SEE: The question paper will contain 12 MCQ questions drawn from each Unit.
- Students have to answer maximum of 10 questions from each unit.
- All five units are to be answered compulsorily.