AISSMS
COLLEGE OF ENGINEERING
ज्ञानम् सकलजनहिताय
An Autonomous Institute Affiliated with
Savitribai Phule Pune University
Accredited by NAAC with "A+" Grade | NBA - 7 UG Programmes

Savitribai Phule Pune University

All India Shri Shivaji Memorial Society's

COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

Faculty of Science and Technology

National Education Policy (NEP) Compliant Curriculum

S.Y. B. Tech. Electronics Engineering (VLSI Design & Technology) Syllabus

(2025 Pattern)

(With effect from Academic Year 2026-27)

www.aissmscoe.com

Institute Vision & Mission

Vision:

- Service to society through quality education

Mission:

- Generation of national wealth through education and research
- Imparting quality technical education at the cost affordable to all strata of the society
- Enhancing the quality of life through sustainable development
- Carrying out high-quality intellectual work
- Achieving the distinction of the highest preferred engineering college in the eyes of the stakeholders

Department Vision & Mission

Vision:

- Society Growth and Welfare through Competent Electronics and Telecommunication Engineering Graduates

Mission:

- To facilitate E and TC graduates with sight of innovation.
- To provide stimulating learning environment with modern tools and technologies.
- To produce dynamic graduates with ethics and moral values.
- To impart quality education in the field of E and TC engineering to solve societal and industrial problems

Knowledge and Attitude Profile (WK)

Knowledge & Attitude	Description
WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs)

Program Outcomes (POs)	Description
PO1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	**The Engineer and The World:** Analyse and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

An Electronics engineering (VLSI D&T) graduate will be able to:

PSO1: **Systems Development**: Design and develop prototype or system using hardware and software skills to solve the real-life problems.

PSO2: Adaptability: Demonstrate ability to design, simulate, test, and verify VLSI circuits for multi-disciplinary applications.

PSO3: Skill Development: Develop technical skills in Digital and Analog circuits design through hands-on experience using EDA tools with industry support.

Program Educational Objectives (PEOs)

PEO1: Demonstrate ability to design and develop solutions for real life problems useful for industry and society.

PEO2: Exhibit lifelong learning ability through professional growth, research, innovation and higher studies.

PEO3: Showcase professional attitude, effective leadership skills and become responsible, cultured human being.

B.Tech. Degree Options as per NEP

1. **B.Tech.** Degree with Multidisciplinary Minor (160-176 credits).

2. **B.Tech. Honours Degree in chosen Major Engg./ Tech. Discipline with Multidisciplinary Minor (180-194 credits):**
    - enables students to take up **five-six additional courses in the same Engg./ Tech.** discipline of 18 to 20 credits distributed over **semesters III to VIII.**
    - The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, which are **over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg./ Tech., will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.

3. **B.Tech. Honours with Research Degree in chosen Major Engg./ Tech. Discipline with Multidisciplinary Minor (180-194 credits):**
    - The students will work on **a research project or dissertation for 18 credits** in the fourth year in the respective Major Engg./ Tech. Discipline.
    - The decision regarding the distribution of 18 credits for Research Project in **Semesters VII and VIII** of the Fourth Year will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.
    - **These 18 Credits will be over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg./ Tech. Program.

4. **B.Tech. Degree in chosen Major Engg./ Tech. Discipline with Double Minor (Multidisciplinary and Specialisation Minor, 180-194 credits):**
    - Students would take **up five-six additional courses of 18 to 20 credits in another Engg./ Tech. discipline/ Emerging Areas** Specialization.
    - Distributed over **semesters III to VIII**.
    - The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, which are **over and above the min.160-max.176 Credits** prescribed for Four Year Multidisciplinary Bachelor's Degree in Engg./Tech., will be taken by Academic Authorities of University/ Autonomous Engineering Colleges.

A. Definition of Credit:

1Hr.Lecture(L) per week	1credit
1Hr.Tutorial(T) per week	1credit
2 Hours Practical (Lab)/week	1credit

B. Range of credits:

A range of credits from 160 to 176 for a student to be eligible to get Undergraduate degree in Engineering. A student will be eligible to get Undergraduate degree with Honors 18 to 20 credits, Double Minor for 18 to 20 credits and/or Multidisciplinary Minors for 18 to 20credits, if he/she completes additional credits.

C. Exit:

After SY a student will be eligible to get Diploma in VLSI Design and Technology after completing an internship of 8 Credit during summer vacation in relevant Discipline.

D. General Guidelines for Examination:

The examination shall be conducted in THREE parts viz. Continuous Comprehensive Assessment (CCA), In Semester Examination (ISE) and End Semester Examination (ESE).

(i) Continuous Comprehensive Assessment (CCA): 20 Marks (Any TWO)

Continuous Comprehensive Assessment (CCA) focuses on the continuous evaluation of students' performance throughout the semester. In addition to classroom and laboratory learning, CCA activities are designed to facilitate the attainment of course outcomes through experiential, participatory, collaborative, active, self-directed, and peer-to-peer learning.

As part of the CCA framework, students shall undertake any two activities from the prescribed CCA Guidelines. The Course Teacher shall guide students in the selection and execution of the activities. The selected activities shall be assessed by the Course Teacher on a regular basis using appropriate assessment criteria. Students shall submit reports for the two selected activities as per the schedule specified by the Course Teacher.

(ii) In-semester Examination (ISE): 30 Marks

In-semester examination will be of 30 marks based on Unit I and II.

Course Content	Questions	Marks	Total Marks	Duration
Unit I	Q. 1 or Q.2	15	30	1 Hour
Unit II	Q. 3 or Q.4	15		

(iii) END Semester Examination (ESE): 50 Marks

Examination will be carried out on unit 3,4 and 5 carrying following marks weightage:

Course Content	Questions	Marks	Total Marks	Duration
Unit III	Q. 1 or Q.2	16	50	2 Hours
Unit IV	Q. 3 or Q.4	17		
Unit V	Q. 5 or Q.6	17		

S.Y.B. Tech. Electronics (VLSI Design & Technology) (2025 Pattern)

ABBREVIATIONS

Abbreviation	Title	Abbreviation	Title
BSC	Basic Science courses	AEC	Ability Enhancement Course
ESC	Engineering Science courses	HSM	Humanities Social Science and Management
PCC	Programme Core Courses	IKS	Indian Knowledge System
PEC	Programme Elective courses	VEC	Value Education Course
MDM	Multidisciplinary Minor	ELC	Experiential Learning Courses
OEC	Open Elective other than particular Programme	CCC	Liberal Learning Courses
VSE	Vocational and Skill Enhancement Course		

B. Tech. Electronics Engineering (VLSI Design & Technology) (2025 Pattern)
Distribution of Credits

Sr. No	Domains		Code	SEM-I	SEM-II	SEM-III	SEM-IV	SEM-V	SEM-VI	SEM-VII	SEM-VIII	Credits
1	Basic Science courses		BSC	8	8	0	0	0	0	0	0	16
2	Engineering Science courses		ESC	9	6	0	0	0	0	0	0	15
3	Programme Core Courses		PCC	0	3	12	12	8	8	8	0	51
4	Programme Elective courses		PEC	0	0	0	0	4	8	4	4	20
5	Multidisciplinary Minor	Multidisciplinary Courses	MDM	0	0	2	2	4	2	2	2	14
6	Open Elective other than particular Programme		OEC	0	0	2	2	2	0	0	0	6
7	Vocational and Skill Enhancement Course	Skill Courses	VSE	1	1	1	1	2	2	0	0	8
8	Humanities Social Science and Management	Ability Enhancement Course	AEC	2	0	0	2	0	0	0	0	4
		Entrepreneurship/Economics/ Management courses	HSM	0	0	2	2	0	0	0	0	4
		Indian Knowledge System	IKS	0	2	0	0	0	0	0	0	2
		Value Education Course	VEC	0	0	2	1	0	0	0	0	3
9	Experiential Learning Courses	Research Methodology	ELC	0	0	0	0	0	0	4	0	4
		CEP		0	0	1	0	0	0	0	0	1
		Project		0	0	0	0	0	2	2	0	4
		Internship		0	0	0	0	0	0	0	12	12
10	Co-curricular Courses (CC)	Liberal Learning Courses	CCC	2	2	0	0	0	0	0	0	4
Total				**22**	**22**	**22**	**22**	**20**	**22**	**20**	**18**	**168**

MDM: Artificial Intelligence

Semester	Course Code	Course Name	Hours/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW*	Total	L	P	T	Total
SEM-3	25AIMDM201C	Data Structures	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-4	25AIMDM202C	Object Oriented Programming	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-5	25AIMDM301C	Data Science	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-5	25AIMDM301LC	Data Science Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-6	25AIMDM302C	Machine Learning	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-7	25AIMDM401C	Natural Language Processing	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-8	25AIMDM402C	Cloud Computing	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Total			**13**	**2**	**0**	**120**	**180**	**300**	**25**	**0**	**0**	**625**	**13**	**1**	**0**	**14**

Open Elective Baskets

BASKET	SEM-III	SEM-IV	SEM-V
Leadership, Management & Innovation	Principles of Management and Organizational Behaviour	Leadership and Team Dynamics	Supply Chain Management
Sustainability and Green Technologies	Circular Economy for Sustainable Development	Green Practices and ESG Frameworks	Sustainable Technologies and Carbon Management
Entrepreneurship & Business	Start-up Management and Venture Creation	Innovation and Business Strategy	Digital Marketing
Holistic Development & Well-Being	Health and Nutrition for Professionals	Stress Management and Mental Well-Being	Lifestyle Management and Preventive Healthcare
Global Languages	French Language Module – I	French Language Module – II	French Language Module – III
	German Language Module – I	German Language Module – II	German Language Module – III
	Japanese Language Module -I	Japanese Language Module -II	Japanese Language Module -III

Honors: Semiconductor Technology

Semester	Course Code	Course Name	Hours/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW*	Total	L	P	T	Total
SEM-3	25ETHNR201	Digital IC Design	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-3	25ETHNR201L	Digital IC Design Lab	-	2	-	-	-	-	25	-		25	-	1	-	01
SEM-4	25ETHNR202	Advanced Digital System Design	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-4	25ETHNR202L	Advanced Digital System Design Lab		2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-5	25ETHNR301	Physical Verification and Sign-off Techniques	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-5	25ETHNR301L	Physical Verification and Sign-off Techniques Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-6	25ETHNR302	Hardware Design for AI and Machine Learning	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-6	25ETHNR302L	Hardware Design for AI and Machine Learning Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
SEM-7	25ETHNR401	AI for VLSI	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Total			**14**	**8**		**100**	**150**	**250**	**75**	**25**	**0**	**600**	**14**	**4**	**0**	**18**

Double Minors offered by Each Department

Offering Department	Double Minor Offered	Sem-3	Sem-4	Sem-5	Sem-6	Sem-7
AI &ML Engineering	**Blockchain Technology**	Fundamentals of Blockchain Technology	Smart Contracts and Decentralized Applications	Blockchain Security and Cryptography	Decentralized AI and Web3 Technologies	Blockchain Applications and Emerging Trends
Chemical Engineering	**Environmental Engineering**	Air Pollution Control	Wastewater Treatment	Solid Waste Management	Climate Change and Sustainability	Mini Project
	Energy Engineering	Introduction to Energy	Bio-energy	Electrochemical Energy	Hydrogen Fuel	Mini Project
Civil Engineering	**Infrastructure Engineering**	Introduction to Infrastructure Engineering	Fundamentals of Infrastructure Engineering	Smart Transportation & Urban Infrastructure	Sustainable & Resilient Infrastructure Systems	Emerging Technologies in Infrastructure Engineering
Computer Engineering	**Cybersecurity Engineering**	Introduction to Cybersecurity	Cryptography and Network Security	Ethical Hacking	Digital Forensics	Cryptography and Data Protection
Electrical Engineering	**Renewable Energy systems**	Renewable Energy Sources for Sustainable Development	Solar Photovoltaic Systems	Wind Energy Conversion Systems	Power Electronics and Control for RES	Renewable Energy: Policies, Planning & Audit
E&TC Engineering	**Communication Engineering**	Analog Communication	Digital Communication	Cellular Networks	Mobile Computing	Optical & Microwave Communication
VLSI D&T Engineering	**Semiconductor IC Design**	Digital Electronics	System Design using Verilog	Digital CMOS Design	Analog CMOS Design	AI for VLSI
Mechanical Engineering	**Mechanical Systems Engineering**	Fundamentals of Manufacturing	Fundamentals of Engineering metallurgy	Fundamentals of Thermal Engineering	Fundamentals of Machine Design	Sustainable and Solar Engineering
Mechanical Sandwich Engineering	**Mechanical Systems Engineering**	Fundamentals of Manufacturing	Fundamentals of Engineering metallurgy	Fundamentals of Thermal Engineering	Fundamentals of Machine Design	Sustainable and Solar Engineering
R&A Engineering	**Robotics and Automation**	Fundamentals of Robotics and Automation	Programming for Robotics	Sensors and Actuators in Robotic Systems	Introduction to Robot Kinematics	Robot Simulation and Application

Double Minor: Semiconductor IC Design

Semester	Course Code	Course Name	Hours/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW*	Total	L	P	T	Total
SEM-3	25MNR201	Digital Electronics	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-3	25ETMNR201L	Digital Electronics Lab	-	2	-	-	-	-	25	-		25	-	1	-	01
SEM-4	25ETMNR202	System Design using Verilog	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-4	25ETMNR202L	System Design using Verilog Lab		2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-5	25ETMNR301	Digital CMOS Design	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-5	25ETMNR301L	Digital CMOS Design Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-6	25ETMNR302	Analog CMOS Design	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-6	25ETMNR302L	Analog CMOS Design Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
SEM-7	25ETMNR401	AI for VLSI	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Total			**14**	**8**		**100**	**150**	**250**	**75**	**25**	**0**	**600**	**14**	**4**	**0**	**18**

S.Y. B. Tech. Electronics (VLSI Design & Technology) (2025 Pattern)

Curriculum Structure: Semester III

Course Category	Course Code	Course Name	Hours/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW*	Total	L	P	T	Total
Program Core Course	25ETPCC201	Electronics Circuits	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25ETPCC202	Engineering Mathematics-III	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25ETPCC203	Digital Electronics	3	-	-	20	30	50	-	-	-	100	3	-	-	03
Multidisciplinary Minor	25AIMDM201C	Multidisciplinary Minor-I	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Open Elective Course	25OEC201	Open Elective Course-I	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Program Core Course Lab	25ETPCC201L	Electronics Circuits Lab	-	2	-	-	-	-	25	-		25	-	1	-	01
Program Core Course Lab	25ETPCC202L	Linear Integrated Circuits Lab		2	-	-	-	-	25	-	-	25	-	1	-	01
Program Core Course Lab	25ETPCC203L	Digital Electronics Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
Vocational and Skill Enhancement Course	25ETVSE201	Vocational and Skill Enhancement Course-I	-	2	-	-	-	-	-	25	-	25	-	1	-	01
Entrepreneurship/Economics/ Management Courses	25HSM201	Entrepreneurship/Economics/ Management Course-I	-	-	2	-	-	-	-	-	50	50	-	-	2	02
Value Education Course	25VEC201	Universal Human Values	-	-	2	-	-	-	-	-	50	50	-	-	2	02
Community Engagement Project	25ETELC201	Community Engagement Project	-	2	-	-	-	-	-	-	25	25	-	-	1	01
	Total		**13**	**10**	**04**	**100**	**150**	**250**	**75**	**25**	**125**	**725**	**13**	**04**	**05**	**22**

L: Lecture**, P:** Practical**, T:** Tutorial**, CCA:** Continuous Comprehensive Assessment**; ISE:** In-semester Examination; **ESE:** End Semester Examination**; PR:** Practical Examination**, OR:** Oral Examination, **TW:** Term Work

Multidisciplinary Minor-I:

Sr. No.	Course Code	Course Name
1.	25AIMDM201C	Data Structures

Open Elective-I

Sr. No.	Course Code	Course Name
1.	25OEC201A	Principles of Management and Organizational Behaviour
2.	25OEC201B	Circular Economy for Sustainable Development
3.	25OEC201C	Start-up Management and Venture Creation
4.	25OEC201D	Health and Nutrition for Professionals
5.	25OEC201E	French Language Module-I
6.	25OEC201F	German Language Module-I
7.	25OEC201G	Japanese Language Module-I

Vocational and Skill Enhancement Course-I:

Sr. No.	Course Code	Course Name
1.	25ETVSE201	Employability Skill Development-I

Entrepreneurship/Economics/Management Courses (HSSM)-I:

Sr. No.	Course Code	Course Name
1.	25HSM201A	Engineering Economic Analysis
2.	25HSM201B	Entrepreneurship
3.	25HSM201C	Project Management
4.	25HSM201D	Financial Accounting

S.Y. B. Tech. Electronics (VLSI Design & Technology) (2025 Pattern)

Curriculum Structure: Semester IV

Course Category	Course Code	Course Name	Hrs/Week			Examination Scheme and Marks							Credits			
			L	P	T	CCA	ISE	ESE	PR	OR	TW*	Total	L	P	T	Total
Program Core Course	25ETPCC204	Signals & Systems	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25ETPCC205	Principles of Communication Systems	3	-	-	20	30	50	-	-	-	100	3	-	-	03
	25VDPCC201	System Design Using Verilog and PLDs	3	-	-	20	30	50	-	-	-	100	3	-	-	03
Multidisciplinary Minor	25AIMDM202C	Multidisciplinary Minor-II	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Open Elective Course	25OEC202	Open Elective Course-II	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Program Core Course Lab	25ETPCC204L	Signals & Systems Lab	-	-	1	-	-	-	-	25	-	25	-	1	-	01
Program Core Course Lab	25ETPCC205L	Principles of Communication Systems Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
Program Core Course Lab	25VDPCC201L	System Design Using Verilog and PLDs Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
Vocational and Skill Enhancement Course	25ETVSE202	Vocational and Skill Enhancement Course-II	-	2	-	-	-	-	-	25	-	25	-	1	-	01
Ability Enhancement Course	25AEC201	Modern Indian Language (MIL)	2	-	-	-	-	-	-	25	25	50	-	1	1	02
Entrepreneurship/Economics/ Management Courses	25HSM202	Entrepreneurship/Economics/ Management Course-II	-	-	2	-	-	-	-	-	50	50	-	-	2	02
Value Education Course	25VEC202	Indian Constitution and Governance	-	-	1	-	-	-	-	-	25	25	-	-	1	01
	Total		**15**	**06**	**04**	**100**	**150**	**250**	**50**	**75**	**100**	**725**	**13**	**05**	**04**	**22**

L: Lecture**, P:** Practical**, T:** Tutorial**, CCA:** Continuous Comprehensive Assessment**; ISE:** In-semester Examination; **ESE:** End Semester Examination**; PR:** Practical Examination**, OR:** Oral Examination, **TW:** Term Work

Multidisciplinary Minor-II:

Sr. No.	Course Code	Course Name
1.	25AIMDM202C	Object Oriented Programming

Open Elective-II:

Sr. No.	Course Code	Course Name
1.	25OEC202A	Leadership and Team Dynamics
2.	25OEC202B	Green Practices and ESG Frameworks
3.	25OEC202C	Innovation and Business Strategy
4.	25OEC202D	Stress Management and Mental Well-Being
5.	25OEC202E	French Language Module-II
6.	25OEC202F	German Language Module-II
7.	25OEC202G	Japanese Language Module-II

Vocational and Skill Enhancement Course-II:

Sr. No.	Course Code	Course Name
1.	25ETVSE202	Employability Skill Development-II

Entrepreneurship/Economics/Management Courses (HSSM)-II:

Sr. No.	Course Code	Course Name
1.	25HSM202A	Business Fundamentals for Entrepreneurs
2.	25HSM202B	Entrepreneurship Essentials
3.	25HSM202C	Financial Management for Managers
4.	25HSM202D	Business Intelligence and Analytics

Modern Indian Language (MIL):

Sr. No.	Course Code	Course Name
1.	25AEC201A	Marathi
2.	25AEC201B	Sanskrit

Course: Electronics Circuits			Code:25ETPCC201	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:**
  Basic Electronics Engineering, Basic Electrical Engineering

- **Course Objectives:**
  1. Understand the operation and characteristics of MOSFET and analyze biasing circuits.
  2. Learn how to determine and maintain the stable operating point of a transistor/MOSFET amplifier.
  3. Apply small signal models to analyze single stage MOSFET amplifiers.
  4. Study the operation and applications of adjustable voltage regulator ICs.
  5. Analyze op-amp characteristics and design basic linear application circuits using operational amplifiers.

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

CO1: Examine MOSFET operation and characteristics.
CO2: Perform the DC analysis of MOSFET.
CO3: Perform the AC analysis of MOSFET.
CO4: Analyze and assess the performance of regulators.
CO5: Design basic analog circuits using operational amplifiers.

- **Course Contents:**

Unit I	MOSFET Fundamentals	8 Hours

Introduction to MOSFET, Types of MOSFET: Enhancement and Depletion type MOSFET, EMOSFET: Construction, Threshold voltage, operation regions, V-I characteristics: Transfer characteristics and output characteristics. MOSFET as a switch, CMOS inverter, resistor & diode, non-ideal effects in MOSFET viz. Finite output resistance, channel length modulation, body effect, subthreshold conduction, breakdown effects and temperature effects.

Unit II	MOSFET DC Analysis	8 Hours

DC Load Line, operating point (Q point), Types of biasing: Voltage divider bias and drain feedback bias, MOSFET Configurations: Common source circuit, Common Drain circuit and common Gate circuit.

Unit III	MOSFET AC Analysis	7 Hours

Common Source, Common Gate, Common Drain Amplifiers. AC analysis of a common-source amplifier with and without a bypass capacitor, Numerical analysis based on AC analysis of a common-source amplifier. Current sink & source, Current mirror Circuit. MOSFET Small Signal Frequency Response of Single Stage Amplifier, High & Low Frequency Effect.

Unit IV	Voltage Regulators	9 Hours

Three terminal voltage regulators: Block diagram of power supply, transistor series voltage regulator Types: Fixed and Variable, Block diagram of linear voltage regulator, IC 317 and IC337, Numerical based on design of Regulator. Features and specifications, typical circuits, current boosting, Low Dropout Regulator (LDO).

Unit V	Operational Amplifiers and Linear Applications	8 Hours

Block diagram, Op amp parameters, Current mirror, Op-amp characteristics (AC & DC). Inverting amplifier (Voltage series), non-inverting amplifier (voltage shunt), Effect on Ri, Ro, gain & bandwidth., Voltage follower,

Summing amplifier, Differential amplifier, Practical integrator, first Order Low pass, Practical differentiator, High Pass Filter, Precision half-wave Rectifier.

● **Continuous Comprehensive Assessment (Any Two (CCA1 Compulsory))**		**20 Marks**
CCA1	**List of Course Activity**	**10Marks**

Application Based Course Activities (any one)

1. **Automatic Street Light Controller using MOSFET**
   Design a MOSFET-based automatic street light system using sensors to control switching operation for energy saving applications.

2. **Mobile Charger Power Supply Design**
   Develop a regulated DC power supply using IC317/IC337 and analyse voltage regulation used in mobile charging circuits

3. **Audio Amplifier using MOSFET and Op-Amp**
   Build a low-noise audio amplifier circuit for speaker applications using Common Source MOSFET amplifier and Op-amp stages.

4. **Temperature Monitoring and Control System**
   Implement an Op-amp based temperature sensing and control circuit using comparator and voltage regulator concepts for industrial automation.

CCA2	**Case Study/Survey**	**10 Marks**

List of Case Study:

1. MOSFET Usage in Low-Power Portable Electronics
2. High Frequency Effects in RF Amplifiers

List of Surveys:

- Amplifier Bandwidth Enhancement Techniques
- Stability Issues in High-Gain Feedback Amplifiers

CCA3	**Seminar:** Any topic from unit 1 to 5	**10 Marks**

- **Text Books:**
  1. Robert L. Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, 11th Edition, Pearson Education, 2013.
  2. Ravish R. Singh, *Network Analysis and Synthesis*, McGraw-Hill Education (India) Pvt. Ltd., First Edition, 2017.
- **Reference Books:**
  1. Jacob Millman and Christos C. Halkias, *Integrated Electronics: Analog and Digital Circuits and Systems*, 2nd Edition, McGraw-Hill Education, 2010 (Reprint).
  2. Behzad Razavi, *Fundamentals of Microelectronics*, 2nd Edition, Wiley, 2013.
  3. Thomas L. Floyd, *Electronic Devices (Conventional Current Version)*, 10th Edition, Pearson Education, 2017.
  4. Jacob Millman and Arvin Grabel, *Microelectronics*, 2nd Edition, McGraw-Hill Education, 1987.
- **MOOC/NPTEL:**
  1. UDEMY Course on MOSFET Transistor :MOSFET Transistor - Complete Course for Beginners | MOSFETS

Course: Engineering Mathematics-III			Code: 25ETPCC202	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Basic knowledge of calculus, differential equations, matrices, and Fourier series studied in Engineering Mathematics I and II.

- **Course Objectives:**
  1. To equip students with essential mathematical tools such as probability, transforms, vector calculus, and complex analysis for solving engineering problems.
  2. The course aims to develop analytical thinking and the ability to model and analyze systems in electronics and telecommunication engineering.

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

CO1: Apply fundamental concepts of probability and random variables to analyze uncertain systems.

CO2: Use Laplace transforms to solve differential equations and analyze electrical circuits.

CO3: Apply vector calculus concepts such as gradient, divergence, and curl in engineering applications.

CO4: Evaluate line, surface, and volume integrals and apply major theorems (Green's, Gauss's, Stokes') in physical problems.

CO5: Analyze functions of complex variables using analytic functions, Cauchy-Riemann equations, and complex integration techniques.

- **Course Contents:**

Unit I	Probability Theory and Random Variables	8 Hours

Basic concepts of probability, Conditional probability, Bayes' theorem, Random variables: discrete and continuous, Probability density function (PDF) and cumulative distribution function (CDF), Mathematical expectation and variance, Important distributions: Binomial, Poisson, Normal

Unit II	Laplace Transform	8 Hours

Laplace transform: Definition and properties, Laplace transform of standard functions, Inverse Laplace transform, Convolution theorem, Solution of linear differential equations, Applications to electrical circuits

Unit III	Vector Calculus	8 Hours

Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivatives, Vector identities, Applications in Engineering

Unit IV	Vector Analysis	8 Hours

Line, surface and volume integrals, Conservative, irrotational and solenoidal fields, Scalar potential, Green's, Gauss's and Stoke's theorems, Solution of difference equations, Applications to problems in electromagnetic fields

Unit V	Complex Variables and Analytic Functions	8 Hours

Functions of complex variable, Analytic functions, Cauchy–Riemann equations, Harmonic functions, Complex integration, Cauchy's integral theorem and Cauchy's integral formula

• **Continuous Comprehensive Assessment: (Any Two)**		**20 Marks**
CCA 1	**Report Writing / Mini-Project**	**10 Marks**

List of Topics:

1. **Probability Analysis in Digital Communication Systems**
   Study of noise effects and error probability in communication channels.
2. **Application of Laplace Transform in RLC Circuit Analysis**
   Modelling and solving transient response of electrical circuits.
3. **Vector Calculus in Electromagnetic Field Analysis**
   Use of gradient, divergence and curl in E&TC applications.
4. **Statistical Modelling of Random Signals and Noise**
   Analysis using Normal and Poisson distributions.
5. **Complex Variable Techniques in Signal Processing**
   Applications of analytic functions and complex integration in engineering problems.

CCA 2	**Seminar / Blog Writing**	**10 Marks**

List of Topics:

1. Role of Probability Theory in Modern Communication Engineering
2. Importance of Laplace Transform in Control Systems and Electronics
3. Real-Life Applications of Gauss and Stoke's Theorems
4. How Complex Numbers Simplified Electrical Engineering
5. Applications of Vector Fields in Wireless and Antenna Systems

CCA 3	**Case Study / Survey**	**10 Marks**

List of Topics:

1. Case Study on Noise Distribution in Mobile Communication Systems
2. Survey of Mathematical Techniques Used in Signal Processing
3. Case Study of Laplace Transform Applications in Power Electronics
4. Survey on Electromagnetic Field Analysis Methods Using Vector Calculus
5. Case Study on Complex Analysis Applications in Communication Networks

- **Textbooks:**
  1. B. S. Grewal, *Higher Engineering Mathematics*, 45th Edition, Khanna Publishers, 2023.
  2. Erwin Kreyszig, *Advanced Engineering Mathematics*, 10th Edition, John Wiley & Sons, 2011.
- **Reference Books:**
  1. B. V. Ramana, *Higher Engineering Mathematics*, 2nd Edition, McGraw Hill Education (India), 2018.
  2. Murray R. Spiegel, *Schaum's Outline of Advanced Mathematics for Engineers and Scientists*, Schaum's Outline Series, McGraw-Hill Education, 2009.
  3. H. K. Dass and Er. Rajnish Verma, *Higher Engineering Mathematics*, 4th Revised Edition, S. Chand Publishing, 2022.
- **NPTEL course on Advanced Engineering Mathematics by Prof. P. N. Agarwal|IIT Roorkee:** https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_ma68

Course: Digital Electronics			Code: 25ETPCC203	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	03	03	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Basic Gates, Number Systems and their conversions

- **Course Objectives:**

1. To understand K-map and its use to the design the various applications of Combinational Digital Circuits.
2. To analyze Sequential Logic using flip flops and their applications viz. Counters, processes and implement logical operations.
3. To understand the concepts of Sequential Circuits and apply them in State Machines.
4. To understand the Digital Logic Families and System Design using Programmable Logic Devices.
5. To understand the concepts of VHDL and its fundamental applications.

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

CO1: Design Combinational Circuits.
CO2: Design Sequential Circuits.
CO3: Analyze FSM and ASM.
CO4: Design Digital System using PLDs.
CO5: Describe Fundamentals of VHDL.

- **Course Contents:**

Unit I	Combinational Logic Design	10 Hours

Definition of Combinational logic, Standard representations for logic functions, K-map representation of logic functions (SOP and POS forms), minimization of logical functions for min- terms and max-terms (up to 4 variables), don't care conditions.

Design Examples: Full adder, Full Subtractor, Code Converters -4 bit Binary to Gray, 2- bit Comparator, Multiplexers, multiplexer trees, Demultiplexers, Demultiplexer trees and 3: 8 Decoders.

Self-Study: Half Adder, Half Subtractor, BCD to Gray, BCD to Excess-3.

Unit II	Sequential Logic Design	09 Hours

1-Bit Memory Cell/latch, Clocked SR flip flop, J-K flip flop, M-S J-K flip flop, D and T flip flops. Use of Preset and Clear terminals in flip flops, Excitation Table for flip flops, Conversion of flip flops, Registers, Shift Registers, Counters: Ripple, Up/Down Counters, Synchronous Counters & its Design Examples (4 Bit)

Unit III	Finite State Machines	08 Hours

Moore and Mealy Machines, State diagram, State table, State reduction, State assignment, Design of Finite State Machine, Sequence Generators, Sequence Detector using flip flops. Introduction to Algorithmic State Machines-construction of ASM Chart and realization for Sequential Circuits.

Unit IV	Digital Logic Family and Programmable Logic Devices	07 Hours

Digital Logic Family: Performance parameters of Digital ICs- fan in, fan out, noise margin, propagation delay, power dissipation.
Operation of TTL NAND gate, CMOS inverter, NAND, NOR gates. Comparison of CMOS and TTL.
Programmable Logic Devices: Detail architecture of PROM, PAL, PLA and Designing Combinational Circuits using PLDs. General Architecture and Specifications of FPGA and CPLD.

Unit V	**Introduction to VHDL**	**07 Hours**

Introduction to Library, Entity and Architecture Modeling styles, Data Objects, Concurrent and Sequential Statements, Design examples using VHDL for Basic Gates, Full Adder, 4:1 Multiplexer and D & T flip-flops using Behavioral Modeling style.
Self-Study: Design examples using VHDL for Full Subtractor, 1:4 De-multiplexer

• **Continuous Comprehensive Assessment: (Any one assignment** from **CCA 1 or 2**, and **any one assignment** from **CCA 3 to 5)**	**20 Marks**

CCA 1	**Mini-Project**	**10 Marks**

Design and implementation of a **Digital Visitor Counter System** using counters, displays and sensors for classroom/laboratory occupancy monitoring.

CCA 2	**Project Based Learning (PBL)**	**10 Marks**

Development of a **Smart Traffic Light Control System** using sequential circuits, counters and timing logic for traffic management applications

CCA 3	**Case Study**	**10 Marks**

Case study and hardware analysis of **Digital Electronics in Consumer Appliances** such as washing machines, microwave ovens, calculators and digital clocks.

CCA 4	**Hardware Design Activity**	**10 Marks**

Design and implementation of a **Digital Voting Machine (DVM)** using combinational and sequential logic circuits with verification of operational conditions.

CCA 5	**Simulation & HDL Based Activity**	**10 Marks**

VHDL-based modeling and simulation of **Digital Arithmetic and Control Circuits** such as ALU, counters, multiplexers and shift registers using FPGA design tools.

- Text Books:
  1. R. P. Jain, *Modern Digital Electronics*, 5th Edition, McGraw-Hill Education (India), 2022.
  2. Thomas L. Floyd, *Digital Fundamentals*, 10th Edition, Pearson Education, 2009.
- Reference Books:
  1. John F. Wakerly, *Digital Design: Principles and Practices*, 5th Edition, Pearson Education, 2021.
  2. M. Morris Mano and Michael D. Ciletti, *Digital Design*, 6th Edition, Pearson Education, 2017.
  3. Stephen Brown and Zvonko Vranesic, *Fundamentals of Digital Logic with VHDL Design*, 3rd Edition, McGraw-Hill Education, 2008.
- MOOC / NPTEL Courses: **Digital Circuits b**y Prof. Santanu Chattopadhyay|IIT Kharagpur**:** **https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee75**

Course: Data Structures			**Code: 25AIMDM201C**	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	02	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Fundamentals of Programming Languages, C Programming

- **Course Objectives:**

1. To understand the significance of data structures and implement searching and sorting methods using the C language.
2. To learn the concept and understand the importance of time and space complexity.
3. To understand data representation, implementation and applications of linear and nonlinear data structure.

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

CO1: Apply and implement the principle sorting and searching algorithms on the given data using the C language.
CO2: Develop applications of stack and queue using arrays.
CO3: Implement and demonstrate the applicability of a Linked List.
CO4: Demonstrate the construction, representation, and traversal of a Binary Search Tree.
CO5: Develop programs to build, represent, and traverse Binary Search Trees for efficient data organization.

- **Course Contents:**

Unit I	**Searching and Sorting**	**6 Hours**
Algorithm Analysis: Time and Space Complexity, Asymptotic Notations: Big O, Omega, Theta, Best, Worst, and Average Case Analysis, Searching Algorithms: Linear Search, Binary Search, Sorting Algorithms: Bubble, Selection Sorting Algorithms		
Unit II	**Stack and Queue**	**6 Hours**
Stack: Concept, Basic Stack operations, Array representation of stack, Stack as ADT, Stack Applications: Reversing data, Arithmetic expression conversion (Infix to Postfix) and Expression evaluation. Queue: Concept, Queue operations, Array representation of queue, Queue as ADT, Circular queue		
Unit III	**Linked List**	**6 Hours**
Pointer: Basic concepts, Pointer declaration and initialization, Dynamic Memory Allocation (malloc, calloc, realloc, free), comparison of sequential and linked organization, Linked List: Singly, Doubly, and Circular Linked List; Stack and Queue implementation using Linked list.		
Unit IV	**Non-linear Data Structure: Tree**	**5 Hours**
Introduction to tree: Basic Tree Concepts. Binary Tree: Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree. Binary Search Tree (BST): Basic Concepts, BST operations,		
Unit V	**Non-linear Data Structure: Graphs**	**5 Hours**

Graph: Basic Concepts & terminology, Representation of graph: Adjacency matrix, Adjacency list. Operations on graph: Traversing a graph.

List of Activities: Any two
1. **Algorithm Complexity Analysis:** Students measure and compare time/space complexity of different data structure operations. 2. **Case Study Redesign:** Present a poorly designed system and ask students to redesign it with efficient data structures. 3. **Peer Teaching:** Students explain a data structure concept to peers with examples and code. 4. **Team Based Projects:** Build a complete application (e.g., library management, hospital system, or traffic simulation) integrating multiple data structures.

• **Textbooks:** 1. Ellis Horowitz and Sartaj Sahni, *Fundamentals of Data Structures*, 2nd Edition, Galgotia Publications, 2008. 2. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach with C*, 2nd Edition, Cengage Learning, 2004.
• **Reference Books:** 1. Reema Thareja, *Data Structures Using C*, 2nd Edition, Oxford University Press, 2014. 2. Yedidyah Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, *Data Structures Using C and C++*, 2nd Edition, Prentice Hall of India (PHI), 1996. 3. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C*, 2nd Edition, Pearson Education, 1997.
• **MOOC / NPTEL Courses:** NPTEL course on Data Structure using C Programming by Dr. Dipti Verma and Mr. Aditya Tiwari : https://onlinecourses.swayam2.ac.in/nou23_cs13/preview

Course: Principles of Management and Organizational Behaviour				Code: 25OEC201A
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

Prerequisites:

- Basic knowledge of Engineering Mathematics
- Fundamentals of Economics and Accounting
- Analytical and quantitative reasoning skills

Course Objectives: The objectives of the course are -

1.To introduce the fundamental concepts, functions, and theories of management.
2. To develop an understanding of organizational behavior and individual dynamics at the workplace.
3. Evaluate leadership styles, communication processes, and team dynamics.
4. Apply decision-making, planning, organizing, and controlling techniques in practical scenarios.
5. Assess organizational culture, change management processes, and conflict resolution strategies.

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

CO1: Explain core management functions and classical as well as modern management theories.
CO2: Analyze individual behavior, personality, perception, and motivation in organizational settings.
CO3: Apply capital budgeting methods for evaluating engineering investment decisions.
CO4: Evaluate cost of capital and capital structure decisions.
CO5: Apply working capital and financial planning concepts for engineering projects.

- **Course Contents:**

Unit I	Introduction to Management	6 Hours

Definition and nature of management; functions of management (planning, organizing, staffing, directing, controlling); levels of management; managerial roles and skills; evolution of management thought (classical, behavioural, modern approaches); principles of management

Unit II	Planning and Organizing	6 Hours

Planning process; types of plans; decision-making process and techniques; organizing principles; organizational structure (line, functional, matrix); delegation, authority, and responsibility; centralization and decentralization.

Unit III	Individual Behavior in Organizations	6 Hours

Foundations of organizational behavior; personality and attitudes; perception and attribution; learning theories; motivation theories (Maslow, Herzberg, McGregor, etc.); job satisfaction and employee engagement.

Unit IV	Group Behavior and Leadership	6 Hours

Group dynamics; team development; communication process and barriers; leadership theories and styles; power and politics; conflict management; negotiation techniques; organizational culture.

Unit V	Organizational Change and Development	6 Hours

Organizational change and resistance to change; change management models; organizational development; stress management; ethics and corporate social responsibility; contemporary issues in management; digital transformation and innovation in organizations

List of Course Activities for Continuous Comprehensive Assessment (Any Two):

1. **Case Study Analysis**
   Students analyze a real organizational problem related to planning, leadership, motivation, or change management and present solutions.
2. **Group Discussion & Presentation**
   Teams discuss management topics such as leadership styles, organizational culture, or conflict management and deliver presentations.
3. **Role Play / Management Simulation**
   Students perform role plays on manager–employee communication, negotiation, decision-making, or team management scenarios.
4. **Mini Project on Organizational Study**
   Students visit or study an organization/startup and prepare a report on management practices, hierarchy, communication, and work culture.
5. **Hands-on Activity using Planning & Decision Tools**
   Students prepare organizational charts, decision trees, SWOT analysis, project planning schedules, or management process flowcharts using practical examples.

- **Textbooks:**
  1. Robbins, S. P. & Coulter, M., Management, Pearson Education.
  2. L. M. Prasad, Principles and Practice of Management, Sultan Chand & Sons.
- **Reference Books:**
  1. Robbins, S. P. & Judge, T. A., Organizational Behavior, Pearson Education.
  2. Koontz, H. & Weihrich, H., Essentials of Management, McGraw Hill.
  3. K. Aswathappa, Organizational Behavior, Himalaya Publishing House.
  4. Harold Koontz & Cyril O'Donnell, Principles of Management, McGraw Hill.
  5. P. Subba Rao, Management and Organizational Behavior, Himalaya Publishing House.
- **NPTEL/MOOCS:**
  1. NPTEL course on Principles of Management by Prof. Susmita Mukhopadhyay, Prof. S. Srinivasan, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg88
  2. NPTEL course on Organizational Behaviour by Prof. M. P. Ganesh, IIT Hyderbad: https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_mg51

Course: Circular Economy for Sustainable Development				Code: 25OEC201B
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Entrepreneurship, market survey, innovation

- **Course Objectives:** The objectives of the course are
  1. Understand the fundamentals principles of circular economy, sustainability, environmental systems, and resource cycles.
  2. Apply sustainable development goals (SDGs), life-cycle thinking, and circular economy models in real-world contexts.
  3. Develop the ability to assess materials, energy, and waste flows in businesses and communities to optimize resource use and reduce environmental impact.
  4. Examine environmental governance, global sustainability policies, and circular strategies for industry and society.
  5. Foster creative and practical solutions for sustainable consumption, production, and cleaner technologies.

- **Course Outcomes:** After successful completion course, students will be able to:

  CO1: Explain the fundamental principles of circular economy and sustainable development, and differentiate between linear and circular economic systems.
  CO2: Analyse global environmental challenges and evaluate the role of Sustainable Development Goals (SDGs) in addressing sustainability issues.
  CO3: Apply life cycle thinking, material flow analysis, and resource efficiency tools to assess environmental impacts of products and processes.
  CO4: Design and evaluate circular business models incorporating strategies such as reuse, recycling, remanufacturing, and extended producer responsibility.
  CO5: Assess sustainability policies, governance mechanisms, and technological interventions to propose practical solutions for sustainable development.

- **Course Contents:**

Unit I	**Fundamentals of Circular Economy and Sustainable Development**	**6 Hours**

Concept of sustainable development; evolution of sustainability; environmental, social and economic dimensions (Triple Bottom Line); limitations of the linear economy (take–make–dispose model); principles of circular economy; relationship between circular economy and sustainability; planetary boundaries; ecological footprint; overview of global sustainability challenges; introduction to Sustainable Development Goals (SDGs) and their relevance to industry and society.

Unit II	**Resource Efficiency and Life Cycle Approaches**	**6 Hours**

Resource scarcity and resource efficiency; material flow analysis (MFA); life cycle thinking; Life Cycle Assessment (LCA) methodology and stages (goal and scope definition, inventory analysis, impact assessment, interpretation); carbon footprint and water footprint; eco-efficiency and resource productivity indicators; waste hierarchy (reduce, reuse, recycle, recover); strategies for decoupling economic growth from resource consumption

Unit III	Circular Business Models and Industrial Applications	6 Hours
Circular business model innovation; product life extension strategies; reuse, repair, refurbishment and remanufacturing; recycling technologies; product-as-a-service (PaaS); sharing economy; eco-design and design for environment (DFE); reverse logistics and closed-loop supply chains; Extended Producer Responsibility (EPR); industrial symbiosis; sustainable manufacturing practices.		
Unit IV	**Policy, Governance and Sustainable Development Frameworks**	**6 Hours**
Environmental governance and regulatory frameworks; national and international sustainability policies; climate change mitigation and adaptation strategies; green finance and sustainable investment; Environmental, Social and Governance (ESG) reporting; corporate social responsibility (CSR); sustainable procurement practices; role of government, private sector and civil society in promoting circular economy; global environmental agreements and initiatives		
Unit V	**Tools, Technologies and Case Studies in Circular Economy**	**6 Hours**
Emerging technologies enabling circular economy (IoT, Artificial Intelligence, blockchain for traceability); digitalization and smart resource management; sustainable supply chain management; urban circular systems and smart sustainable cities; waste-to-energy and waste-to-resource technologies; sectoral applications (manufacturing, agriculture, construction, energy); case studies of successful circular economy initiatives; challenges and future prospects of sustainable development.		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**
  1. **Waste Audit & Recycling Survey**
     Students conduct a survey of waste generation in campus/home and suggest recycling or reuse strategies based on circular economy principles.
  2. **Life Cycle Assessment (LCA) Mini Study**
     Analyze the life cycle of a product (plastic bottle, mobile phone, paper bag, etc.) and identify environmental impacts and sustainability improvements.
  3. **Case Study Presentation on Circular Economy Models**
     Teams study companies practicing circular economy, green manufacturing, or sustainable business models and present findings.
  4. **Hands-on Eco-Design / Upcycling Activity**
     Students create useful products from waste or redesign an existing product using eco-design and sustainability concepts.
  5. **Sustainability Policy & SDG Mapping Project**
     Students map business/industrial activities with Sustainable Development Goals (SDGs) and prepare reports on sustainable practices.

- **Textbooks:**
  1. Kirchherr, J., Reike, D., & Hekkert, M. – Conceptualizing the Circular Economy: An overview (Journal/Book compendium)
  2. Ellen MacArthur Foundation – Towards the Circular Economy (Vol. 1–3)
  3. Pearce, D. & Turner, R. K. – Economics of Natural Resources and the Environment
  4. Bruntland Commission Report – Our Common Future (UN document foundational to sustainability thought)

- **Reference Books:**
  1. Bocken, N. M. P., et al. – Product Design and Business Model Strategies for a Circular Economy
  2. Geissdoerfer, M., et al. – The Circular Economy: A Critical Literature Review
  3. McDonough, W. & Braungart, M. – Cradle to Cradle: Remaking the Way We Make Things
  4. UNEP / UN Documents – Global Environmental Outlook Reports
  5. Geyer, R., et al. – Industrial Ecology and Circularity

- **MOOC / NPTEL Courses:**

1. Coursera : Sustainability and Circular Economy, Michael J. Readey, University of Colorado Boulder https://www.coursera.org/learn/sustainability-and-the-circular-economy
2. NPTEL2, Environment and Development, Prof. By Prof. Ngamjahao Kipgen, IIT Guwahati https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs83

3. NPTEL3, Education for Sustainable Development, By Prof. Atasi Mohanty, IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_hs61
4. NPTEL4, Environmental Planning and Management, By Prof. Sonal K. Thengane, IIT Roorkee https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge08
5. NPTEL5, Corporate social responsibility By Prof. Aradhna Malik, IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg54

Course: Start-up Management &Venture Creation				**Code: 25OEC201C**
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Entrepreneurship, market survey, innovation

- **Course Objectives:** The objectives of the course are
  1. Understand the fundamentals of startup management and venture creation.
  2. Develop the ability to identify, evaluate, and validate startup ideas.
  3. Gain knowledge of business models, funding mechanisms, and startup operations.
  4. Understand legal, ethical, and IPR aspects related to startups.
  5. Build entrepreneurial skills, teamwork, leadership, and lifelong learning orientation.

- **Course Outcomes:** After successful completion course, students will be able to:

  CO1. Explain concepts, types, and lifecycle stages of start-ups and new ventures.
  CO2. Identify and analyze start up opportunities using market and customer discovery tools.
  CO3. Develop suitable business models and assess technical and financial feasibility of ventures.
  CO4. Apply knowledge of funding, legal, IPR, and government policies for startup creation.
  CO5. Prepare and present a startup business plan demonstrating teamwork, communication, ethics, and lifelong learning.

- **Course Contents:**

Unit I	**Introduction to Startups & Venture Creation**	**6 Hours**

Startup: Definition, characteristics, and types, Startup vs MSME vs traditional business, Startup lifecycle and growth stages, Role of startups in innovation and economic development Case studies of successful startups (Indian & global).

Unit II	**Idea Generation, Opportunity & Market Validation**	**6 Hours**

Entrepreneurial mindset and ideation techniques, Problem identification and solution fit, Design Thinking and Lean Startup approach, Customer discovery and validation, Market analysis and value proposition development.

Unit III	**Business Models & Feasibility Analysis**	**6 Hours**

Business Model Canvas and Lean Canvas, Technical, market, and financial feasibility, Cost structures, revenue models, and break-even analysis, Risk analysis and mitigation strategies, Sustainability and ethical considerations in startups

Unit IV	**Startup Ecosystem, Funding & Legal Aspects**	**6 Hours**

Startup ecosystem in India and globally, Government initiatives: Startup India, MSME, SIDBI, DPIIT, Sources of funding: bootstrapping, angel investors, venture capital, crowdfunding, Legal aspects: company registration, compliance, Intellectual Property Rights (IPR): patents, trademarks, copyrights

Unit V	Startup Operations, Scaling & Business Plan	6 Hours

Team formation, leadership, and culture, Operations and scaling strategies, Marketing, branding, and customer acquisition Business plan preparation and pitch deck, Future trends, failure analysis, and lifelong learning for entrepreneurs

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**

1. **Startup Idea Pitching Activity**
   Students develop and present innovative startup ideas addressing real-world problems using value proposition concepts.
2. **Business Model Canvas Workshop**
   Hands-on preparation of Business Model Canvas (BMC) for a startup including customer segments, revenue streams, and value proposition.
3. **Market Survey & Customer Validation**
   Students conduct field/online surveys to identify customer needs, validate startup ideas, and analyze market opportunities.
4. **Prototype / Product Demonstration**
   Teams create a basic prototype, mock-up, or digital model of a product/service and demonstrate its functionality and usefulness.
5. **Startup Business Plan Preparation**
   Students prepare a practical business plan including funding requirements, marketing strategy, operational plan, and financial feasibility analysis.

- **Textbooks:**

1. S. S. Khanka – Entrepreneurial Development, S. Chand & Company.
2. Vasant Desai – Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House.

- **Reference Books:**

1. Steve Blank & Bob Dorf – The Startup Owner's Manual, Wiley.
2. Alexander Osterwalder & Yves Pigneur – Business Model Generation, Wiley.
3. Barringer & Ireland – Entrepreneurship: Successfully Launching New Ventures, Pearson.
4. Peter F. Drucker – Innovation and Entrepreneurship, Harper Business.
5. Steve Blank & Bob Dorf – The Startup Owner's Manual, Wiley.

- **MOOC / NPTEL Courses:**

1. NPTEL1, Entrepreneurship, By Prof. C Bhaktavatsala Rao, IIT Madras https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg70
2. NPTEL2, Entrepreneurship Essentials By Prof. Manoj Kumar Mondal, IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_ge08
3. NPTEL3, Innovation, Business Models and Entrepreneurship, By Prof. Vinay Sharma, Prof. Rajat Agrawal, IIT Roorkee: https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg95
4. NPTEL4, Entrepreneurship Essentials, By Prof. Manoj Kumar Mondal, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ge03
5. Coursera : Technology & Entrepreneurship Specialization, Brent Sebold, Arizona State University https://www.coursera.org/specializations/technology-and-entrepreneurship

Course: Health and Nutrition for Professionals				Code: 25OEC201D
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** No prerequisite required.
- **Course Objectives:**
  1. To understand the importance of nutrition and healthy lifestyle for professionals.
  2. To create awareness about balanced diet and nutritional requirements.
  3. To understand lifestyle diseases and their prevention.
  4. To develop healthy habits for stress management and productivity.
- **Course Outcomes:** At the end of the course, students will be able to:

  CO1: Explain the basic concepts of health and nutrition.

  CO2: Understand nutritional requirements and balanced diet.

  CO3: Identify lifestyle diseases and preventive measures.

  CO4: Apply principles of healthy living and stress management.

  CO5: Analyze the role of nutrition in improving professional productivity
- **Course Contents:**

Unit I	**Introduction to Health and Nutrition**	**6 Hours**

Concept of health and wellness, Dimensions of health (physical, mental, social), Importance of nutrition for professionals, Nutrients and their functions, Macronutrients and micronutrients

Unit II	**Balanced Diet and Nutritional Requirements**	**6 Hours**

Concept of balanced diet, Dietary guidelines, recommended dietary allowance (RDA), Nutritional needs during childhood, adolescence, adulthood and old age, Special Nutritional needs for working professionals
Vegetarian vs non-vegetarian diets, Food pyramid and healthy eating habits

Unit III	**Lifestyle Diseases**	**6 Hours**

Causes of lifestyle diseases, Obesity, diabetes, hypertension, heart disease, Role of diet in prevention of diseases, Importance of physical activity, Nutritional management of common diseases, Prevention through healthy diets and lifestyle

Unit IV	**Health Management for Professionals**	**6 Hours**

Work-life balance, Stress and its management, Role of exercise and yoga, Sleep and mental health, Ergonomics and workplace health

Unit V	Food Safety and Healthy Lifestyle	6 Hours

Food hygiene and sanitation, Food adulteration, Safe food handling practices, Sustainable and healthy eating habits, Nutrition for long-term health and productivity, Importance of hydration, Healthy snacking options at work

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**
  1. **Balanced Diet Planning Activity**
     Students prepare a daily/weekly balanced diet chart for different age groups or working professionals based on nutritional requirements.
  2. **Nutritional Analysis Survey**
     Conduct a survey on eating habits, junk food consumption, hydration, or lifestyle diseases and analyze the collected data.
  3. **Healthy Recipe Preparation / Demonstration**
     Students prepare and present nutritious, low-cost, and healthy food recipes promoting balanced nutrition and food safety.
  4. **Fitness, Yoga & Stress Management Activity**
     Practical sessions on yoga, exercise routines, meditation, posture correction, and stress management techniques for healthy living.
  5. **Food Safety & Awareness Campaign**
     Students create posters, presentations, or awareness drives on food hygiene, adulteration detection, healthy snacking, and lifestyle disease prevention.

- **Textbooks:**
  1. Srilakshmi, B., Human Nutrition, New Age International (P) Ltd., Publishers, New Delhi.
  2. Joshi, Shubhangini A., Nutrition and Dietetics: With Indian Case Studies, 5th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2021.

- **Reference Books:**
  1. Swaminathan, M., Food and Nutrition, Bangalore Printing & Publishing Co. Ltd., Bangalore.
  2. Swami Nathan, M., Essentials of Food and Nutrition, Vol. I & II, Ganesh & Co., Madras (Chennai), 1974.
  3. Dietary Guidelines for Indians. A manual by National Institute of Nutrition, ICMR
  4. Safety and Health for Engineers, Roger L. Brauer, John Wiley & Sons.

- **MOOC / NPTEL Courses /Online Resources:**
  1. Adolescent Health and Well-Being: A Holistic Approach by By Prof. Sumana Samanta, Prof. Parmeshwar Satpathy, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge102
  2. Diet Management in Health and Disease by By Dr. Vipparti Vijaya Lakshmi, The English and Foreign Languages University: https://onlinecourses.swayam2.ac.in/e-learning/preview/cec25_hc01
  3. Food and Nutrition by By Dr. Asna Urooj, University of Mysore: https://onlinecourses.swayam2.ac.in/e-learning/preview/cec19_ag02

Course: French Language Module-I			Code: 25OEC201E	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	02	**CCA**	**20**
			ISE	**30**
			ESE	**50**

- **Prerequisites:** No prerequisite required.

- **Course Objectives:**
  1. To identify basic French vocabulary and pronunciation.
  2. To develop elementary listening and speaking skills in French.
  3. To construct simple French sentences using basic grammar.
  4. To apply French language skills in everyday communication.
  5. To build a foundation for further learning of the French language.

- **Course Outcomes:** At the end of the course, students will be able to
  CO1. Identify basic French vocabulary and pronunciation.
  CO2. Use simple French expressions for self-introduction and basic interactions.
  CO3. Read and write simple French sentences.
  CO4. Communicate in familiar everyday situations using basic French.
  CO5. Demonstrate awareness of French culture and etiquette.

- **Course Contents:**

Unit I	**Introduction au français (Introduction to French)**	**6 Hours**
French alphabet and pronunciation, Greetings and introductions, Numbers (1-100), days and months Classroom expressions		
Unit II	**Parler de ses loisirs et de sa famille (Talking about his hobbies and his family)**	**6 Hours**
Talking about a hobby, (Vocab: Activities, expressions + Aimer), Family and friends, (Grammar: Subject pronouns, ER ending verbs, Family relations)		
Unit III	**La France (France)**	**6 Hours**
Reading about French city, asking simple questions about France, Writing a post card (Vocab: Information on France and it's cities, interrogative words.)		
Unit IV	**Au café! (At the cafe!)**	**6 Hours**
Ordering in French, Fruits and vegetables, Quantities, Expressions of politeness		
Unit V	**Faire une invitation (Make an invitation)**	**6 Hours**
Letter writing, organising a party, Accepting / refusing an invitation, Role play activities		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**
  1. Self-introduction in French: Students introduce themselves using simple French sentences.
  2. Greetings and Classroom Conversation: Students practice basic greetings and classroom expressions in French.
  3. **Listening Comprehension Exercise:** Students listen to short French audio clips and answer simple questions.
  4. **Picture Description in French:** Students describe a given picture using basic French vocabulary.
  5. French Culture Presentation: Students give a short presentation on French culture, food, or festivals.

- **Text Books:**

  1. Alter Ego A1 – Hachette (Goyal Publishers)

  2.Latitude 1 – Didier (Goyal Publishers)

- **Reference Books:**
  1. Myrna Bell Rochester, "Easy French Step-By-Step: Master High-Frequency Grammar for French Proficiency—Fast", McGraw Hill, ISBN-13 : 978-0071453875
  2. Eugene Jackson, Antonio Rubio, Julien J. Lafontant, Pamela Haze, "French Made Simple", Crown Publication, ISBN-13 : 978-0767918596
  3. Claire Miquel, "Communication Progressive du Français A1", Cle International, Atlantic Publishers and Distributors (P) Ltd., 7/22, Ansari Road, Darya Ganj, New Delhi – 110002
  4. Ranjit, Mahita & Singh, Monica, Apprenons le frangais', Part 1, Saraswati House Pvt. Ltd.,New Delhi. Second Revised Edition, 2007
  5. Ranjit, Mahita & Singh, Monica, Cahier d'exercices', (Apprenons le francais) 1., Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007

- **MOOC / NPTEL Courses /Online Resources Online Resources:**
  1. https://www.elearningfrench.com/
  2. https://www.laits.utexas.edu/fi/index.html
  3. https://blog.rosettastone.com/french-accent-marks/
  4. https://www.frenchcircles.ca/online-free-french-resources/
  5. Proficiency course in French By Prof. Nirupama Rastogi (Retd): https://onlinecourses.swayam2.ac.in/e-learning/preview/cec19_lg04
  6. Foundations of French by Ramya Jagannathan: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg73
  7. The Complete French Course : Learn French – Beginners : https://www.udemy.com/course/french-for-beginners-a1/?couponCode=PMNVD2025
  8. Complete French Course: Learn French for Beginners : https://www.udemy.com/course/complete-french-course/?couponCode=PMNVD2025

Course: German Language Module-I			Code: 25OEC201F	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** No prerequisite required.

- **Course Objectives:**

1. To identify basic German vocabulary and pronunciation.
2. To develop elementary communication skills in German.
3. To construct simple German sentences using basic grammar.
4. To apply German language skills in everyday communication.
5. To develop awareness of German culture and traditions.

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

CO1. Identify basic German vocabulary and pronunciation.

CO2. Use simple German expressions for basic communication.

CO3. Read and write elementary German sentences.

CO4. Apply common German phrases in everyday situations.

CO5. Demonstrate awareness of German culture and traditions.

- **Course Contents:**

Unit I	Willkommen! (Welcome!)	6 Hours

Topics and Vocabulary: Greetings, Introductions, Numbers, Countries & languages

Grammar: Alphabet, Pronunciation, Personal pronouns

Skills

- Speaking: self-introduction
- Listening: simple conversations
- Reading: name cards, dialogues
- Writing: short introduction paragraph

Unit II	Familie, Freunde und ich (Family, Friends and I)	6 Hours

Topics and Vocabulary: Family members, Hobby and work

Grammar: Nominative case, Articles- der, die, das, Regular verb conjugation

Skills

- Speaking: describe family, ask about profession, introduce others
- Reading: small paragraphs about nuclear and joint families

Activity

Family tree presentation

Unit III	Orte und Dinge (Places and things)	6 Hours

Grammar: Sentence structure, Definite articles- der, die, das, Indefinite articles- ein, eine, ein,

Negative markers- kein, keine, kein, nicht

Skills

- Speaking**:** describing surroundings and objects
- Reading**:** simple descriptive passages and labels
- Writing**:** short descriptions using simple sentences

Activities

- Vocabulary Hunt
- Mystery Object Game

Picture Description

Unit IV	Studentenleben & Alltag (Student life & everyday life)	6 Hours

Topics and Vocabulary: Daily routine, University life, Subjects, Time expressions

Grammar: Time, Nominative case- personal pronouns, Nominative case- possessive Pronouns

Skills: Speaking and Writing: daily routine discussion

Listening: schedules at university and at the work place

Unit V	Revision & Mini Project	6 Hours

Integrated Skills: Students prepare: self-introduction, poster, dialogue, simple presentation

Suggested Project

My dream study trip to Germany/ Cultural connectivity between Germany and India/ Any other topic related to German language and culture.

Assessment

- Speaking viva
- Listening test
- Vocabulary quiz
- Listening exercises
- Pronunciation practice
- Role play activities

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**

1. **Self-introduction in German:** Students introduce themselves using simple German sentences.
2. **Greetings and Basic Conversation:** Students practice greetings and everyday expressions in German.
3. **Listening Comprehension Exercise:** Students listen to short German audio clips and answer questions.
4. **Picture Description in German:** Students describe simple pictures using basic German vocabulary.
5. **German Culture Presentation:** Students present topics related to German culture, food, or festivals.

- **Text Books:**
  1. Stefanie Dengler, “Netzwerk A1 (Textbook + Workbook + Glossar)”, Hachette, ISBN: 9788183077033, (Goyal Publishers)
  2. Monika Reimann Daniela Niebisch, Sylvette Penning-Hiemstra, Angela Pude, Franz Specht, Monika Bovermann, “Schritte international Neu 1: Deutsch als Fremdsprache / Kursbuch + Arbeitsbuch mit Audios online”, Hueber Publications, GOYAL Publishers & Distributors Pvt. Ltd, ISBN-13: 978-3193610829

- **Reference Books:**
  1. Deepak Kushwaha, “German Made Easy Part 1 + German Made Easy Part 2 with Answer”, Goyal Publishers
  2. Arnold Leitner, “German Made Simple”, Crown Publications, Penguin Random House India Pvt Ltd
  3. Kurs Und Ubungsbuch, “Studio-D A1 - Combo of 3 (German)”, Goyal Publishers & Distributers
  4. Funk and Kuhn, “Studio D A1Deutsch Buch “, Cornelsen Verlag (Goyal Publishers India)

- **MOOC / NPTEL Courses /Online Resources Online Resources:**
  1. Learn German Language: Complete German Course – Beginners (Udemy): https://www.udemy.com/course/complete-german-course-learn-german-for-beginners/
  2. German A1 - German For Complete Beginners! : https://www.udemy.com/course/german-for-complete-beginners/?couponCode=PMNVD2025
  3. DW Learn German: https://learngerman.dw.com/en/learn-german/s-9528
  4. Practise German for free (Goethe-Institut Resources) : https://www.goethe.de/en/spr/ueb.html
  5. Duolingo German : https://www.duolingo.com/course/de/en/Learn-German

Course: Japanese Language Module-I			Code: 25OEC201G	
Teaching Scheme (Hours/Week)		Credit	Evaluation Scheme	
Lecture	2	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** No prerequisite required.

- **Course Objectives:** The objectives of the course are-
  1. To identify basic Japanese pronunciation, scripts, and vocabulary.
  2. To develop pre-elementary listening and speaking skills in Japanese.
  3. To construct simple Japanese sentences using basic grammar.
  4. To apply simple Japanese expressions in everyday communication.
  5. To develop awareness of Japanese culture and etiquette.

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

  CO1. Identify basic Japanese pronunciation, scripts, and vocabulary.

  CO2. Use simple Japanese expressions for basic communication.

  CO3. Read and write basic Japanese characters and sentences.

  CO4. Participate in elementary conversations using simple Japanese expressions.

  CO5. Demonstrate awareness of Japanese culture and etiquette.

- **Course Contents:**

Unit I	Nihongo nyūmon (Introduction to Japanese)	8 Hours
Hiragana, Greetings and introductions, Numbers and dates, Pronunciation practice		
Unit II	**Kihon-tekina bunpō to goi (Basic Grammar and Vocabulary)**	**6 Hours**
Sentence patterns, Basic Particles, Basic verbs, Pronouns and nouns		
Unit III	**Nichijō no komyunikēshon (Everyday Communication)**	**4 Hours**
Self-introduction, Family and hobbies, Daily activities, Asking simple questions		
Unit IV	**Dokkairyoku to sakubun nōryoku (Reading and Writing Skills)**	**6 Hours**
Reading simple scripts, Daily Vocabulary, Writing practice, Sentence construction		
Unit V	**Risuningu to supīkingu no renshū (Listening and Speaking Practice)**	**6 Hours**
Japanese culture, Pronunciation practice, Role play activities, Guided communication, activities.		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**
  1. **Self-introduction in Japanese:** Students introduce themselves using simple Japanese expressions.

2. **Greetings and Classroom Conversation:** Students practice basic greetings and classroom communication in Japanese.
3. **Listening Comprehension Exercise:** Students listen to short Japanese audio clips and answer simple questions.
4. **Picture Description in Japanese:** Students describe pictures using simple Japanese vocabulary.
5. **Japanese Culture Presentation:** Students present topics related to Japanese culture, food, or festivals.

- **Text Books:**
  1. 3A Corporation, "Minna No Nihongo 1-1,1-2,2-1,2.2 Main Textbook elementary", ISBN-13: 9789388141147, Goyal Publishers & Distributors Pvt. Ltd, India
  2. Eri Banno, Yoko Ikeda, Yutaka Ohno, Chikako Shinagawa, Kyoko Tokashiki, "Genki 1 Textbook: An Integrated Course in Elementary Japanese", ISBN-13 : 978-4789014403

- **Reference Books:**
  1. The Japan Foundation, "Marugoto: Japanese Language and Culture Starter A1 Coursebook for Communicative Language Activities", Goyal Publishers
  2. The Japan Foundation, "Marugoto Starter (A1) Rikai - Course Book For Communicative Language Competences", Goyal Publishers, ISBN-13: 9788183078047
  3. The Japan Foundation, "Marugoto Starter (A1) Katsudoo", Goyal Publishers
  4. "Japanese for Busy People,3rd edition", Association for Japanese Language Teaching, Kodansha Tokyo Japan Kodansha International, November, 2011.,
  5. Tae Kim, "A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar", Createspace Independent Pub, ISBN-13 : 978-1495238963, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002
  6. Nyumon Nihongo- ALC Press, U.K
  7. Nihongo Soomatome N5, ASK Publishing, Tokyo

- **MOOC / NPTEL Courses /Online Resources Online Resources:**
  1. Online Japanese Beginner Course (Udemy): https://www.udemy.com/course/online-japanese-beginner-course
  2. JF-Japanese e-learning : https://minato-jf.jp/
  3. Introduction to Japanese Langauge : Prof Vatsala Misra (NPTEL) : https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_hs83
  4. Learn Japanese Language: Free Online Courses: https://www.busuu.com/en/course/learn-japanese-online

Course: Electronics Circuits Lab				Code: 25ETPCC201L
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Practical	2	1	Practical	Marks: 25

- **Prerequisites:** Basic Electronics Engineering, Basic Electrical Engineering

- **Course Objectives:**

1. To study the characteristics of MOSFET devices by plotting drain and transfer characteristics and determining threshold voltage.
2. To design and analyze single-stage amplifier circuits such as common source (CS) and common emitter (CE) amplifiers and evaluate their performance parameters.
3. To design and implement adjustable voltage regulator circuits using LM317 voltage regulator and LM337 voltage regulator ICs and analyze their results.
4. To study Opamp characteristics and measure AC parameters.

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

CO1: Measure and interpret MOSFET characteristics, including drain characteristics, transfer Characteristics and threshold voltage.

CO2: Verify DC operating point for MOSFET

CO3: Design amplifier circuits, determining voltage gain, input impedance, output impedance, and frequency response.

CO4: Implement adjustable voltage regulators and compare theoretical and practical performance.

CO5: Measure AC Parameters of Opamp.

List of Experiments

Perform any 10 experiment (1-8 experiment compulsory)

1) MOSFET Characteristics (Enhancement Type)
   a) Plot Drain Characteristics (ID–VDS) and Transfer Characteristics (ID–VGS)
   b) Determine Threshold Voltage (Vth)

2) Design, build single stage CS configuration & verify DC operating point and comment on result.

3) Small Signal Analysis of CE Amplifier
   Measure Voltage Gain, Input Impedance, Output Impedance and Compare theoretical and practical results

4) MOSFET Common Source (CS) Amplifier
   a) Design and measure voltage gain
   b) Study frequency response

5) Frequency Response of Single Stage Amplifier
   Plot Gain v/s Frequency curve, Determine Lower Cutoff (fL), Upper Cutoff (fH), and Bandwidth

6) Design & implement adjustable voltage regulator using IC LM317/LM337 and comment on result.

7) Design build and test summing amplifier

8) Measure AC parameters of Opamp: a) CMRR b) Gain Bandwidth product. Compare the result with a datasheet of corresponding Op-Amp.

- **Virtual Laboratories:**
  9. **Frequency response of CS amplifier:** https: //aec-iitkgp.vlabs.ac.in/exp/cs-amplifier/
  10. **Half Wave Rectifier:** https://be-iitkgp.vlabs.ac.in/exp/half-wave-rectification/
  11. **Full Wave Rectifier:** https://be-iitkgp.vlabs.ac.in/exp/full-wave-rectification/
  12. **BJT CE Amplifier:** https://be-iitkgp.vlabs.ac.in/exp/ce-amplifier/

Course: Linear Integrated Circuits Lab				Code:25ETPCC202L
Teaching Scheme (Hours/Week)		Credit	Evaluation Scheme	
Practical	2	1	PR	25

- **Prerequisites:**

Basic Electronics Engineering, Electronic Circuits

- **Course Objectives:**

1. To understand the internal structure and working principles of operational amplifiers and their basic building blocks.

2. To analyze and design linear and non-linear applications of operational amplifiers.

3. To study and compare different types of ADC and DAC using OP-AMP circuits.

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

CO1: Measure key Op-Amp parameters and compare the measured values with the manufacturer's datasheet specifications.
CO2: Design, build, and test fundamental Op-Amp application circuits such as integrator, precision rectifier (half & full wave), and Schmitt trigger, and evaluate their performance characteristics. Design and implement precision half-wave and full-wave rectifier circuits using Op-Amps.
CO3: Design, construct, and test basic data conversion systems including 2-bit R-2R ladder DAC and 2-bit flash ADC, and analyse their conversion accuracy.
CO4: Design and experimentally analyse timing and synchronization circuits such as Phase Locked Loop (PLL) and interpret their dynamic characteristics including lock range and capture range.
CO5: Design and test Op-Amp based square and triangular wave generators and verify waveform parameters such as frequency and Amplitude.

- **Course Contents:**

List of Experiments:

1. Measure AC parameters of Opamp: a) Open loop gain b) Slew rate. Compare the result with a datasheet of corresponding Op-Amp.
2. Measure DC parameters of Opamp and compare with the specifications. Input bias current, input offset current and CMRR Compare the result with a datasheet of corresponding Op-Amp.
3. Design, build and test integrator for given frequency.
4. Design, build and test precision half wave rectifier.
5. Design, build and test op amp as comparator
6. Design, build and test Schmitt trigger and plot transfer characteristics.
7. Design, build and test PLL.
8. Design and implement 2-bit R-2R ladder DAC.
9. Design and build Wein bridge Oscillator.
10. Virtual Lab: https://aec-iitkgp.vlabs.ac.in/exp/schmitt-trigger/
11. Virtual Lab: https://ae-iitr.vlabs.ac.in/exp/wein-bridge-oscillator/
12. Virtual Lab: https://ae-iitr.vlabs.ac.in/exp/function-generator/

Course: Digital Electronics Lab				Code:25ETPCC203L
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Practical	**02**	**01**	**Practical**	**Marks: 25**

Prerequisites: Basic Electronics Engineering Lab

- **Course Objectives:**

1. To Provide Hands-on experience in Designing and Implementing Combinational Logic Circuits such as Multiplexers, Decoders, Adders, Subtractors and Code Converters using standard Digital ICs.
2. To Develop the ability to Design and Analyze Sequential Logic Circuits including Counters, Shift Registers, and Pulse Generators and to interpret their timing behavior.
3. To Introduce basic Digital System Simulation using VHDL, enabling students to verify Combinational Logic Circuits through HDL-based modeling.

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

CO1: Design and Implement Combinational Logic Circuits using Multiplexers, Decoders and Arithmetic ICs, and verify their functionality using truth tables.

CO2: Design and Implement Sequential Logic Circuits such as Counters, Shift Registers, and Pulse Generators and interpret their operation using timing diagrams.

CO3: Develop and Simulate basic VHDL models of Digital Circuits such as Multiplexers and Adders for functional verification.

List of Experiments:

Group A: (Any 4)

1. a) Design and Implement 8:1 MUX using IC-74153 & Verify its Truth Table.
   b) Design & implement the given 4-variable function using IC-74153. Verify its Truth Table.
2. Design and implement full adder and full subtractor function using IC-74138.
3. Design and implement 3-bit Binary to Gray code converter and BCD to Excess-3 code converter using IC-74138.
4. Design and Implement 1-digit BCD adder using IC-7483.
5. Design and Implement 4-bit Binary adder and subtractor with mode control using IC-7483.

Group B: (Any 3)

6. Design and Implement MOD-N and MOD-NN using IC-7490 and draw Timing diagram.
7. Design & Implement Up/down Counter with mode control using IC-74191 / IC-74193.Draw Timing Diagram.
8. Design and Implement 4-bit right shift and left shift register using D-flip flop IC-7474.
9. Design and Implement Pulse train generator using IC-74194 / IC-7495 (Use right/left Shift).
10. Design and Implement 4-bit Ring Counter / Twisted ring Counter using shift registers IC-74194 / IC-7495.

Group C: (Any 1)

11. Simulate VHDL code for 4:1 multiplexer & 1:4 Demultiplexer.
12. Simulate VHDL code for Hall Adder and Half Subtractor.

Virtual Laboratories:

1. Digital Applications Lab: https://da-iitb.vlabs.ac.in/List%20of%20experiments.html
2. Hybrid Electronics Lab: https://he-coep.vlabs.ac.in/List%20of%20experiments.html

Course: Entrepreneurship/Economics/ Management Course-I				**Code: 25HSM201**
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Tutorial	2	2	Term work	Marks: 50

GUIDELINES FOR SELECTING HSM COURSE

1. HSSM courses shall be offered through Institute-approved Swayam/ NPTEL courses. The minimum duration of the course must be **8 weeks**.
2. Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self-learning is being pursued by the students 'in true letter and spirit'. The faculty has to register for the selected course as a course mentor.
3. Students shall complete the prescribed online lectures, assignments, and learning activities during the semester.
4. Swayam/ NPTEL certification examination is optional and students shall not be required to pay certification fees for successful completion of the course.
5. Any plagiarism, misrepresentation of course completion, or submission of forged certificates shall be treated as academic misconduct.
6. The decision of the Institute regarding course mapping, evaluation, and award of credits shall be final.

SELECTION OF HSSM COURSE

List of Courses to be opted (Any one) under HSSM-I

1. Engineering Economic Analysis – IIT Roorkee, Prof. P. K. Jha :https://nptel.ac.in/courses/112107209
2. Entrepreneurship – IIT Madras, Prof. C. Bhaktavatsala Rao: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg114
3. Project Management – IIT Kanpur, Prof. Raghu Nandan Sengupta: https://nptel.ac.in/courses/110104073
4. Financial Accounting, IIT Bombay Prof. Varadraj Bapat: https://nptel.ac.in/courses/110101131

Assessment of HSSM Course:

1. Term Work (50 Marks) shall be evaluated by the Faculty Mentor based on:
   - 25 Marks: NPTEL assignment score.
   - 25 Marks: Institute level examination.
   - For DSE students there will be 50 Marks institute level end semester examination.
2. During the course students will be submitting the online assignments. A copy of the same can be submitted as a part of term work for the corresponding Audit course. The cumulative marks obtained in

the online assignments shall be proportionately converted to a maximum of 25 marks for the purpose of term work assessment.

Course: Employability Skill Development-I				**Code: 25ETVSE201**
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Practical	2	1	Oral	Marks: 25

- **Prerequisites:** C Programming, Data Structures

- **Course Objectives:**
  1. To understand and implement basic data structures using programming.
  2. To develop programs for operations on arrays, stacks, queues, and linked lists.
  3. To implement searching and sorting algorithms and analyze their performance.
  4. To construct and perform operations on trees and graphs.

Course Outcomes: At the end of the course, students will be able to:
CO1: Implement basic data structures such as arrays, stacks, queues, and linked lists using programming.
CO2: Apply searching and sorting techniques to organize and retrieve data efficiently.
CO3: Construct operations on tree data structures such as Binary Search Trees.
CO4: Analyze and implement different data structure algorithms for solving computational problems.
CO5: Demonstrate the use of data structures through practical programming and virtual lab experiments.

List of Experiments (Any 10)

List of Experiments

1. Write a program to implement linear search and binary search algorithms to locate a target element in a dataset.
2. Write and execute programs to implement sorting algorithms such as Bubble Sort, Selection Sort, and Insertion Sort.
3. Student Database Management You are developing a student result management system. The database should support updating records, adding new entries, searching for specific students, and sorting based on performance. Using an array of structures, implement a student database with attributes: roll no, name, program, course, subject marks, total, and average. Support operations: dis- play, search, and sort. (Students can additionally perform modify, append.)
4. Stack or Queue using Array (Static Implementation) Simulate a parcel handling system at a post office where packages are stacked (LIFO) or queued (FIFO). Use an array to implement a stack (push, pop, display) or a queue (add, delete, dis- play). Choose the appropriate model based on the scenario.

5. Singly Linked List Operations You are building a text editor where lines of text are stored dynamically. You need to allow insertion and deletion of lines at any position, and display text both normally and in reverse. Use a singly linked list to implement: display, insert (front/end/middle), delete (front/end/middle), display in reverse, and reverse the list.
6. Binary Search Tree Operations an online directory system uses a BST to keep names in a sorted manner and support fast searching. Create a binary search tree and implement recursive traversals (inorder, preorder, pos- torder) and search for a specific name in the directory.
7. Graph Traversal You are designing a navigation system for a campus with multiple buildings. The system should explore possible paths (routes) using BFS or DFS. Create a graph using an adjacency matrix and implement Breadth-First Search and Depth-First Search to explore the building connectivity.
8. Stack or Queue using Linked List (Dynamic Implementation) Design a service window system where customers arrive and are served in order (FIFO), or a browser history system where the last visited page is accessed first (LIFO). Use a linked list to implement a dynamic stack (push, pop, display) or queue (add, delete, display) based on the given use case.
9. Balanced Parentheses or Decimal to Binary Write a program to check for balanced parentheses in a given expression (including (), {}, []) using a stack implemented with arrays or linked lists. OR write a program to convert a Decimal number to a binary number using a stack.
10. Height and Depth in BST Develop a program that constructs a Binary Search Tree and computes the height of the tree and the depth of a given node.
11. Count and Classify Nodes Write a program to count the number of: - Leaf nodes - Internal nodes - Nodes with only one child in a given binary tree.

Virtual Laboratories: Computer Science and Engineering: https://ds1-iiith.vlabs.ac.in

Course: Universal Human Values			Code: 25VEC201	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Tutorial	2	2	TW	50

- **Prerequisites:** The course requires openness to self-reflection and willingness to understand ethical and value-based perspectives in personal and professional life.

- **Course Objectives:**
  1. To help students understand the importance of human values in personal and professional life.
  2. To develop ethical awareness and responsible decision-making.
  3. To create harmony between individual, society, and nature.
  4. To encourage engineers to contribute towards sustainable and value-based development.

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

  CO1: Explain the concept of human values and self-exploration, and recognize their importance in personal life, professional life, and the role of engineers in society.

  CO2: Understand the importance of sustainable development, environmental responsibility, and ecological balance, and evaluate the impact of technology on society and nature.

  CO3: Apply values such as trust, respect, empathy, and responsibility to maintain harmony in family and society and practice ethical behavior in social interactions.

  CO4: Demonstrate professional ethics, value-based decision making, leadership, and teamwork in engineering practice for the welfare of society.

  CO5: Understand the relationship between self and body, differentiate their needs, and develop self-awareness and balanced lifestyle practices for personal well-being.

- **Course Contents:**

Unit I	Introduction to Human Values	6 Hours

Meaning and importance of human values, Basic needs of values, need for value based education in Engineering, Types of Human Values, Importance of human values to full fill happy and successful life, Values in personal life and professional life,, Factors affecting human values- Cultural, societal factors, personal factors , experiences, Concept of self-exploration, How to cultivate both values and skill in person's life that navigate him to face life's challenges and opportunities, Role of Engineer in society. Technology and values.

Unit II	Harmony in Nature	6 Hours

Understanding of harmony in Nature, Four orders of nature, Physical, Bio, Animal, Human order, interconnectedness and mutual fulfilment among four orders. Basic characteristic of nature, perseverance, bravery, Generosity, recyclability and self-regulation in nature, Holistic perception of harmony at all levels of existence, human being as a cause of imbalance in nature-pollution, depletion of resources, and role of technology in nature. Understanding existence of human being as a co-existence of mutually interacting units -in all pervasive space. Sustainable development, Environmental responsibility, Resource conservation, Ecological balance, Technology and its impact on society.

Unit III	Harmony in Family and Society	6 Hours

Family as the basic unit of society: role of family in developing values, mutual understanding, and responsibility. Values in relationships: trust, respect, affection, care, guidance, and gratitude in maintaining harmony in family and society. Ethical behaviour in society: honesty, responsibility, empathy, cooperation, and respect for diversity in social interactions.

Social harmony and responsible citizenship: duties and responsibilities of individuals towards society and community. Professional ethics and social responsibility: role of engineers and professionals in promoting ethical practices and sustainable development. Role of values in building a harmonious society: importance of value-based decision making in personal, social, and professional life.

Unit IV	Holistic Development and Professional Ethics	6 Hours

Holistic approach to life and education: integration of intellectual, emotional, ethical, and social development for balanced personal and professional growth. Human values and ethical principles: understanding honesty, integrity, empathy, responsibility, and respect in personal and social life. Professional ethics: ethical conduct in professional practice, integrity in work, accountability, and commitment to societal welfare. Ethical decision making: identifying ethical dilemmas and applying value-based reasoning in professional situations. Social and environmental responsibility of professionals: contribution of engineers and professionals towards sustainable development and societal well-being. Role of values in leadership and teamwork: importance of trust, cooperation, and ethical behaviour in professional environments.

Unit V	Harmony Between Self and Body	6 Hours

Understanding the Self and the Body: distinction between the conscious self (I) and the physical body. Self–body coexistence: relationship between the self as the experiencer and the body as the instrument of action. Needs of the self and the body: physical needs (food, rest, health) and psychological needs (happiness, values, purpose). Harmony in the individual: maintaining balance between mental well-being and physical health through responsible living. Role of self-awareness and self-regulation: understanding thoughts, emotions, and behaviour for a balanced life. Importance of healthy lifestyle: discipline, proper habits, and value-based living for overall well-being.

- **Activities for term work Evaluation:**
  1. Group Discussion on Human Values and Ethics
  2. Case Study Analysis on Ethical Issues in Society and Profession
  3. Reflective Journal Writing on Self-Development and Values
  4. Role Play / Skit on Social Responsibility and Moral Values
  5. Debate on Contemporary Ethical and Social Issues
  6. Community Service / Social Outreach Activity Report
  7. Seminar / Presentation on Professional Ethics and Leadership
  8. Essay Writing on Family Values, Harmony, and Responsibility
  9. Participation in Workshops, Expert Talks, and Value-Based Activities

- **Textbooks:**
  1. R. R. Gaur, R. Sangal, and G. P. Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019.
  2. R. R. Gaur, R. Sangal, and G. P. Bagaria, *Universal Human Values: Understanding Harmony*, AICTE Student Edition, Excel Books, New Delhi, 2020.

- **Reference Books:**
  1. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, 4th Edition, McGraw-Hill Education, 2005.
  2. Charles B. Fleddermann, *Engineering Ethics*, 5th Edition, Pearson Education, 2012.

- **MOOC / NPTEL Courses:**

1. Exploring Human Values – Visions of Happiness and Perfect Society by Prof. A. K. Sharma, IIT Kanpur: https://nptel.ac.in/courses/109104068
2. Moral Thinking – An Introduction to Values and Ethics by Prof. Vineet Sahu, IIT Kanpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_hs169
3. Human Values and Professional Ethics By Dr. Kounsar Jan, Deptt of education University of Kashmir: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg125
4. Universal Human Values by Reliance Foundation Skilling Academy: https://www.skillindiadigital.gov.in/courses/detail/d7db86f0-d2d8-42aa-a8c0-502467563b5a

Course: Community Engagement Project				Code: 25ETELC201
Teaching Scheme (Hours/Week)		Credit	Evaluation Scheme	
Practical	2	1	Term Work	Marks: 25

- **Prerequisites:**

1. It is an experiential learning approach that combines community service, community development, education and learning.
2. Project involves students in community development and service activities and applies the experience to personal and academic development.
3. The targeted contribution of college students to the village/local development will benefit the community.

- **Course Objectives:**

1. To establish a mutually beneficial relationship between the college and the community.
2. To opportunities to engage with their local community, fostering empathy, teamwork, and problem-solving skills while contributing positively to their surroundings.
3. To an understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
4. To apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
5. To evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact

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

CO1 - Identify and analyze local community needs and challenges by engaging with stake- holders and evaluating real-world problems.

CO2- Design and Implement practical, creative, and context-specific solutions using engineering principles to address community issues.

CO3 - Reflect and Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations.

- **Guidelines:**

1. A group of 3 to 4 students or a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.
2. Each group is allotted to a faculty member of the department as a mentor.
3. The group of students will be associated with a government official / village authorities /NGOs etc. concerned, allotted by the district administration, during the duration of the project.
4. The Community Engagement Project should be different from the regular programmes of NSS/NCC/Green Club/Hobby Clubs, Special Interests Groups etc.
5. An activity book has to be maintained by each of the students to record the activities undertaken/involved and will be countersigned by the concerned mentor/HoD.
6. Project report shall be submitted by each student/group of students.
7. An internal evaluation shall also be conducted by a committee constituted by the HoD.
8. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HoD.
9. Students' groups can conduct an awareness programme on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e- waste management or any other activity in an area of their studies and as per his/her aptitude.

- **List of topics:**

The below lists are not exhaustive and open for HoD's or mentors to add, delete or modify. It is expected that the focus should be on specific local issues in their nearby areas. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall.

- Use and/or miss-use of cell phones
- Career orientation of youth
- Water facilities and drinking water availability
- Health and hygiene of the school going students, home makers and old personals
- Health intervention and awareness programmes
- Horticulture Herbal and Nutrition
- Traditional and Modern health care methods
- Food habits
- Air /Sound /Water pollution
- Plantation and Soil protection
- Renewable energy and Solar Systems
- Yoga awareness and practice
- Health care awareness programmes and their impact
- Organic farming, IoT implementations
- Food adulteration
- Incidence of Diabetes and other chronic diseases
- Blood groups and blood levels
- Chemicals in daily life
- Music and dance
- Women education and empowerment

Project Scope:

- Conduct workshops or awareness drives on topics like digital literacy, environmental sustain- ability, mental health, or career planning for local stakeholders.
- Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.
- Promote health through awareness programs on hygiene, nutrition, and exercise.
- Teach basic computer or technical skills to students, staff, or the community

- **Text Books:**

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.

- **MOOC / NPTEL/YouTube Links:**

Ecology and Society https://onlinecourses.nptel.ac.in/noc20_hs77/preview

- **Web Links:**

1. UNESCO: Education for Sustainable Development https://www.unesco.org
2. EPICS (Engineering Projects in Community Service) https://engineering.purdue.edu/EPICS
3. Ashoka: Innovators for the Public https://www.ashoka.org
4. Design for Change https://www.dfcworld.com

SEMESTER-IV

Course: Signals & Systems			Code: 25ETPCC204
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**
Lecture	3	3	CCA: 20
			ISE: 30
			ESE: 50

- **Prerequisites:**
  Basic Mathematics (Calculus, Linear Algebra, Trigonometry and Exponential Functions) and Basic Electronics Engineering (for systems analysis)

- **Course Objectives:**

1. Introduce the concept and classification of signals and systems in both continuous-time (CT) and discrete-time (DT) domains.
2. Develop understanding of time-domain analysis of signals and systems.
3. Analyze Linear Time-Invariant (LTI) systems using convolution and system properties.
4. Understand frequency-domain representation of signals using Fourier analysis.
5. Apply Laplace Transform and Z-Transform for system analysis in CT and DT domains.

- **Course Outcomes:** After successful completion of the course, students will be able to:
  CO1: Compute operations on signals by classifying basic signals and systems
  CO2: Apply the knowledge of system classification and impulse response to find input output relation of LTI system using convolution
  CO3: Execute the CT signals in frequency domain using Fourier Transform
  CO4: Analyze the DT signals in frequency domain using Discrete Fourier Transform
  CO5: Analyze the DT system using Z Transform

- **Course Contents:**

Unit I	**Introduction to Signals & Systems**	**8 Hours**
Introduction to signals, Elementary signals, Continuous-time and discrete-time signals, Basic signal operations, classification of signals, Introduction to systems, System properties		
Unit II	**Time Domain Analysis of LTI Systems**	**8 Hours**
Linear Time-Invariant (LTI) systems, Impulse response and system representation, Convolution integral & convolution sum, Properties of convolution, Interconnection of LTI systems, Difference and differential equation representation of systems		
Unit III	**Fourier Analysis of Signals**	**8 Hours**
Fourier Transform (FT), Fourier Transform of common signals, Properties of Fourier Transform, Frequency Response.		
Unit IV	**Discrete-Time Frequency Domain Analysis**	**9 Hours**
DTFS, DTFT, Discrete Fourier Transform (DFT), Properties of DFT, Frequency Response, FFT, Radix 2 DIT, DIF algorithm.		
Unit V	**Z Transform**	**9 Hours**
Z-Transform, Region of Convergence (ROC), Properties of Z-Transform, Inverse Z-Transform, System analysis using Z-Transform, Stability and causality in Z-domain		

• Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA1	**List of Course Activity**	**10Marks**

1.**Signal Visualization using MATLAB/Python**
- Generate and visualize elementary CT and DT signals such as unit step, impulse, ramp, exponential and sinusoidal signals.
- Study operations like time shifting, scaling, folding, and amplitude scaling.

2.**Audio Signal Analysis using Fourier Transform**
- Record a speech/music signal and analyze its frequency spectrum using Fourier Transform.
- Compare frequency components of speech and musical signals.

3.**Convolution based System Simulation**
- Simulate convolution of input signals with impulse responses using MATLAB/Python.
- Observe the response of LTI systems for different inputs.

4.Mini Project on Digital Signal Processing Applications
- Develop a simple DSP application such as noise removal, echo generation, or audio filtering.

5.**Frequency Response Analysis of Filters**
- Study and compare low-pass, high-pass, band-pass, and band-stop filters using Fourier analysis.

6.Implementation of FFT Algorithm
- Implement Radix-2 DIT/DIF FFT algorithm and compare computational complexity with DFT.

7.Z-Transform based Stability Analysis
- Analyze stability and causality of discrete-time systems using pole-zero plots.

8.Real-Time Signal Acquisition using Sensors
- Acquire real-world signals from sensors (temperature/sound/light) using Arduino or similar platform and analyze them.

CCA2	**Case Study/Survey**	**11 Marks**

List of Case Study Topics:

1.Applications of Signals and Systems in Communication Engineering
- Study signal transmission, modulation, and filtering in communication systems.

2.Speech Processing Systems
- Analyze how signals and transforms are used in speech recognition and voice assistants.

3.Biomedical Signal Processing
- Study ECG/EEG signal acquisition and analysis using Fourier methods.

4.Image and Video Compression Techniques
- Understand the role of DFT and FFT in JPEG/MPEG compression.

5.Noise Reduction Techniques in Audio Systems
- Study practical filtering methods used in audio and mobile communication systems.

6.Applications of DSP in Radar and Sonar Systems
- Explore signal detection and processing techniques used in defense applications.

7.System Stability Analysis using Z-Transform
- Study practical applications of pole-zero analysis in control and DSP systems.

List of Surveys:

1.Survey on Applications of Fourier Transform in Daily Life

- Applications in mobile phones, Wi-Fi, image processing, and medical diagnosis.

2.Survey on DSP Processors and Modern Embedded Systems

- Compare DSP processors used in smartphones, automotive systems, and IoT devices.

3.Survey on Audio and Video Streaming Technologies

- Study signal compression and transmission methods used in OTT platforms.

4.Survey on AI Applications using Signal Processing

- Explore use of signal processing in AI-based speech and image recognition systems.

5.Survey on Communication Technologies

- Study 4G/5G communication systems and role of signal processing techniques.

6.Survey on Biomedical Instruments

- Analyze use of signals and systems concepts in medical instruments like ECG, MRI, and EEG.

CCA3	Group Discussion / Seminar / Blog Writing	10 Marks

List of Group Discussion Topics:

1.Importance of Signal Processing in Modern Technology
2.Analog Signals vs Digital Signals
3.Role of Fourier Transform in Communication Systems
4.Applications of DSP in Artificial Intelligence
5.Impact of 5G Technology on Signal Processing
6.Signal Compression Techniques in Multimedia Systems

List of Seminar Topics:

1.Applications of Fourier Transform in Engineering
2.Digital Signal Processing in Healthcare Systems
3.FFT Algorithms and their Engineering Applications
4.Signal Processing in Wireless Communication
5.Biomedical Signal Analysis using DSP
6.Real-Time DSP Applications in Robotics and Automation
7.Role of Z-Transform in Discrete-Time System Analysis

List of Topics for Blog Writing:

1.How Signals and Systems are Used in Smartphones
2.Fourier Transform: The Backbone of Modern Communication
3.Applications of DSP in Music and Audio Processing
4.Signal Processing Techniques in Medical Diagnosis
5.Understanding FFT and its Real-Life Applications
6.Role of Signals and Systems in Artificial Intelligence
7.Digital Communication and Signal Processing in 5G Networks

- **Text Books:**

1. Simon Haykin and Barry Van Veen, *Signals and Systems*, 2nd Edition, John Wiley & Sons (Wiley India), 2003.
2. Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab, *Signals and Systems*, 2nd Edition, Pearson Education, 1997.
3. B. P. Lathi, *Linear Systems and Signals*, 2nd Edition, Oxford University Press, 2005.

- **Reference Books:**

1. S. Nagoor Kani, *Signals and Systems*, 2nd Edition, McGraw Hill Education (India), 2013.
2. John G. Proakis and Dimitris G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and*

Applications, 4th Edition, Pearson Education, 2007.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, *Deep Learning*, MIT Press, 2016.
4. Charles L. Phillips, John M. Parr, and Eve A. Riskin, *Signals, Systems, and Transforms*, 5th Edition, Pearson Education, 2019.
5. P. Ramesh Babu and R. Anandanatarajan, *Signals and Systems*, 4th Edition, SciTech Publications (India), 2018.
6. P. Ramesh Babu, *Digital Signal Processing*, 7th Edition, SciTech Publications (India), 2018.

- **MOOC / NPTEL/YouTube Links:**
  1. NPTEL Course "Principles of Signals & System": https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee37
  2. Lecture Series on, "Signals & Systems": http://www.nptelvideos.in/2012/12/signals-and-system.html

Course: Principles of Communication Systems				Code:25ETPCC205
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:**
  Basic Electronics Engineering

- **Course Objectives:**

1. To equip/ familiarize students with basic fundamentals of communication systems.
2. To acquaint the students with the fundamental principles of modulation process and different amplitude and angle modulation systems.
3. To introduce the students with the concept of Sampling theorem and pulse modulation techniques PAM, PWM, PPM.
4. To impart pre-requisites of digital communication systems and explore digital representation techniques like PCM, DPCM, DM and ADM.

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

CO1: Describe the fundamentals of communication systems.
CO2: Apply amplitude modulation and demodulation techniques to analyze AM system performance.
CO3: Apply frequency modulation and demodulation techniques to analyze FM system performance.
CO4: Examine analog to digital conversion techniques and execute pulse modulation schemes for digital communication systems.
CO5: Interpret real-world applications of communication systems.

- **Course Contents:**

Unit I	Fundamentals of Communication System	9 Hours

Introduction to Communication System, Block Diagram of Communication System, Types of Communication System: Analog, Digital, Wired and Wireless, Regenerative repeaters, Types of Noise: External and Internal, Noise Calculations, Noise Figure, Concept of baseband and bandpass signals, Signal Energy and Energy Spectral Density, Signal Power and Power Spectral Density.

Unit II	Amplitude Modulation and Demodulation Techniques	9 Hours

Need of Modulation, Amplitude Modulation (AM), Types of AM, Modulation Index, Spectrum of AM, Double Sideband Suppressed Carrier (DSB-SC) Modulation, Single Sideband Modulation (SSB), Vestigial Sideband Modulation (VSB), Power Efficiency, Envelope Detection, AM receiver.

Unit III	Frequency modulation and demodulation Techniques	8 Hours

Concept of FM, Modulation index, Spectrum, bandwidth, power and Relationship between Phase Modulation (PM) and Frequency modulation, features of Bessel coefficient, Narrow band and wideband FM, FM modulator and demodulator-FM generation by Armstrong ’s method, FM detection using PLL.

Unit IV	Pulse Modulation Techniques	7 Hours

Need of analog to digital conversion, sampling theorem, Nyquist criteria, Types of sampling: Natural and Flat top. Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM)- Generation and Detection.

Unit V	Digital Representation of Analog Signals	7 Hours

Quantization of Signals: Quantization error, Uniform & Non-Uniform types of Quantization, Mid-rise & Mid-tread Quantizer. Companding: A-law & μ-law. Pulse Code Modulation system: Generation &

Reconstruction, Differential Pulse code modulation, Delta Modulation, Adaptive Delta Modulation.

• **Continuous Comprehensive Assessment (Any Two (CCA1 Compulsory)**		**20 Marks**
CCA 1	**List of Course Activity (Any One)**	**10 Marks**
1. Mini project – To build AM Transmitter 2. Mini project – To build FM Transmitter		
CCA 2	**Case Study/Group Discussion/Seminar**	**10 Marks**
1. Television Evolution 2. Advancement in communication (wired to wireless)		
CCA 3	**Group Discussion/Seminar**	**10 Marks**
Any topic from unit 1 to 5		

- **Text Books:**

1. Herbert Taub, Donald L. Schilling, and Goutam Saha, *Principles of Communication Systems*, 4th Edition, McGraw-Hill Education, 2013.

2. B. P. Lathi and Zhi Ding, *Modern Digital and Analog Communication Systems*, 4th Edition, Oxford University Press, 2009.

- **Reference Books:**

1. Bernard Sklar and Prabitra Kumar Ray, *Digital Communications: Fundamentals and Applications*, 2nd Edition, Pearson Education, 2009.
2. George Kennedy, Bernard Davis, and S. R. M. Prasanna, *Electronic Communication Systems*, 5th Edition, McGraw-Hill Education, 2013.
3. Wayne Tomasi, *Electronic Communications Systems: Fundamentals Through Advanced*, 5th Edition, Pearson Education, 2004.
4. A. Bruce Carlson, Paul B. Crilly, and Janet C. Rutledge, *Communication Systems: An Introduction to Signals and Noise in Electrical Communication*, 5th Edition, McGraw-Hill Education, 2010.
5. Simon Haykin, *Communication Systems*, 4th Edition, John Wiley & Sons, 2001.

- **MOOC/NPTEL:**

1. NPTEL course on Principles of Communication Systems - I, IIT Kanpur by Prof. Aditya Jagannatham: https://nptel.ac.in/courses/108104091
2. NPTEL course on Principles of Communication Systems – II by Prof. Aditya K. Jagannatham, IIT Kanpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ee73

Course: System Design Using Verilog and PLDs			Code: 25VDPCC201	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:**
  Electronic circuits and Digital Circuits

- **Course Objectives:**

1. To know FPGA Architecture and Interconnect.
2. To understand Digital System Design using FPGA.
3. To know different FPGAs and implementation methodologies.
4. To know configuration and implementation of digital embedded system.
5. To develop proficiency in Hardware Description Languages (HDL) such as Verilog/VHDL

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

CO1: Understand the FPGA Architecture

CO2: Implement FPGA design flow using tools such as Xilinx ISE/Vivado.

CO3: Develop and simulate combinational, sequential, and FSM-based digital designs using HDL (Verilog/VHDL).

CO4: Optimize FPGA-based designs of complex sequential digital circuits

CO5: Design and implement FSM-based applications and embedded system designs using FPGA technology.

- **Course Contents:**

Unit I	**Overview of FPGA Architectures and Technologies**	**09 Hours**

Introduction to FPGA Architecture, FPGA Architectural options, coarse vs fine grained, vendor specific issues, Antifuse, SRAM and EPROM based FPGAs, FPGA CLB logic cells, interconnection network, Programmable switch routing matrix and I/O Pads.

Unit II	**FPGA Design Flow**	**06 Hours**

FPGA design flow. Architecture design. Project design using Verilog Hardware Description Language (HDL). Defining testing methodology and test bench, design. RTL, synthesis, implementation, gate level design. Reusing of internal hard modules during design and implementation.

Unit III	**Verilog HDL**	**09 Hours**

Introduction to HDL, History of Verilog HDL, Coding Style: Lexical Conventions - Ports and Modules Operators - Gate Level Modeling - Data Flow Modeling - Behavioral Level Modeling - System Tasks & Compiler Directives - Test Bench -Tasks & Functions.

Unit IV	**Verilog Modelling**	**09 Hours**

Verilog Modelling of Combinational and Sequential Circuits: Behavioral, Data Flow and Structural Realization of Adders, Multiplexers, Comparators, Flip Flops, Shift Register, Realization of a Counter: Synchronous and Asynchronous, Pseudo Random LFSR (Linear Feedback Shift Register), Cyclic Redundancy Check.		
Unit V	**Synchronous Sequential Circuits**	**09 Hours**
Design examples: Sequence Generator, Sequence detector, Serial adder, Embedded system design using FPGAs, reconfigurable systems, Traffic light Controller, Real Time Clock, LCD Interfacing, Vending machine.		

• **Continuous Comprehensive Assessment (Any Two)**		**20 Marks**
CCA 1	**List of Course Activity**	**10 Marks**
1. Write simple Verilog code 16:1 MUX, using structural modelling style, simulate outputs, Observe waveform timing. 2. Write simple Verilog code for Universal Shift Register, simulate outputs, Observe waveform timing. 3. Write simple Verilog code for FSM.		
CCA 2	**Case Study/Survey**	**10 Marks**
List of Case Study: 1. FPGA in AI Applications 2. FPGA in Automotive Systems 3. FPGA in Communication Systems 4. FPGA in Image Processing		
CCA 3	**Group Discussion/Seminar/ Blog writing**	**10 Mark**
List of Course Seminar Topics: 1. Comparison of BJT and MOSFET in Analog Circuit Design 2. Frequency Response of Single Stage Amplifier 3. Audio Power Amplifiers 4. Role of Negative Feedback in Amplifier Performance 5. Analog Circuits in IoT Devices		
CCA 4	**Mini Project**	**10 Mark**
1. Digital Dice 2. LED Blinking 3. Running LED 4. Digital Counter 5. Password Lock System		

- **Textbooks:**

1. M. J. S. Smith, *Application-Specific Integrated Circuits*, Pearson Education, 2000.
2. Wayne Wolf, *FPGA-Based System Design*, Pearson Education, 2004.
3. J. Bhaskar, *A Verilog HDL Primer*, 3rd Edition, BS Publications, 2003

- **Reference Books:**

1. Samir Palnitkar, *Verilog HDL: A Guide to Digital Design and Synthesis* Prentice Hall, Second Edition, 2003
2. Clive Maxfield, *The Design Warriorss Guide to FPGAs*, Elsevier, 2004
3. S. Ramachandran, *Digital VLSI System Design: A Design Manual for implementation of Projects on FPGAs and ASICs Using Verilog*, Springer Publication, 2007
4. Wayne Wolf, *FPGA Based System Design*, Prentices Hall Modern Semiconductor Design Series

- **MOOC / NPTEL Courses:**
  1. NPTEL course on System Design Through Verilog, IIT Guwahati: https://nptel.ac.in/courses/108103179
  2. NPTEL course on Hardware modeling using Verilog https://onlinecourses.nptel.ac.in/noc20_cs63
  3. FPGA Architecture and Programming using Verilog HDL | Government of India : National Institute of Electronics & Information Technology

Course: Object Oriented Programming			**Code: 25AIMDM202C**	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	02	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Fundamentals of Programming Languages, C Programming

Course Objectives:

1. To make the students familiar with basic concepts and techniques of object-oriented programming.
2. To develop an ability to write programs for problem solving.
3. To make the students familiar with Templates, Namespaces and Exception Handling concepts to write programs.

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

CO1: Describe the principles of object-oriented programming.
CO2: Apply the concepts of data encapsulation, inheritance.
CO3: Understand Operator overloading and friend functions.
CO4: Apply the concepts of classes, methods inheritance and polymorphism to write programs.
CO5: Apply Templates, Namespaces and Exception Handling concepts to write programs.

- **Course Contents:**

Unit I	**Foundation of Object-Oriented Programming**	**6 Hours**

Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, need of object-oriented programming, fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism. Inline functions, Function overloading, call by value and call by reference, return by reference, functions with default arguments, this pointer, illustrative Simple Programs. Dynamic initialization of variables, memory management operators, Member dereferencing operators, operator precedence, typecast operators, Scope resolution operators.

Unit II	**Classes & Objects**	**6 Hours**

Defining class, Defining member functions, static data members, static member functions, private data members, public member functions, arrays of objects, objects as function arguments. Constructors and Destructors: types of constructors, handling of multiple constructors, destructors. (Complex Class & String Class)

Unit III	**Operator Overloading**	**6 Hours**

Fundamentals of Operator Overloading, Restrictions on Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading Unary Operators, Overloading Binary Operators, Overloading of operators using friend functions.

Unit IV	Inheritance & Polymorphism	6 Hours

Introduction to inheritance, base and derived classes, friend classes, types of inheritance, hybrid inheritance, member access control, static class, multiple inheritance, ambiguity, virtual base class, Introduction to polymorphism, pointers to objects, virtual functions, pure virtual functions, abstract base class, Polymorphic class, virtual destructors, early and late binding, container classes, Contained classes, Singleton class

Unit V	Templates, Namespaces and Exception handling	6 Hours

Templates: Introduction, Function template and class template, function overloading vs. function templates Namespaces: Introduction, Rules of namespaces Exception handling: Introduction, basics of exception handling, exception handling mechanism, throwing and catching mechanism, specifying exceptions, Multiple Exceptions, Exceptions with arguments streams, stream classes, unformatted I/O, formatted I/O and I/O manipulators

List of Activities:

Code Refactoring: Convert procedural language code into OOP style.

Basic Programs

1. Hello World: The classic first program to understand syntax and compilation.
2. Sum of Two Numbers: Input two integers and display their sum.
3. Simple Calculator: Perform addition, subtraction, multiplication, and division.
4. Even or Odd: Check whether a number is even or odd.
5. Factorial Program: Calculate factorial using loops or recursion.

Control Structures

1. Prime Number Check: Determine if a number is prime.
2. Fibonacci Series: Generate Fibonacci numbers using loops.
3. Reverse a Number: Reverse digits of an integer.
4. Palindrome Check: Verify if a number or string is a palindrome.
5. Armstrong Number: Check if a number is Armstrong (sum of cubes of digits equals the number).

Arrays & Strings

1. Array Sorting: Implement bubble sort or selection sort.
2. Matrix Addition: Add two matrices.
3. String Reversal: Reverse a string without using built-in functions.

- **Textbooks:**

1. E. Balagurusamy, *Programming with C++*, 3rd Edition, McGraw Hill Education (India), 2013.
2. Herbert Schildt, *C++: The Complete Reference*, 4th Edition, McGraw-Hill Education, 2003.

- **Reference Books:**

1. Robert Lafore, *Object-Oriented Programming in C++*, 4th Edition, Sams Publishing, 2001.
2. Matt Weisfeld, *The Object-Oriented Thought Process*, 4th Edition, Addison-Wesley Professional (Pearson), 2013.

- **MOOC / NPTEL Courses:**

  1. NPTEL Course on “Programming in C++” by Prof. Partha Pratim Das, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_cs02

Course: Leadership and Team Dynamics			Code: 25OEC202A	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Basic communication and interpersonal skills

- **Course Objectives:** The objectives of the course are-

1. Introduce concepts of leadership, organizational behavior, and group dynamics.
2. Develop communication, interpersonal, and collaborative leadership skills.
3. Explain leadership styles, motivation theories, and team processes.
4. Enhance conflict resolution, negotiation, and decision-making abilities.
5. Prepare students for leadership roles in multicultural and multidisciplinary organizations

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

CO 1. Explain leadership theories, organizational behavior, and group dynamics concepts.
CO 2. Apply communication and interpersonal skills in team environments.
CO 3. Analyze leadership styles, group processes, and motivational approaches.
CO 4. Evaluate team effectiveness, conflict management, ethics, and leadership challenges.
CO 5. Develop leadership strategies for professional and global organizational environments.

- **Course Contents:**

Unit I	**Foundations of Leadership and Organizational Behaviour**	**6 Hours**
Introduction to leadership and team management, Leadership versus management, Leadership myths and leadership development, Organizational behavior fundamentals, Groups and types of groups, Stages of group development, Emotional intelligence and self-awareness		
Unit II	**Leadership Theories and Leadership Development**	**6 Hours**
Trait and behavioural leadership theories, Situational and contingency leadership models, Path-goal theory and Leader-Member Exchange (LMX) theory, Transformational and transactional leadership, Power, influence, and persuasion, Leadership ethics, values, and credibility		
Unit III	**Communication, Motivation, and Interpersonal Behaviour**	**6 Hours**
Communication process and barriers, Verbal and non-verbal communication, social networks, rumors, and grapevine, Motivation theories and leadership, Transactional analysis and JOHARI Window, Coaching, mentoring, and feedback mechanisms		
Unit IV	**Team Dynamics and Conflict Management**	**6 Hours**
Group dynamics and team processes, Team formation and team effectiveness, Cooperation, competition, and cohesiveness, Delegation and empowerment, Conflict management and negotiation, Virtual and multicultural teams		
Unit V	**Organizational Ethics and High-Performance Leadership**	**6 Hours**
Organizational justice and ethical behavior, Corporate Social Responsibility (CSR), Positive organizational scholarship, Building trust and credibility in teams, High-performance team development, Global leadership and leadership challenges in modern organizations		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**

4. **Leadership Style Role Play**
   Students perform role plays demonstrating different leadership styles, communication approaches, and conflict management situations.
5. **Team Building & Group Dynamics Activity**
   Practical activities/games to study teamwork, cooperation, delegation, trust-building, and group decision-making.
6. **Case Study Analysis on Organizational Behaviour**
   Analyze real-life organizational situations related to motivation, leadership challenges, ethics, or team conflicts and present solutions.
7. **Communication & Negotiation Workshop**
   Hands-on practice sessions on verbal/non-verbal communication, negotiation skills, feedback mechanisms, and interpersonal behaviour.
8. **Self-Assessment & Leadership Development Report**
   Students prepare a report based on personality tests, emotional intelligence assessment, JOHARI window, or leadership skill evaluation with improvement plans.

- **Text Books:**

1. Hughes, R.L., Ginnett, R.C., & Curphy, G.J., Leadership: Enhancing the Lessons of Experience, 9th Edition, McGraw Hill Education, 2019.

- **Reference Books:**

1. Robbins, S.P., Judge, T.A. & Vohra, N., Organizational Behavior, 18th Edition, Pearson Education, 2019.
2. Parek, U. & Khanna, S., Understanding Organizational Behavior, 4th Edition, Oxford University Press, 2018.
3. Greenberg, J. & Baron, R., Behavior in Organizations, 10th Edition, Pearson-Prentice Hall, 2009.
4. Luthans, F., Organizational Behavior, 10th Edition, McGraw-Hill, 2004.
5. Cameron, K.S. & Spreitzer, G.M., The Oxford Handbook of Positive Organizational Scholarship, Oxford University Press, 2012.
6. Baron, R.A. & Byrne, D., Social Psychology, 10th Edition, Pearson Education, 2004.

- **MOOC / NPTEL Courses /Online Resources Online Resources:**

1. Organizational Behaviour: Individual Dynamics in Organization by Prof. Abraham Cyril Issac: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg20
2. Leadership and Team Effectiveness by Prof. Santosh Rangnekar: https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_mg39
3. Leadership & Management : https://swayam-plus.swayam2.ac.in/courses/course-details?id=F_WADHW_26
4. Harvard Business Review Leadership Resources : https://hbr.org/topic/subject/leadership-and-managing-people
5. https://www.edx.org/learn/leadership

Course: Green Practices & ESG Frameworks			Code: 25OEC202B	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Basic knowledge of environmental science and sustainability, Understanding of industrial processes and resource utilization, Basic awareness of corporate management and ethics

- **Course Objectives:** The Objectives of the Course are

1. To introduce the principles of sustainability and green practices in engineering and industry.
2. To understand Environmental, Social, and Governance (ESG) frameworks used in modern organizations.
3. To analyse environmental impacts and promote sustainable resource management.
4. To study social responsibility and governance practices for sustainable development.
5. To apply ESG reporting standards and sustainability assessment tools in organizations.

- **Course Outcomes:** After successful completion of the course, students will be able to:

CO1: Explain the concepts of sustainability, green practices, and ESG frameworks.

CO2: Analyse environmental impacts and adopt green technologies for sustainable development.

CO3: Evaluate social responsibility and stakeholder engagement practices in organizations.

CO4: Understand governance principles, ethical leadership, and regulatory frameworks.

CO5: Apply ESG reporting standards and sustainability assessment methods in industries.

- **Course Contents:**

Unit I	Fundamentals of Sustainability and Green Practices	6 Hours

Concept of sustainability and sustainable development, Environmental challenges: climate change, global warming, biodiversity loss, resource depletion, Principles of green practices and environmental responsibility, Green economy and circular economy concepts, Sustainable Development Goals (SDGs) and global sustainability initiatives, Sustainable consumption and production patterns, Role of engineering and technology in sustainable development, Importance of green practices in industrial and organizational activities.

Unit II	Environmental Sustainability and Green Technologies	6 Hours

Environmental sustainability and environmental protection strategies, Environmental Impact Assessment (EIA) and its importance, Carbon footprint analysis and greenhouse gas emissions, Carbon management strategies and carbon neutrality initiatives, Renewable energy technologies: solar, wind, hydro, biomass, Energy efficiency and energy conservation methods, Waste management techniques: reduce, reuse, recycle (3R concept), Water resource management and pollution control, Green manufacturing, eco-friendly materials, and cleaner production technologies

Unit III	Social Responsibility and Sustainable Development	6 Hours

Concept and importance of Corporate Social Responsibility (CSR), Employee welfare, workplace health, and safety standards, Labour rights and fair working conditions, Diversity, equity, and inclusion in organizations, Stakeholder engagement and community development initiatives, Social impact assessment and community sustainability programs, Ethical business conduct and responsible supply chain management, Role of organizations in social and economic development

Unit IV	Governance and Ethical Business Practices	6 Hours

Concept and principles of corporate governance, Governance structures and roles of board of directors, Transparency, accountability, and ethical leadership, Risk management and compliance mechanisms, Business ethics and anti-corruption policies, Legal and regulatory frameworks related to corporate governance, Sustainability governance and corporate responsibility policies, Governance practices for long-term organizational sustainability.

Unit V	ESG Reporting, Assessment, and Implementation	6 Hours

Introduction to ESG metrics and sustainability performance indicators, ESG reporting frameworks and standards, Global Reporting Initiative (GRI) guidelines, Integrated reporting and sustainability disclosure practices, ESG ratings, benchmarking, and performance evaluation, Green finance, sustainable investments, and climate finance, Implementation of ESG strategies in organizations, Challenges in ESG adoption and reporting, Case studies of ESG implementation in industries and multinational companies.

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**

1. **Campus Green Audit & Waste Segregation Study**
   Students conduct a sustainability audit of the campus/department by analysing waste generation, segregation practices, energy usage, and water consumption. Submit findings with improvement recommendations.
2. **Carbon Footprint Calculation Project**
   Students calculate the carbon footprint of a household, classroom, or small organization using standard carbon calculators and prepare a report suggesting carbon reduction strategies.
3. **ESG Reporting Case Analysis**
   Students select a company and study its ESG or sustainability report (based on GRI/SDG framework). Prepare a presentation evaluating environmental, social, and governance practices.
4. **Sustainable Product / Process Design Activity**
   Teams design an eco-friendly product, packaging solution, or green operational process applying principles of reduce–reuse–recycle and resource efficiency.
5. **Community Awareness & Social Responsibility Campaign**
   Organize and document an awareness activity such as tree plantation, plastic-free drive, energy conservation campaign, or social impact survey, followed by submission of outcomes and reflections.

- **Textbooks:**

1. Understanding Sustainability Principles and ESG Policies: Colin Read, Springer Nature, Year: 2023
2. The ESG and Sustainability Desk book for Business, Kristyn Noeth, Springer, 2024

- **Reference Books:**

1. Values at Work: Sustainable Investing and ESG Reporting, Daniel C. Esty, Todd Cort, Palgrave Macmillan, Year: 2020
2. Business Responsibility and Sustainability in India, Bimal Arora, Pawan Budhwar, Divya Jyoti Publisher**:** Palgrave Macmillan,Year: 2019
3. Looking at and Beyond Corporate Governance in India,Authors**:** Seema Joshi, Ruchi Kansil Publisher**:** Springer / Palgrave MacmillanYear: 2023
4. Dharmanomics: An Indigenous and Sustainable Economic Model,Author: Sriram Balasubramanian Publisher: Bloomsbury India,Year: 2024

- **MOOC / NPTEL Courses /Online Resources Online Resources:**
  1. Sustainability through Green Manufacturing Systems an applied approach, By Prof. Deepu Philip and Prof. Amandeep Singh, IIT Kanpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg85
  2. Sustainable Energy Technology By Prof. Sayak Banerjee, IIT Hyderabad: https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_me138
  3. Corporate social responsibility By Prof. Aradhna Malik, IIT Kharagpur : https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg54
  4. Implementing ESG and Sustainability in Business By Dr. Aditya Gupta, Indian Institute of Management, Bangalore: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb25_mg77
  5. Business Ethics and Corporate Governance By Dr. Sweta Banerjee, Dr. Leena Dam, Sri Balaji University, Pune: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb25_mg62

Course: Innovation and Business Strategy			Code: 25OEC202C	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Basic understanding of technology, creativity, and problem-solving concepts.

- **Course Objectives:** The objectives of the course are-

1. Introduce concepts of innovation, creativity, and business strategy.
2. Develop strategic thinking and innovation management skills.
3. Explain business models, entrepreneurship, and technology innovation processes.
4. Familiarize students with sustainability, intellectual property rights, and innovation ecosystems.
5. Prepare students for innovation-driven business and entrepreneurial environments

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

CO 1. Explain concepts of innovation, creativity, and business strategy.
CO 2. Apply innovation management and strategic thinking tools for business problem-solving.
CO 3. Analyze business models, technology innovation, and entrepreneurial strategies.
CO 4. Evaluate sustainability, intellectual property, and innovation management practices.
CO 5. Develop innovative business solutions and strategic growth approaches.

- **Course Contents:**

Unit I	**Foundations of Innovation and Creativity**	**6 Hours**
Innovation and creativity: concepts and importance, Innovation in the current business environment, Types of innovation, Schools of innovation, Challenges of innovation, Divergent and convergent thinking		

Unit II	**Innovation Management and Design Thinking**	**6 Hours**
Innovation management process, Idea management systems, Design thinking and entrepreneurship Experimentation and prototyping, Co-creation and idea championship, Incubation and entrepreneurship ecosystems		

Unit III	**Business Models and Strategic Innovation**	**6 Hours**
Business models and value proposition, Entrepreneurship and social entrepreneurship, Blue Ocean Strategy, Strategic positioning and competitive advantage, Business model failure: reasons and remedies, Innovation-driven business growth		

Unit IV	**Technology Innovation and Intellectual Property Rights**	**6 Hours**
Technology innovation process, Technology forecasting and planning, Technological innovation management strategies, Management of innovation, Intellectual Property Rights (IPR) Patents, copyrights, and patents in India		

Unit V	**Sustainable Innovation and Future Business Trends**	**6 Hours**
Sustainability innovation and entrepreneurship, Innovation for sustainable development, SME involvement in sustainability, Material efficiency and sustainable business models, Managing investors for innovation, Future markets and innovation opportunities for India		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**

1. **Innovation Idea Pitch Presentation**
   Students identify a real-world problem and present an innovative product, service, or business solution using creativity and design thinking tools.

2. **Business Model Canvas Workshop**
   Teams prepare a Business Model Canvas for a startup or sustainable business idea, explaining value proposition, customer segments, revenue streams, and competitive advantage.
3. **Prototype Development & Demonstration**
   Students create a basic prototype/mock-up of an innovative product or digital solution and demonstrate its functionality and market relevance.
4. **Case Study Analysis on Successful Innovations**
   Analyze companies known for innovation and strategy (e.g., startups or technology firms) and present factors behind their success, business strategy, and innovation practices.
5. **IPR & Patent Search Activity**
   Students perform a patent/trademark search related to a chosen innovation area and prepare a short report on intellectual property protection and commercialization opportunities.

- **Text Books:**

1. Krishnan, R.T. & Dabholkar, V., 8 Steps to Innovation: Going from Jugaad to Excellence, Harper Collins India.

- **Reference Books:**

1. Drucker, Peter F., Innovation and Entrepreneurship, Routledge.
2. Harvard Business Review Series, Innovation and Entrepreneurship, Harvard Business School Publishing.
3. Osterwalder, A. & Pigneur, Y., Business Model Generation, Wiley.
4. Kim, W. Chan & Mauborgne, Renée, Blue Ocean Strategy, Harvard Business Review Press.
5. Tidd, J. & Bessant, J., Managing Innovation, Wiley Publications.

- **MOOC / NPTEL Courses /Online Resources Online Resources:**

1. Innovation Business Models and Entrepreneurship by Prof. Vinay Sharma, Prof. Rajat Agrawal : https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg95
2. Entrepreneurship & IP strategy by Prof. Gouri Gargate : https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_hs213
3. Managing Innovation by Rishikesha T Krishnan and Vinay Dabholkar: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb19_mg05
4. Business Strategy Specialization by University of Virginia: https://www.coursera.org/specializations/business-strategy
5. Design Thinking for Beginners: Develop Innovative Ideas (Udemy): https://www.udemy.com/course/design-thinking-for-beginners/?couponCode=PMNVD2025
6. Strategic Management Resources : https://www.hbsp.harvard.edu/catalog/collections/strategic-management-resources
7. https://www.edx.org/learn/innovation

Course: Stress Management and Mental Well Being			Code: 25OEC202D
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**
Lecture	2 Hours/Week	2	CCA: 20
			ISE: 30
			ESE: 50

- **Prerequisites:** Basic awareness about personal health, emotions, and daily life challenges.

- **Course Objectives:**
  1. To introduce the concept of stress, mental health, and wellbeing.
  2. To help students identify stressors in academic and professional life.
  3. To develop effective coping strategies and stress management skills.
  4. To promote emotional intelligence and resilience.
  5. To encourage healthy lifestyle habits for long-term wellbeing.

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

  CO1: Explain the concepts of stress, mental health, and wellbeing

  CO2: Identify sources of stress and analyse their impact

  CO3: Apply stress management techniques

  CO4: Demonstrate emotional intelligence and coping strategies

  CO5: Design a personal wellbeing and stress management plan

- **Course Contents:**

Unit I	Fundamentals of Stress and Mental Health	6 Hours

Concept and definition of stress and mental wellbeing, Types of stress: Eustress and Distress, Stress response and General Adaptation Syndrome (GAS), Causes and symptoms of stress, Mind–body relationship, Impact of stress on academic performance and productivity. Difference between stress, anxiety, and depression.

Unit II	Sources of Stress and Emotional Awareness	6 Hours

Academic, professional, social, and personal stressors; Personality types and stress (Type A and Type B personality);
Emotional intelligence: Self-awareness, Self-regulation, Motivation, Empathy, Social skills; Identifying negative thinking patterns

Unit III	Stress Management Techniques	6 Hours

Relaxation techniques: Deep breathing, Progressive muscle relaxation; Meditation and mindfulness, Yoga and physical exercises for stress reduction, Time management and goal setting, Positive thinking and cognitive restructuring

Unit IV	Mental Wellbeing and Healthy Lifestyle	6 Hours

Importance of sleep, nutrition, and physical activity, managing emotions: anxiety, anger, frustration, Building resilience and self-confidence, Work–life balance, Digital wellbeing and social media stress

Unit V	Personal Development and Coping Strategies	6 Hours

Interpersonal communication and relationship management, Coping strategies for change and uncertainty, Conflict management and emotional regulation, Developing a personal wellbeing plan, Case studies on stress management in student and workplace environments.

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**

1. **Stress Diary & Self-Assessment Activity**
   Students maintain a weekly stress journal to identify stress triggers, emotional responses, and coping methods, followed by a reflective analysis report.
2. **Mindfulness and Relaxation Practice Session**
   Conduct guided activities such as meditation, deep breathing, yoga, or progressive muscle relaxation and submit observations on stress reduction outcomes.
3. **Case Study Analysis on Mental Wellbeing**
   Analyze real-life or workplace/student stress management cases and suggest coping strategies, emotional intelligence techniques, and wellbeing solutions.
4. **Work–Life Balance & Digital Wellness Survey**
   Students design and conduct a survey on stress, screen time, sleep, or work–life balance among peers, then present findings with recommendations.
5. **Personal Wellbeing and Stress Management Plan**
   Prepare an individual wellness plan including fitness, sleep, nutrition, time management, and emotional wellbeing strategies for long-term mental health improvement.

- **Textbooks:**

1. Leahy, Robert L. The Worry Cure. Three Rivers Press, 2006.
2. Carnegie, Dale. How to Stop Worrying and Start Living. Simon & Schuster, 1948.
3. Johnstone, Matthew. I Had a Black Dog. Robinson Publishing, 2005.

- **Reference Books:**

1. Goleman, Daniel. Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Books, 1995.
2. Kabat-Zinn, Jon. Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life. Hyperion, 1994.
3. Covey, Stephen R. The 7 Habits of Highly Effective People. Free Press, 1989.

- **MOOC / NPTEL Courses /Online Resources Online Resources:**

1. NPTEL course on Stress Management by Prof. Rajlakshmi Guha, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_hs163
2. NPTEL course on Psychology of Stress, Health and Well-being by Prof. Dilwar Hussain, IIT Guwahati: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs29

Course: French Language Module-II			Code: 25OEC202E	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	**CCA**	**20**
			ISE	**30**
			ESE	**50**

- **Prerequisites:** French Language Module-I

- **Course Objectives:** The objectives of the course are-
  1. To strengthen beginner-level communication skills in French.
  2. To improve listening, reading and writing abilities.
  3. To develop confidence in practical conversations.
  4. To introduce travel and public communication vocabulary.
  5. To prepare students for DELF A1 level competency.

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

  CO 1: Use basic French expressions confidently.
  CO 2: Understand simple dialogues and instructions.
  CO 3: Read and write short paragraphs.
  CO 4: Participate in guided conversations.
  CO 5: Apply French in practical situations.

- **Course Contents:**

Unit I	**Voyages (Travel)**	**6 Hours**
Talking about one's dream travel destination, the near future tense, Prepositions, Giving a reason (parce que / car)		

Unit II	**Au magasin… au restaurant (At the store… at the restaurant)**	**6 Hours**
Clothes and accessories , Shopping dialogues , French cuisine and some famous dishes , Restaurant communication		

Unit III	**La vie quotidienne (Daily life)**	**6 Hours**
Pronominal verbs, talk about one's routine, Talk about one's favourite outings, Conversation to plan outings		

Unit IV	**Quand j'était petie …(When I was little…)**	**6 Hours**
Past tense (Le passé compose), Talk about some activities in the past, Past continuous (L'imparfait) Talk about one's childhood		

Unit V	**La francophonie (The French-speaking world)**	**6 Hours**
Francophone countries, talking about seasons and climate, Expressing emotions, Conversations		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**
  1. **Shopping Role Play:** Students perform shopping conversations using French vocabulary and expressions.
  2. Restaurant Communication Activity: Students practice ordering food and interacting in French.
  3. Travel Conversation Simulation: Students perform dialogues related to travel and directions.

4. **Travel Conversation Simulation:** Students perform dialogues related to travel and directions.
5. **Paragraph Writing in French:** Students write short paragraphs on daily routines or hobbies.
6. **French Culture Presentation:** Students present information on French-speaking countries or traditions.

- **Text Books:**

1. Véronique M Kizirian, Emmanuelle Daill, Annie Berthet, Catherine Hugot, "Alter Ego+ (A1)", Hachette, ISBN: 9782011558107, (Goyal Publishers)
2. Nathalie Hirschsprung, Tony Tricot, "Cosmopolite 1-A1", Textbook +Workbook (2 Book Set) (Goyal Publishers), ISBN: 9788194434108

- **Reference Books:**

1. Annie Heminway, "Practice Makes Perfect: Complete French Grammar", McGraw-Hill Education, ISBN-13 : 978-1259642371
2. Claire Miquel, "Vocabulaire progressif du francais - Niveau debutant (A1)", Cle International, ISBN-13 : 978-2090380170, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002
3. Evelyne Siréjols, "Communication En Dialogues", CLE international, ISBN: 9782090380637 (Goyal Publishers)
4. Myrna Bell Rochester, "Easy French Step-By-Step: Master High-Frequency Grammar for French Proficiency—Fast", McGraw Hill, ISBN-13 : 978-0071453875
5. Claire Miquel, "Communication Progressive du Français A1", CLE International, Atlantic Publishers and Distributors (P) Ltd., 7/22, Ansari Road, Darya Ganj, New Delhi – 110002
6. Ranjit, Mahita & Singh, Monica, Apprenons le frangais', Part 2, Saraswati House Pvt. Ltd.,New Delhi. Second Revised Edition, 2007
7. Ranjit, Mahita & Singh, Monica, Cahier d'exercices', (Apprenons le francais) Part 2., Saraswati House Pvt. Ltd.,New Delhi. Second Revised Edition, 2007

- **MOOC / NPTEL Courses /Online Resources Online Resources:**

1. The Complete French Course : Learn French – Beginners : https://www.udemy.com/course/french-for-beginners-a1/?couponCode=PMNVD2025
2. Francés Introductorio: https://www.coursera.org/learn/frances-introductorio
3. Français Débutant A1 : https://www.coursera.org/learn/french-beginner
4. The Complete French Course : Learn French - Low Intermediate : https://www.udemy.com/course/the-complete-french-course-learn-french-low-intermediate/?couponCode=PMNVD2025
5. Complete French Course: Learn French for Beginners : https://www.udemy.com/course/complete-french-course/?couponCode=PMNVD2025

Course: German Language Module-II			Code: 25OEC202F	
Teaching Scheme (Hours/Week)		Credit	Evaluation Scheme	
Lecture	2	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** German Language Module-I

- **Course Objectives: The objectives of the course are-**

1. To strengthen beginner-level communication skills in German.
2. To improve reading, writing and listening abilities.
3. To develop confidence in practical conversations.
4. To introduce travel and public communication vocabulary.
5. To prepare students for Goethe A1 level competency.

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

CO 1: Use beginner-level German expressions confidently.
CO 2: Understand simple dialogues and instructions.
CO 3: Read and write short passages.
CO 4: Participate in practical conversations.
CO 5: Apply German in everyday situations.

- **Course Contents:**

Unit I	Wohnen und Leben (Housing and life)	6 Hours

Topics and Vocabulary: house (different types of houses and things inside a house), furniture, renting

Grammar: Accusative case, Definite, Indefinite articles in accusative case, Accusative case – Personal Pronouns, Accusative case – Possessive Pronouns

Skills: Speaking: describe room/home, Reading: advertisements, Writing: a message to friends to invite for celebration

Unit II	Stadt und Orientierung (City and Orientation)	6 Hours

Topics and Vocabulary: Places in city, means of transport, Directions, Travel, Planning and hotel booking

Grammar: Types of sentences and formation- statement, interrogative sentence, imperative sentence, Past tense formation- haben, sein

Skills: Speaking: asking/giving directions, listening: friends planning a trip, writing: My last trip, reading: trip blogs and experiences

Activity: Navigation task

Unit III	Essen und Trinken (Food and Drink)	6 Hours

Topics and Vocabulary: Food, Beverages, Restaurant expressions, Shopping and cooking

Grammar: Perfekt tense introduction - haben/sein, Adjectives

Skills: Reading and writing: food blogs, speaking: ordering food, expressing likes/dislikes

Activity: café role-play

Unit IV	Gesundheit und Körper (Health and body)	6 Hours

Topics and Vocabulary: Body parts, Symptoms, Medicine,

Grammar: Conjunctions, Modal auxiliary- function, usage, structure

Skills: Email writing/ message writing- unable to attend an event because of illness, Reading- health related small text,

Activity: doctor-patient conversations

Unit V	Intercultural Communication (Intercultural Communication)	6 Hours

Topics: German etiquette, punctuality, university culture, workplace culture

Skills: intercultural awareness, formal communication

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**

1. **Shopping Role Play:** Students perform shopping conversations using German vocabulary and expressions.
2. **Restaurant Communication Activity:** Students practice food ordering conversations in German.
3. **Travel Conversation Simulation:** Students perform dialogues related to travel situations and directions.
4. **Paragraph Writing in German:** Students write short paragraphs on familiar topics in German.
5. **German Culture Presentation:** Students present information about German-speaking countries and traditions.

- **Text Books:**

1. Stefanie Dengler, “Netzwerk A1 (Textbook + Workbook + Glossar)”, Hachette, ISBN: 9788183077033, (Goyal Publishers)
2. Kurs Und Ubungsbuch, “Studio-D A1 - Combo of 3 (German)”, Goyal Publishers & Distributers

- **Reference Books:**

1. Martin Durrell, “Hammer's German Grammar and Usage”, Fifth Edition: Volume 1, Hodder Education
2. Harriette Lanzer, Anne Lise Gordon, “German Vocabulary Builder”, OUP Oxford
3. Funk and Kuhn, “Studio D A1Deutsch Buch “, Cornelsen Verlag (Goyal Publishers India)

- **MOOC / NPTEL Courses /Online Resources Online Resources:**

1. DW Learn German: https://learngerman.dw.com/en/learn-german/s-9528
2. Practise German for free (Goethe-Institut Resources) : https://www.goethe.de/en/spr/ueb.html
3. Learn German Easily: https://learn-german-easily.com/
4. BBC Languages German: https://www.bbc.co.uk/languages/german/
5. Gothe Exam A1 practice material : https://www.goethe.de/ins/mm/en/spr/prf/gzsd1/ueb.html
6. Best Way to Learn German Language: Full Beginner (A1.1): https://www.udemy.com/course/best-way-to-learn-german-full-beginner-starter-kit/?couponCode=PMNVD2025
7. Best Way to Learn German Language: Beginner Level 2 (A1.2) : https://www.udemy.com/course/learn-german-for-the-advancing-beginner-a1-a2/?couponCode=PMNVD2025

Course: Japanese Language Module-II			Code: 25OEC202G	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	02	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Japanese Language Module-I

- **Course Objectives:**
  1. To strengthen beginner-level Japanese communication skills.
  2. To improve reading and writing abilities in Japanese.
  3. To develop confidence in practical conversations.
  4. To introduce travel and public communication vocabulary.
  5. Learn about Japanese festivals, food and travel.

- **Course Outcomes:** At the end of the course, students will be able to
  - CO 1. Communicate using beginner-level Japanese expressions.
  - CO 2. Understand short dialogues and passages.
  - CO 3. Read and write basic Japanese sentences.
  - CO 4. Participate in practical conversations.
  - CO 5. Apply Japanese in everyday situations.

- **Course Contents:**

Unit I	Kihon bunpō (tsudzuki) (Basic Grammar Continuation)	8 Hours
Katakana, Adjectives types, Particle usage, Katakana Pronunciation		
Unit II	**Jissen-tekina komyunikēshon (Practical Communication)**	**4 Hours**
Culture & Etiquette, Asking directions, Basic Communication		
Unit III	**Risuningu to supīkingu no sukiru (Listening and Speaking Skills)**	**6 Hours**
Pronunciation improvement, Listening comprehension, Dialogue practice, Group conversation		
Unit IV	**Yomikaki (Reading and Writing)**	**6 Hours**
Numbers, Dates & Time, Vocabulary enhancement, Translation practice		
Unit V	**Bunka-teki oyobi shakai-teki komyunikēshon (Cultural and Social Communication)**	**6 Hours**
Japanese culture and etiquette, social conversations, Telephone communication, Presentation activities		

- **List of Course Activities for Continuous Comprehensive Assessment (Any Two):**
  1. Shopping Role Play: Students perform shopping conversations using Japanese vocabulary and expressions.

2. **Restaurant Communication Activity:** Students practice ordering food and basic interaction in Japanese.
3. **Travel Conversation Simulation:** Students perform dialogues related to travel and directions in Japanese.
4. **Paragraph Writing in Japanese:** Students write short paragraphs on daily routines or hobbies.
5. **Japanese Culture Presentation:** Students present information about Japanese traditions or festivals.

- **Text Books:**

1. 3A Corporation, "Minna No Nihongo 1-1,1-2,2-1,2.2 Main Textbook elementary", ISBN-13: 9789388141147, Goyal Publishers & Distributors Pvt. Ltd, India
2. Banno Eri, "Genki: An Integrated Course in Elementary Japanese II Textbook [third Edition]", ISBN-13 : 978-4789017329, Japan Times

- **Reference Books:**

1. The Japan Foundation, "Marugoto: Japanese Language and Culture Starter A1 Coursebook for Communicative Language Activities", Goyal Publishers
2. The Japan Foundation, "Marugoto Starter (A1) Rikai - Course Book For Communicative Language Competences", Goyal Publishers, ISBN-13: 9788183078047
3. The Japan Foundation, "Marugoto Starter (A1) Katsudoo", Goyal Publishers
4. "Japanese for Busy People,3rd edition", Association for Japanese Language Teaching, Kodansha Tokyo Japan Kodansha International, November, 2011.,
5. Tae Kim, "A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar", Createspace Independent Pub, ISBN-13 : 978-1495238963, Bookswagon, 2/13 Ansari Road, Daryaganj, New Delhi 110002
6. Timothy G. Stout , Kaori Hakone, "Japanese Kanji for Beginners: (JLPT Levels N5 & N4) First Steps to Learn the Basic Japanese Characters", Tuttle Publishing UK, Verseas Press India Pvt Ltd.

- **MOOC / NPTEL Courses /Online Resources Online Resources:**

1. Online Japanese Beginner Course (Udemy): https://www.udemy.com/course/online-japanese-beginner-course
2. JF-Japanese e-learning : https://minato-jf.jp/
3. Introduction to Japanese Langauge : Prof Vatsala Misra (NPTEL): https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_hs83
4. Learn Japanese Language: Free Online Courses: https://www.busuu.com/en/course/learn-japanese-online
5. Marugoto Online : https://www.marugoto-online.jp/info/
6. JLPT N5 Practice Material: https://www.jlpt.jp/e/samples/sampleindex.html

Course: Signals & Systems Lab				Code: 25ETPCC204L
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Tutorial	1	1	Oral	Marks: 25

- **Prerequisites:**
  Basic Mathematics (Calculus, Linear Algebra, Trigonometry and Exponential Functions) and Basic Electronics Engineering (for systems analysis)

- **Course Objectives:** The course aims to

1. Introduce the concept and classification of signals and systems in both continuous-time (CT) and discrete-time (DT) domains.
2. Develop understanding of time-domain analysis of signals and systems.
3. Analyze Linear Time-Invariant (LTI) systems using convolution and system properties.
4. Understand frequency-domain representation of signals using Fourier analysis.
5. Apply Laplace Transform and Z-Transform for system analysis in CT and DT domains.

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

CO1: Compute operations on signals by classifying basic signals and systems
CO2: Apply the knowledge of system classification and impulse response to find input output relation of LTI system using convolution
CO3: Execute the CT signals in frequency domain using Fourier Transform
CO4: Analyze the DT signals in frequency domain using Discrete Fourier Transform
CO5: Analyze the DT system using Z Transform

List of Tutorials

1. A) Sketch and write mathematical expression for the following signals in Continuous Time (CT) and Discrete Time (DT)
a) Sine b) Rectangular c) Triangular d) Exponential e) Unit Impulse
f) Unit Step g) Ramp h) Signum i) Sinc h) Gaussian
B) Classify and find the respective value for the above signals if applicable
a) Periodic / Non-Periodic
b) Energy / Power /Neither
c) Even and Odd signal
2. Take any two CT and DT signals and perform the following operations:
Amplitude scaling, Addition, multiplication, differentiation, integration (accumulator for DT)
Time scaling, Time folding, Time shifting
3. Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time invariant, Invertible
4. Express any two system mathematical expressions in impulse response form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time invariant, Invertible.
5. Perform Convolution Integral of two Continuous time signals and Convolution Sum of any two Discrete Time signal. (Various Combinations can be taken for this.)
6. State and prove the various properties of CT Fourier Transform. Take rectangular and sinc signal as examples and demonstrate the applications of CTFT properties. Demonstrate the interplay between the time and frequency domain
7. State and prove the properties of Discrete Fourier Transform.
8. Radix 2 DIT & DIF butterfly structures to compute 2 point, 4 point, 8 point DFT
9. State and prove the properties of Z Transform. Take any example of a system in time domain and demonstrate the application of Z transform in system analysis.

Course: Principles of Communication Systems Lab				Code: 25ETPCC205L
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Practical	2	1	Practical	Marks: 25

- **Prerequisites:**
  Basic Electronics Engineering

- **Course Objectives:**
  1. Understand and implement analog and digital modulation techniques and analyze their performance parameters.
  2. Study signal sampling, encoding, and detection methods used in modern communication systems.
  3. Develop programming skills for analyzing communication system parameters such as SNR, Sampling and PCM companding.
  4. Explore practical communication hardware, measurement techniques, and system architectures used in real-world applications**.**

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

CO1: Analyze AM (DSB-FC) and FM signals.

CO2: Verify the Sampling Theorem in the time domain and examine the effects of under-sampling and over-sampling on signal reconstruction.

CO3: **Analyze** the generation and detection processes of Delta Modulation (DM) and Adaptive Delta Modulation

CO4: **Measure** the resonant frequency of different antennas using a **Vector Network Analyzer (VNA)**

List of Experiments (Any 10)

List of Experiments

1. AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal and Observe Spectrum.
2. Frequency modulator & demodulator using Varicap/Varactor Diode and NE 566 VCO, IC 565 (PLL based detection), calculation of modulation index & BW of FM.
3. Verification of Sampling Theorem in time domain (Flat top & Natural sampling).
4. Generation and Detection of PWM using IC 555
5. Study of DM: Generation and detection
6. Study of ADM: Generation and detection
7. Write a program to calculate Signal to noise ratio for PCM system & DM system
8. Write a program to demonstrate PCM Companding.
9. Write a program to Verify Sampling Theorem
10. Project based Learning / Poster Presentation Choose one communication application and presents the system architecture.
11. Measure resonant frequency for different Antenna using VNA.

Course: System Design Using Verilog and PLDs Lab				**Code: 25VDPCC201L**
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Practical	2	1	Practical	Marks: 25

- **Prerequisites:**
  Electronic circuits and Digital Circuits
- **Course Objectives:**
  1. To provide hands-on experience in FPGA design flow including simulation, synthesis, implementation, and hardware verification using tools such as Xilinx ISE/Vivado.
  2. To develop practical skills in HDL coding (Verilog/VHDL) for combinational and sequential digital systems.
  3. To implement digital systems on FPGA boards and interface them with external peripherals such as LEDs, switches, LCDs, and sensors.
  4. To analyze timing reports, resource utilization, and constraints (Design Summary) for optimizing FPGA designs.
  5. To design and test FSM-based applications

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

CO1: Write, simulate, and verify HDL programs for combinational and sequential circuits.

CO2: Perform synthesis, implementation, and generate bitstream files using FPGA development tools.

CO3: Design and implement FSM-based applications such as sequence detectors, traffic light controllers, vending machines on FPGA boards.

List of Experiments

Group A

1. To design, write test bench, simulate, synthesis, download and verify full adder.
2. To design, write test bench, simulate, synthesis, download and verify 4 bit ALU.
3. To design combinational digital logic circuit using structural modelling, write test bench, simulate, synthesis, download and verify.
4. To design, write test bench, simulate, synthesis, download and verify 8:1 Mux.
5. To design, write test bench, simulate, synthesis, download and verify 4-bit comparator.

. **Group B** (Any 5 experiments to be performed)

1. To design, write test bench and simulate JK, D and T flip flops.
2. To design, write test bench and simulate 4-bit counter.
3. To design, write test bench and simulate 4-bit shift register for SISO and SIPO modes.
4. To design, write test bench and simulate Moore Sequence Detector using FSM
5. To design, write test bench and simulate traffic light controller.
6. To design, write test bench and simulate Vending machine.

Virtual Laboratories:

Logic Design and Computer Organization Virtual Lab:
https://cse.iitkgp.ac.in/~chitta/coldvl/index.html

DLD with Verilog Virtual Laboratory: https://dldv-iiith.vlabs.ac.in

Course: Entrepreneurship/Economics/ Management Course-II				Code: 25HSM202
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Tutorial	2	2	Term work	Marks: 50

GUIDELINES FOR SELECTING HSM COURSE

1. HSSM courses shall be offered through Institute-approved Swayam/ NPTEL courses. The minimum duration of the course must be **8 weeks**.
2. Faculty mentor shall be allotted for individual courses and he/she shall monitor the progress for successful accomplishment of the course. Such monitoring is necessary for ensuring that the concept of self-learning is being pursued by the students 'in true letter and spirit'. The faculty has to register for the selected course as a course mentor.
3. Students shall complete the prescribed online lectures, assignments, and learning activities during the semester.
4. Swayam/ NPTEL certification examination is optional and students shall not be required to pay certification fees for successful completion of the course.
5. Any plagiarism, misrepresentation of course completion, or submission of forged certificates shall be treated as academic misconduct.
6. The decision of the Institute regarding course mapping, evaluation, and award of credits shall be final.

SELECTION OF HSSM COURSE

List of Courses to be opted (Any one) under HSSM-II

1. NPTEL course on Business Fundamentals for Entrepreneurs by Prof. Devdip Purkayastha, IIT Bombay : https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg11
2. NPTEL course on Entrepreneurship Essentials by Prof. Manoj Kumar Mondal, Department of Multidisciplinary IIT Kharagpur : https://nptel.ac.in/courses/127105007
3. NPTEL course on Financial Management for Managers by Prof. Anil K. Sharma, IIT Roorkee: https://nptel.ac.in/courses/110107144
4. NPTEL course on Business Intelligence and Analytics by Prof. Saji K Mathew, Department of Management Studies IIT Madras: https://nptel.ac.in/courses/106106361

Assessment of HSSM Course:

1. Term Work (50 Marks) shall be evaluated by the Faculty Mentor based on:
   - 25 Marks: NPTEL assignment score
   - 25 Marks: Institute level examination
   - For DSE students there will be 50 Marks institute level end semester examination.
2. During the course students will be submitting the online assignments. A copy of the same can be submitted as a part of term work for the corresponding Audit course. The cumulative marks obtained in the online assignments shall be proportionately converted to a maximum of 25 marks for the purpose of term work assessment.

Course: Employability Skill Development-II				Code: 25ETVSE202
Teaching Scheme (Hours/Week)		Credit	Evaluation Scheme	
Practical	2	1	Oral	Marks: 25

- **Prerequisites:**
  C Programming, Data Structures

- **Course Objectives:**

1. To understand and apply the basic concepts of Object-Oriented Programming.
2. To develop programs using classes and objects.
3. To implement OOP concepts such as inheritance, polymorphism, encapsulation, and abstraction.

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

CO1: Implement basic object-oriented programs using classes and objects.

CO2: Apply OOP concepts such as inheritance, polymorphism, encapsulation, and abstraction.

CO3: Develop programs using function overloading and operator overloading.

CO4: Demonstrate the use of file handling and exception handling.

CO5: Design and implement object-oriented solutions for real-world problems.

List of Experiments:

Group1: [Any Four to be performed]

1. Write a program to sort the numbers in an array using separate functions for read, display, sort and swap. The objective of this assignment is to learn the concepts of input, output, functions, call by reference.

2. Write a program that illustrates the concept of Function over loading.

3. Write a program to perform following operations on complex numbers Add, Subtract, Multiply, Divide, Complex conjugate. Design the class for complex number representation and the operations to be performed. The objective of this assignment is to learn the concepts classes and objects.

4. Write a program to implement Stack. Design the class for stack and the operations to be performed on stack. Use Constructors and destructors. The objective of this assignment is to learn the concepts classes and objects, constructors and destructors.

5. Write a program to overload unary operators for complex class. Group B: [Any Seven to be performed]

Group2: [Any Seven to be performed]

6. Write a program to perform following operations on complex numbers Add, Subtract, Multiply,

Divide. Use operator overloading for these operations. The objective of this assignment is to learn the concepts operator overloading.

7. Write a program to implement string class. Write constructors, destructor, Accepts function and Display function.

8. Write a program to implement string class. Write constructors, destructor, Accepts function and Display function. To overload = operator so as call copy constructor.

9. Write a program to implement containment concept using Employee, B Date, & String Classes.

10. Write a program to Read and Display the Information of Employee Using Multiple Inheritance. Use Basic Info and Department Info as a base class of employee class.

11. Write a program that illustrates run time polymorphism by using virtual functions.

12. Write a program which use try and catch for exception handling.

13. Write a program which to implement class and function template.

14. Write a program which to demonstrate use of namespace in the program.

15. Write a program which copies the contents of one file to another.

Virtual Laboratories:

Object Oriented Programing Laboratory: OOPS Lab | Indian Institute of Information Technology Bhagalpur

Course: Modern Indian Language (Marathi)			Code: 25AEC201A
Teaching Scheme (Hours/Week)	**Credit**	**Evaluation Scheme**	
Lecture 02	02	TW	25
		OR	25

- **Prerequisite:** No prerequisite required.

- **Course Objectives:**

अभ्यासक्रमाची उद्दिष्ट्ये:

१. प्रगत भाषिक कौशल्यांची क्षमता विकसित करणे.
२. प्रसारमाध्यमातील संज्ञापनातील स्वरूप आणि स्थान स्पष्ट करणे.
३. व्यक्तिमत्त्व विकास आणि भाषा यांच्यातील सहसंबंध स्पष्ट करणे
४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
५. प्रसारमाध्यमांची लेखनक्षमता विकसित करणे.

- **Course Outcomes:**

हा अभ्यासक्रम पूर्ण केल्यानंतर विद्यार्थी पुढील बाबी साध्य करू शकतील :

CO१. मराठी भाषेतील प्रगत भाषिक कौशल्यांचा प्रभावीपणे वापर करून संवाद साधू शकतील.
CO२. प्रसारमाध्यमांतील संज्ञापनाचे विविध प्रकार, स्वरूप व समाजातील त्यांचे स्थान स्पष्ट करू शकतील.
CO३. व्यक्तिमत्त्व विकासामध्ये भाषेचे महत्त्व ओळखून प्रभावी संवादकौशल्य विकसित करू शकतील.
CO४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांतील परस्परसंबंधांचे विश्लेषण करू शकतील.
CO५. प्रसारमाध्यमांसाठी विविध प्रकारचे लेखन कौशल्य आत्मसात करून प्रभावी लेखन करू शकतील.

- **Course Contents:**

Unit I	**घटक १**	**६ तास**

- मराठी भाषेची आविष्कार रूपे
- भाषा आणि व्यक्तिमत्त्व विकास: सहसंबंध
- लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे

Unit II	**घटक २**	**६ तास**

- वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितशोधन
- आकाशवाणीसाठी भाषणाची संहितालेखन
- दूरचित्रवाणीसाठी माहितीपटासाठी संहितालेखन
- समीक्षणात्मक लेखन: पुस्तक समीक्षण, चित्रपट समीक्षण

Unit III	**घटक ३**	**६ तास**

- भाषा, जीवन व्यवहार आणि नवमाध्यमे, समाजमाध्यमे
- नवमाध्यमे आणि समाजमाध्यमांचे प्रकार: ब्लॉग, फेसबुक, ट्विटर
- नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर, परिणाम

Unit IV	**घटक ४**	**६ तास**

- वेबसाईट आणि ब्लॉग, ट्विटरसाठी लेखन, ई-मेल
- व्यावहारिक लेखन कौशल्य : अर्जलेखन व पत्रलेखन

Unit V	घटक ५	६ तास

- अनुवाद कौशल्य (Translation): इंग्रजी किंवा इतर भाषांमधून मराठीत अनुवाद करणे.
- कथा/कादंबरी/संवाद लेखन: सर्जनशील साहित्याची निर्मिती, पटकथा आणि संवाद लेखन.

- **Textbooks:**

१. सायबर संस्कृती : डॉ. रमेश वरखडे
२. व्यावहारिक मराठी: डॉ. ल. रा. नसिराबादकर, फडके प्रकाशन, कोल्हापूर
३. उपयोजित मराठी : संपादक डॉ. केतकी मोडक, संतोष शेणई, सुजाता शेणई
४. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात , दीपक शिक्रापूरकर, उज्ज्वल मराठे, उत्कर्ष प्रकाशन, पुणे
५. व्यावहारिक मराठी, पुणे विद्यापीठ प्रकाशन, पुणे
६. प्रसारमाध्यमांसाठी लेखन कौशल्य, यशवंतराव चव्हाण मुक्त विद्यापीठ, नाशिक

Course activities for Term Work Evaluation

Subject teacher should frame minimum 10 assignments-based covering on all five units

1. सारांश लेखन (Summary Writing)

विद्यार्थ्यांनी उतारा वाचून स्वतःच्या शब्दात एक संक्षिप्त सारांश लिहावा.

Students read a passage and write a **short summary** in their own words.

2 . भाषांतर (Translation Assignment)

Students translate text from **English to Marathi**.

विद्यार्थ्यांनी इंग्रजी भाषेतील मजकूर मराठीमध्ये भाषांतरित करावा.

Example

- Short technical paragraph translation
- Daily communication sentences

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3. पत्र लेखन (Letter Writing)

विद्यार्थ्यांनी वेगवेगळ्या प्रकारची औपचारिक व अनौपचारिक पत्रे लिहावी

Types

- औपचारिक पत्र (Formal Letter)
- अनौपचारिक पत्र (Informal Letter)
- अर्ज लेखन

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4. **गट्क्रिया (Group Activity)**

विद्यार्थ्यांनी खालीलपैकी एक गट क्रियाकलाप करावा.

Example

- रोड शो
- स्किट प्ले
- एकांकिका

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5. सादरीकरण (Presentation Assignment)

विद्यार्थ्यांनी तंत्रज्ञान, पर्यावरण, सामाजिक इ . कोणत्याही एका विषयावर सादरीकरण करावे.

Students present a topic in Marathi.

Examples

- तंत्रज्ञानातील नवीन शोध

- पर्यावरण विषयक सादरीकरण

6. गटचर्चा (Group Discussion)

विद्यार्थ्यांनी गटांमध्ये एखाद्या विषयावर चर्चा करावी.

Students discuss a topic in groups.

Example Topics

- सोशल मीडियाचा प्रभाव
- ऑनलाइन शिक्षणाचे फायदे व तोटे

7. मराठी ब्लॉग लिहणे

विद्यार्थ्यांनी त्यांच्या अभ्यासाच्या क्षेत्रातील विकासावर २०० शब्दांपर्यंत ब्लॉग लिहून पोस्ट लिहून सोशल मीडियावर पोस्ट कराव्या.

Write blogs and posts on social media up to 200 words on recent development in their field of study.

8. पुस्तक परीक्षण (Book Review)

विद्यार्थ्यांना मराठी पुस्तक किंवा लेख वाचावे आणि त्यावर समीक्षा लिहावी.

Students read a Marathi book or article and write a **review**.

9. चित्रपट परीक्षण (Marathi film Review)

विद्यार्थ्यांनी उपलब्ध असलेला सामाजिक मराठी चित्रपट पाहावा आणि त्यावर समीक्षा लिहून, ती त्यांच्या आवडीच्या सोशल मीडियावर पोस्ट करावी.

Social Marathi movie available and write a review on post it on social media of their choice.

10. स्पर्धांमध्ये सहभाग (Participation in Competition)

पुरुषोत्तम, फिरोदिया, दाजीकाका गाडगीळ करंडक, आणि श्रीटेज करंडक या स्पर्धांमध्ये सहभाग नोंदवावा.Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak.

Course: Modern Indian Language (Sanskrit)				Code: 25AEC201B
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	OR	25
			TW	25

Prerequisites: Basic ability to read Devanagari script is helpful but not mandatory.

- **Course Objectives:**
  1. To introduce engineering students to the basic structure of the Sanskrit language.
  2. To highlight the relevance of Sanskrit in modern fields such as Computational Linguistics and Artificial Intelligence.
  3. To encourage appreciation of Indian Knowledge Systems and their applications in modern engineering and research**.**

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

CO1: Understand the basic structure, phonetics, and grammar of the Sanskrit language.
CO2: Construct simple Sanskrit sentences using basic grammatical rules.
CO3: Interpret selected Sanskrit verses related to science, mathematics, and philosophy.
CO4: Recognize the contributions of ancient Indian scholars to science and engineering.
CO5: Appreciate the relevance of Sanskrit in modern fields such as computational linguistics, knowledge

- **Course Contents:**

Unit I	**Introduction to Sanskrit Language**	**6 Hours**

Importance and historical development of Sanskrit, Characteristics of Sanskrit as a scientific language, Sanskrit alphabet (Varnamala): vowels and consonants, Pronunciation rules and phonetics, Basic introduction to Sanskrit grammar

- पठित अवबोधनम् | गद्यान्श् अपेक्षित कार्य : प्रश्नोत्तरामी तथा निर्देशानुसार कृतयः
- पठित अवबोधनम् | पद्यान्श

Unit II	**Basic Sanskrit Grammar**	**6 Hours**

Introduction to nouns (Subanta), Gender and number (Vachana), Case system (Vibhakti), Introduction to verbs (Dhatu), Present tense forms, Formation of simple sentences सन्धिकार्यम् समास प्रत्ययाः त्यकार अव्ययाः समय लेखनम् - अनुप्रयुक्त-व्याकरणम्

Unit III	**Reading and Interpretation of Sanskrit Texts**	**6 Hours**

Reading simple Sanskrit shlokas, Vocabulary building for scientific and technical terms, Translation of selected Sanskrit passages, Interpretation of verses related to logic, mathematics, and nature, Practice exercises in sentence construction and translation

Unit IV	**Reading and Interpretation of Sanskrit Texts**	**6 Hours**

Translation of selected Sanskrit passages, Interpretation of verses related to logic, mathematics, and nature Practice exercises in sentence construction and translation, लेखनकौशलम् वृत्तान्तलेखनम्, चित्रपटवर्णनम्, निबन्धलेखनम्

Unit V	**Sanskrit and Modern Science & Technology**	**6 Hours**

Sanskrit and computational linguistics
Logic and knowledge representation in Sanskrit texts
References to engineering concepts in ancient texts
Sanskrit terminology used in mathematics, astronomy, and architecture. Mathematical problems from **Lilavati** by **Bhaskara II**
Structure of Sanskrit grammar and its relevance to computer science
Applications of Sanskrit in modern research
Overview of Sanskrit influence on Artificial Intelligence and language processing

- **Textbooks:**

1. सरस्वती - मणिका संस्कृत व्याकरणम
2. नवम तथा दशम कक्षा 'मणिका' पुस्तकम
3. संस्कृत आल्हादः - दादशी कक्षा तथा निभन्धसोपन:

Reference Books:

1. Panini Ashtadhyayi – Panini
Selected Sanskrit texts related to science and mathematics.

Course activities for Term Work Evaluation

Subject teacher should frame minimum 10 assignments-based covering on all five units

1. Summary Writing: Students read a passage and write a short summary in their own words.
2. Translation Assignment: Students translate text from English to Sanskrit.
3. Short technical paragraph translation
4. Daily communication sentences
5. Letter Writing
6. Group Discussion
7. Book Review
8. Film review
9. Blog writing
10. Participation in a Competition

Course: Indian Constitution and Governance				Code: 25VEC202
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Tutorial	1	1	TW	25

- **Prerequisites:** Basic awareness of Indian history, civic studies at school level, and general understanding of social and political systems.

- **Course Objectives: The objectives of the course are**
  1. To introduce students to the philosophy, features, and framework of the Indian Constitution.
  2. To understand the structure, powers, and functions of the Union and State governments.
  3. To explain Fundamental Rights, Duties, and Directive Principles and their role in democracy.
  4. To familiarize students with constitutional bodies and governance mechanisms in India.
  5. To develop awareness of contemporary issues related to constitutional values, governance, and citizenship.

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

CO1. Explain the historical background, features, and structure of the Indian Constitution.
CO2. Describe Fundamental Rights, Directive Principles, and Fundamental Duties and their significance
CO3. Apply constitutional provisions to analyze the functioning of Union and State governments.
CO4. Analyze the role of constitutional and statutory bodies in Indian governance
CO5. Evaluate contemporary governance issues with reference to constitutional values and ethics.

- **Course Contents:**

Unit I	**Introduction to Indian Constitution**	**3 Hours**

Meaning and importance of Constitution Historical background and making of the Indian Constitution Salient features of the Indian Constitution Preamble: objectives and significance Citizenship – provisions and amendments

Unit II	**Fundamental Rights, Duties, and Directive Principles Fundamental Rights**	**3 Hours**

Types, scope and limitations Right to Equality, Freedom, Religion, Constitutional Remedies Directive Principles of State Policy – objectives and classification Fundamental Duties and their relevance Relationship between Fundamental Rights and DPSPs

Unit III	**Union and State Government Structure Union Government**	**3 Hours**

President, Vice-President, Prime Minister, Council of Ministers Powers and functions of Parliament State Government: Governor, Chief Minister, State Legislature Center–State relations: legislative, administrative, and financial

Unit IV	**Constitutional and Statutory Bodies Election Commission of India**	**3 Hours**

Composition, powers, and functions Union Public Service Commission (UPSC) and State Public Service Commissions (SPSC): roles and responsibilities Comptroller and Auditor General (CAG) of India: duties and significance in financial accountability Finance Commission: composition, functions, and role in centre–state financial relations Judiciary in India: structure, jurisdiction, and role of the Supreme Court and High Courts

Unit V	**Governance, Democracy and Contemporary Issues Concept of democracy and good governance Local self-government**	**3 Hours**

Panchayati Raj and Urban Local Bodies Constitutional amendments and landmark judgments Ethical governance and citizen participation Current issues related to Indian Constitution and governance

- **Activities for Term work Evaluation:**
  1. Group Discussion on Fundamental Rights and Duties

2. Debate on Constitutional and Contemporary Governance Issues
3. Case Study Analysis on Indian Judiciary and Landmark Judgments
4. Seminar / Presentation on Indian Constitution and Democratic Values
5. Poster Making on Fundamental Rights, Duties, and Good Governance
6. Essay Writing on Role of Citizens in Democracy and Nation Building
7. Mock Parliament / Mock Election Activity
8. Assignment on Constitutional Bodies and Their Functions
9. Field Visit / Report on Local Self-Government Institutions
10. Quiz / Awareness Activity on Indian Constitution and Governance Systems

- **Textbooks:**

1. M. V. Pylee, *An Introduction to the Constitution of India*, 6th Edition, Vikas Publishing House Pvt. Ltd., 2019.

2. D. D. Basu, *Introduction to the Constitution of India*, 26th Edition, LexisNexis Butterworths Wadhwa, 2021.

- **Reference Books:**

1. Granville Austin, *The Indian Constitution: Cornerstone of a Nation*, Oxford University Press, 1966 (Reprinted Edition).

2. Subhash C. Kashyap, *Our Constitution: An Introduction to India's Constitution and Constitutional Law*, National Book Trust, India, Revised Edition, 2019.

- **MOOC / NPTEL Courses:**

1. NPTEL1, Introduction to Indian Constitution, By Prof. Priyanca Mathur, Dr. Amrita Purkayastha, Dr. Sneha Yadav, JAIN (Deemed to be University), Bangalore : https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg151
2. NPTEL2, Constitution Law and Public Administration in India, By Prof. Sairam Bhat, National Law School of India University: https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_lw05
3. NPTEL3, Constitutional Studies, By Prof. Sudhir Krishnaswamy, National Law School of India University: https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_lw03
4. NPTEL4, Public Policy and Governance, By Dr. A. Sridhar Raj, Institute of Public Enterprise: https://onlinecourses.swayam2.ac.in/e-learning/preview/cec24_hs38

Course: Digital IC Design			**Code: 25VDHNR201**	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:**
  Electronics Circuits

- **Course Objectives:**

1. To understand MOS transistor operation, CMOS logic design, fabrication technology, and VLSI design methodologies.
2. To analyze MOSFET characteristics, CMOS inverter performance, and non-ideal device effects.
3. To evaluate timing, delay, power dissipation, reliability, and scaling aspects in VLSI circuits.
4. To study various VLSI circuit families and their applications in digital integrated circuit design.
5. To understand the organization and design of semiconductor memories and programmable logic

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

CO1: Describe basics of MOSFETs
CO2. Demonstrate issues related to the development of digital integrated circuits including fabrication, circuit design, implementation methodologies
CO3. Estimate delays in circuits.
CO4. Choose CMOS family for particular application.
CO5. Describe types of memories.

- **Course Contents:**

Unit I	**MOSFETs-I**	**8 Hours**

MOS transistors, CMOS logic, NAND gate, combinational logic, NOR gate, Compound gates, pass transistor and transmission gates, tristates, multiplexers, latches and flip flops, inverter cross section, fabrication process, Layout design rules, CMOS processing technology, CMOS Process enhancements, stick diagram, VLSI design flow, Euler path in a CMOS gate.

Unit II	**MOSFETs-II**	**8 Hours**

MOS transistor theory, working of NMOS enhancement transistor & PMOS enhancement transistor, Ideal Current voltage characteristics, threshold voltage , non-ideal current voltage effects, velocity saturation, mobility degradation, channel length modulation, Body effect, sub-threshold conduction, Junction leakage, Tunneling, Temperature dependence, Geometry dependence, Small signal AC characteristics, CMOS inverter DC transfer characteristics, Beta ratio effects, noise margin, Ratioed inverter transfer function, switch level RC delay models

Unit III	**Delay Models**	**8 Hours**

Delay estimation, RC delay models, linear delay model, logical effort, parasitic delay, Delay in a logic gate, delay in a multi stage logic networks, power dissipation, interconnect, design margin, Reliability, Scaling

Unit IV	**Circuit Families**	**8 Hours**

Circuit families, static CMOS, ratioed circuits, cascode voltage switch logic, dynamic circuits, pass transistor circuits, differential circuits, sense amplifier circuits, Bi-CMOS circuits

Unit V	**Memories**	**8 Hours**

Static Random Access Memory (SRAM), Dynamic Random Access Memory (DRAM), serial access memories, Content addressable memory Programmable logic arrays.

- **Text Books:**

  1.CMOS VLSI design: A Circuits and Systems Perspective 3rd Edition Neil H. E. Weste, David F. Harris, A. Banerjee, Addison Wesley Publication, 2008

- **Reference Books:**

1. CMOS Digital Integrated Circuits: Analysis and Design 3rd Edition Sung-Mo Kang,Yusuf Lebeleci McGraw-Hill Publications, 2002
2. Digital Integrated Circuits: A Design Perspective, 2nd Edition, Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic, Pearson Education.
3. CMOS Digital Integrated Circuits: Analysis and Design, 4th Edition, Sung-Mo Kang and Yusuf Leblebici, McGraw-Hill Education.

- **MOOC / NPTEL Courses:**

1. NPTEL course 1, CMOS Digital VLSI Design, By Prof. Sudeb Dasgupta|IIT Roorkee: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee85

2. NPTEL Course 2, VLSI Physical Design, By Prof. Indranil Sengupta|IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs50

- **Activities for CCA: Any Two**

1. Study the CMOS fabrication process and prepare a flowchart showing the sequence of fabrication steps
2. Design and draw transistor-level circuits of CMOS Inverter, NAND, and NOR gates and verify their truth tables.
3. Draw stick diagrams and layouts for CMOS logic gates using lambda-based design rules and identify Euler paths.
4. Simulate NMOS and PMOS enhancement transistors and plot their I-V characteristics using a suitable simulation tool.
5. Analyze the effects of threshold voltage, body effect, channel length modulation, and velocity saturation on MOSFET performance.
6. Study CMOS inverter DC transfer characteristics and determine switching threshold, noise margins, and beta ratio effects
7. Calculate propagation delay of CMOS logic circuits using RC delay models and compare analytical and simulated results.
8. Perform a case study on power dissipation, interconnect delay, scaling, reliability, and design margins in VLSI circuits.
9. Compare Static CMOS, Dynamic CMOS, Pass Transistor Logic, Differential Logic, and BiCMOS circuits based on speed, power, and area.
10. Study SRAM, DRAM, CAM, and PLA architectures and prepare a presentation/report highlighting their operation and applications.

Course: Advanced Digital System Design			Code: 25VDHNR202	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:**

Digital Electronics

- **Course Objectives:**

1. To understand the fundamentals of digital design and programmable logic devices (PLDs), CPLDs, and FPGAs.
2. To learn HDL-based design methodologies and the complete digital design flow.
3. To acquire knowledge of Verilog HDL syntax, constructs, and design principles.
4. To develop combinational and sequential digital circuits using Verilog modeling techniques.
5. To design, simulate, synthesize, and verify digital systems using Verilog HDL.

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

CO1: Explain the architecture, operation, and applications of PLDs, CPLDs, FPGAs, and finite state machines in digital system design.

CO2: Apply HDL-based design methodologies and design flow concepts for developing digital hardware systems.

CO3: Develop Verilog programs using appropriate syntax, data types, operators, modules, and test benches for digital circuit design.

CO4: Implement combinational logic circuits using various Verilog modeling styles such as dataflow, structural, and gate-level modeling.

CO5: Design and verify sequential logic circuits using behavioral modeling constructs, timing controls, procedural statements, and simulation techniques.

- **Course Contents:**

Unit I	**PLDs**	**8 Hours**
Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs.		
Unit II	**Design flow**	**8 Hours**
HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module.		
Unit III	**Verilog**	**8 Hours**
Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog & Testbench, Compilation and synthesis, Timing analysis		
Unit IV	**Verilog Modeling**	**8 Hours**

Data Flow Modelling, Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modelling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives.

Unit V	Verilog Modeling	8 Hours

Behavioral Modelling, Initial, Always, Procedural Assignment, Blocking and Non- Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign Deassign, Force Release, Latch Models, FF Models, State Machine Coding, Moore and Mealy Machines.

- **Activities for CCA: Any Two**

1. FPGA/PLD Architecture Study

Students study and compare the architecture and features of PAL, PLA, CPLD, and FPGA devices and submit a technical report.

2. Finite State Machine Design Assignment

Design Moore and Mealy state machines for real-life applications and verify state transitions using state diagrams.

3. Verilog Coding Exercises

Develop Verilog modules for basic combinational circuits such as multiplexers, encoders, decoders, comparators, and adders.

4. Digital Circuit Modeling Activity

Implement digital circuits using structural, dataflow, and behavioral modeling styles and compare the generated results.

5. Simulation and Testbench Development

Develop test benches for Verilog modules, perform simulation, and analyze timing waveforms.

6. Mini Project

Design and implement a small FPGA-based digital system such as a traffic light controller, vending machine controller, digital lock, or sequence detector.

7. Case Study

Study industrial FPGA applications in communication, embedded systems, AI accelerators, automotive electronics, or consumer products.

8. Seminar/Presentation

Present recent trends in FPGA technology, SystemVerilog, ASIC vs FPGA design, or reconfigurable computing.

- **Text Books:**

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd Edition, Pearson Education, 2003.
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", 3rd Edition, McGraw-Hill Education, 2014.
3. M. Morris Mano and Michael D. Ciletti, "Digital Design with an Introduction to the Verilog HDL", 6th Edition, Pearson Education, 2018.

- **Reference Books:**

1. Pong P. Chu, "FPGA Prototyping by Verilog Examples: Xilinx Spartan-3 Version", Wiley India, 2008.
2. Peter J. Ashenden, "The Designer's Guide to Verilog HDL", 2nd Edition, Morgan Kaufmann Publishers, 2002.

3. Charles H. Roth Jr. and Lizy Kurian John, "Digital Systems Design Using Verilog", Cengage Learning, 2014.

- **MOOC/ NPTEL:**

1. NPTEL course on Hardware Modeling using Verilog, IIT Kharagpur by Prof. Indranil Sengupta: https://nptel.ac.in/courses/106105165

2. NPTEL course on Digital System Design by Prof. Neeraj Goel|IIT Ropar: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee39

Course: Digital IC Design Laboratory			Code: 25VDHNR201L
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**
Practical	2	1	Practical / Marks: 25

- **Prerequisites:**

Course Objectives:

1. To analyze the characteristics and operation of MOS transistors and basic CMOS logic circuits.
2. To design, simulate, and analyze combinational and sequential CMOS digital circuits using VLSI CAD tools.
3. To develop skills in implementing and optimizing digital integrated circuit designs using CMOS and programmable logic techniques.

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

CO1. Demonstrate issues related to the development of digital integrated circuits including fabrication, circuit design, implementation methodologies
CO2. Solve complex circuit problems and optimization techniques
CO3. Design CMOS combinational, sequential logic design
CO4. Design programmable logic arrays

List of Experiments (Any 8)

1.a) Plot current voltage characteristics of NMOS transistor.
b) Plot current voltage characteristics of PMOS transistor.
2. To design and simulate CMOS inverter
3. A plot transfer characteristic of Pseudo-NMOS inverter with W/L for PMOS is equal to twice W/L of NMOS.
4. Design and simulate two input CMOS NAND gate
5. Design two input CMOS NOR gate.
6. Design CMOS transmission gate.
7. Design and simulate D-Latch using transmission gate
8. Design 2:1 MUX using transmission gate.
9. Design two input CMOS XOR gate
10. Design function f=not(A+B+C+D) using Euler path approach

Course: Advanced Digital System Design Laboratory			Code: 25VDHNR202L
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**
Practical	2	1	Practical — Marks: 25

- **Prerequisites:** Digital Circuits

Course Objectives:

1. To familiarize students with Verilog HDL syntax and various modeling styles for digital system design.
2. To develop the ability to design, simulate, and verify combinational and sequential logic circuits using modern EDA tools.
3. To provide hands-on experience in implementing finite state machines, switch-level circuits, and programmable digital systems using Verilog HDL.

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

CO1: Design and analyze combinational and sequential logic circuits.
CO2. Understand hardware description language and able to design and simulate digital systems using different abstraction levels
CO3. Understand and apply timing issues in multiple contexts and design the circuit.
CO4. Understand programmable devices and able to design digital systems using modern design tools

List of Experiments (Any 10)

1. Verilog Code using Bitwise Operator.Test it with test stimuli generated by test bench
2. Using GATE level primitive write Verilog code and test it with test stimuli generated by test bench
3. Verilog code using DATA flow modelling style. Test it with test stimuli generated by test bench
4. Write Verilog code using conditional assignment statement. Test it with test stimuli generated by test bench 5. Write Verilog code using Structural Modeling style. Test it with test stimuli generated by test bench
6. Verilog code using Behavioral modeling style. Test it with test stimuli generated by test bench
7. Write UDP for A. Combinational Circuit B. Sequential circuit
8. Write Verilog code using switch level modeling for a. NAND gate b. Full adder using transmission gate
9. Write Verilog code using while loop
10. Write Verilog code for Mealy and Moore sequence detector. (using overlapping allowed and not allowed)

Course: Digital Electronics			Code: 25VDMNR201	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	03	03	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:** Basic Gates, Number Systems and their Conversations

- **Course Objectives:**

1. To understand K-map and its use to the design the various applications of Combinational Digital Circuits.
2. To analyze Sequential Logic using flip flops and their applications viz. Counters, processes and implement logical operations.
3. To understand the concepts of Sequential Circuits and apply them in State Machines.
4. To understand the Digital Logic Families and System Design using Programmable Logic Devices.
5. To understand the concepts of VHDL and its fundamental applications.

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

CO1: Design Combinational Circuits.
CO2: Design Sequential Circuits.
CO3: Analyze FSM and ASM.
CO4: Design Digital System using PLDs.
CO5: Describe Fundamentals of VHDL.

- **Course Contents:**

Unit I	Combinational Logic Design	10 Hours

Definition of Combinational logic, Standard representations for logic functions, K-map representation of logic functions (SOP and POS forms), minimization of logical functions for min- terms and max-terms (upto 4 variables), don't care conditions.
Design Examples: Full adder, Full Subtractor, Code Converters -4 bit Binary to Gray, 2- bit Comparator, Multiplexers, multiplexer trees, Demultiplexers, Demultiplexer trees and 3: 8 Decoders.
Self-Study: Half Adder, Half Subtractor, BCD to Gray, BCD to Excess-3.

Unit II	Sequential Logic Design	09 Hours

1-Bit Memory Cell/latch, Clocked SR flip flop, J-K flip flop, M-S J-K flip flop, D and T flip flops. Use of Preset and Clear terminals in flip flops, Excitation Table for flip flops, Conversion of flip flops, Registers, Shift Registers, Counters: Ripple, Up/Down Counters, Synchronous Counters & its Design Examples (4 Bit)

Unit III	Finite State Machines	08 Hours

Moore and Mealy Machines, State diagram, State table, State reduction, State assignment, Design of Finite State Machine, Sequence Generators, Sequence Detector using flip flops. Introduction to Algorithmic State Machines-construction of ASM Chart and realization for Sequential Circuits.

Unit IV	Digital Logic Family and Programmable Logic Devices	07 Hours

Digital Logic Family: Performance parameters of Digital ICs- fan in, fan out, noise margin, propagation delay, power dissipation. Operation of TTL NAND gate, CMOS inverter, NAND, NOR gates. Comparison of CMOS and TTL.
Programmable Logic Devices: Detail architecture of PROM, PAL, PLA and Designing Combinational Circuits using PLDs. General Architecture and Specifications of FPGA and CPLD.

Unit V	Introduction to VHDL	07 Hours

Introduction to Library, Entity and Architecture Modeling styles, Data Objects, Concurrent and Sequential Statements, Design examples using VHDL for Basic Gates, Full Adder, 4:1 Multiplexer and D & T flip-flops using Behavioral Modeling style.

Self-Study: Design examples using VHDL for Full Subtractor, 1:4 De-multiplexer

- Continuous Comprehensive Assessment (Any two)

List of Course Activity

1. Quiz based on GATE questions.

Design and Simulation

Design and simulate different digital circuits. (Some of the examples are given below)
NOTE: Free Online Simulators like Circuit Verse can be used.

1. Design and Simulate Full Adder.
2. Design and Simulate Full Subtractor.
3. Design and Simulate 3 bit Binary to Gray Code Converter.
4. Design and Simulate 3 bit Gray to Binary Code Converter.
5. Design and Simulate digital comparator.
6. Design and Simulate 4:1 MUX using 2:1 MUX.
7. Design and Simulate 1:4 DEMUX using 1:2 DEMUX.
8. Minimize the given 4 variable function using K-map and simulate the same.

CASE STUDY

List of Case Study:

1. Digital Clock System.
2. Digital Code Lock System.
3. Electronic Voting Machine.
4. Digital Traffic Light Controller System.
5. ATM Security System.
6. Smart Parking System.
7. Error Detection Using Parity bits.

SURVEY

List of Surveys:

1. Combinational Logic Design Techniques.
2. Counters and Their Applications.
3. Analog vs Digital Systems Comparison.
4. Digital Electronics in Medical Devices.
5. Digital Electronics in Communication Systems.

- **Text Books:**

1. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill Publication
2. Thomas Floyd, "Digital Fundamentals", Pearson Publication, India

- **Reference Books:**

1. John. F. Wakerly, "Digital Design-Principles and Practices", Pearson Publication
2. M.M. Mano, "Digital Design," Prentice Hall India.
3. Stephen Brown, "Fundamentals of digital logic design with VHDL" Tata McGraw Hill Publication

- **MOOC / NPTEL Courses:**

MOOC / NPTEL Courses: **Digital Circuits by** Prof. Santanu Chattopadhyay|IIT Kharagpur**:**
https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee75

Course: System Design Using Verilog			Code: 25VDMNR202	
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

- **Prerequisites:**
  Electronic Circuits and Digital Circuits

- **Course Objectives:**

1. To know FPGA Architecture and Interconnect.
2. To understand Digital System Design using FPGA.
3. To know different FPGAs and implementation methodologies.
4. To know configuration and implementation of digital embedded system.
5. To develop proficiency in Hardware Description Languages (HDL) such as Verilog/VHDL

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

CO1: Understand the FPGA Architecture.

CO2: Implement FPGA design flow using tools such as Xilinx ISE/Vivado.

CO3: Develop and simulate combinational, sequential, and FSM-based digital designs using HDL (Verilog/VHDL).

CO4: Optimize FPGA-based designs of complex sequential digital circuits.

CO5: Design and implement FSM-based applications and embedded system designs using FPGA technology.

- **Course Contents:**

Unit I	Overview of FPGA Architectures and Technologies	09 Hours

Introduction to FPGA Architecture, FPGA Architectural options, coarse vs fine grained, vendor specific issues, antifuse, SRAM and EPROM based FPGAs, FPGA CLB logic cells, interconnection network, Programmable switch routing matrix and I/O Pads.

Unit II	FPGA Design Flow	06 Hours

FPGA design flow. Architecture design. Project design using Verilog Hardware Description Language (HDL). Defining testing methodology and test bench, design. RTL, synthesis, implementation, gate level design. Reusing of internal hard modules during design and implementation.

Unit III	Verilog HDL	09 Hours

Introduction to HDL, History of Verilog HDL, Coding Style: Lexical Conventions - Ports and Modules Operators - Gate Level Modeling - Data Flow Modeling - Behavioral Level Modeling - System Tasks & Compiler Directives - Test Bench -Tasks & Functions.

Unit IV	Verilog Modelling	09 Hours

Verilog Modelling of Combinational and Sequential Circuits: Behavioral, Data Flow and Structural Realization of Adders, Multiplexers, Comparators, Flip Flops, Shift Register, Realization of a Counter: Synchronous and Asynchronous, Pseudo Random LFSR (Linear Feedback Shift Register), Cyclic Redundancy Check.

Unit V	**Synchronous Sequential Circuits**	**09 Hours**

Design examples: Sequence Generator, Sequence detector, Serial adder, Embedded system design using FPGAs, reconfigurable systems, Traffic light Controller, Real Time Clock., LCD Interfacing, Vending machine.

• **Continuous Comprehensive Assessment (Any Two)**		**20 Marks**
CCA 1	**List of Course Activity**	**10 Marks**

1. Write simple Verilog code 16:1 MUX, using structural modelling style, simulate outputs, Observe waveform timing.
2. Write simple Verilog code for Universal Shift Register, simulate outputs, Observe waveform timing.
3. Write simple Verilog code for FSM.

CCA 2	**Case Study/Survey**	**10 Marks**

List of Case Study:

1. FPGA in AI Applications
2. FPGA in Automotive Systems
3. FPGA in Communication Systems
4. FPGA in Image Processing

CCA 3	**Group Discussion/Seminar/ Blog writing**	**10 Mark**

List of Course Seminar Topics:

1. Comparison of BJT and MOSFET in Analog Circuit Design
2. Frequency Response of Single Stage Amplifier
3. Audio Power Amplifiers
4. Role of Negative Feedback in Amplifier Performance
5. Analog Circuits in IoT Devices

CCA 4	**Mini Project**	**10 Mark**

1. Digital Dice
2. LED Blinking
3. Running LED
4. Digital Counter
5. Password Lock System

- **Textbooks:**
  1. M. J. S. Smith, *Application-Specific Integrated Circuits*, Addison-Wesley, 2000.
  2. Wayne Wolf, *FPGA-Based System Design*, Pearson Education, First Edition, 2004.
  3. J. Bhasker, *A Verilog HDL Primer*, 3rd Edition, BSP Books Pvt. Ltd., 2005.

- **Reference Books:**
  1. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis Prentice Hall, Second Edition, 2003
  2. Clive Maxfield, The Design Warrior's Guide to FPGAs, Elsevier, 2004

3. S. Ramachandran, Digital VLSI System Design: A Design Manual for implementation of Projects on FPGAs and ASICs Using Verilog Springer Publication, 2007
4. Wayne Wolf, FPGA Based System Design, Prentices Hall Modern Semiconductor Design Series

- **MOOC / NPTEL Courses:**
  1. NPTEL course on System Design Through Verilog, IIT Guwahati: https://nptel.ac.in/courses/108103179
  2. NPTEL course on Hardware modeling using verilog https://onlinecourses.nptel.ac.in/noc20_cs63

Course: Digital Electronics Lab				**Code:25VDMNR201L**
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Practical	**02**	**01**	**Practical**	Marks: **25**

Prerequisites: Basic Electronics Engineering Lab

- **Course Objectives:**

1. To Provide Hands-on experience in Designing and Implementing Combinational Logic Circuits such as Multiplexers, Decoders, Adders, Subtractors and Code Converters using standard Digital ICs.
2. To Develop the ability to Design and Analyze Sequential Logic Circuits including Counters, Shift Registers, and Pulse Generators and to interpret their timing behavior.
3. To Introduce basic Digital System Simulation using VHDL, enabling students to verify Combinational Logic Circuits through HDL-based modeling.

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

CO1: Design and Implement Combinational Logic Circuits using Multiplexers, Decoders and Arithmetic ICs, and verify their functionality using truth tables.

CO2: Design and Implement Sequential Logic Circuits such as Counters, Shift Registers, and Pulse Generators and interpret their operation using timing diagrams.

CO3: Develop and Simulate basic VHDL models of Digital Circuits such as Multiplexers and Adders for functional verification.

List of Experiments:

Group A: (Any 4)

1. a) Design and Implement 8:1 MUX using IC-74153 & Verify its Truth Table.
   b) Design & implement the given 4-variable function using IC-74153. Verify its Truth Table.
2. Design and implement full adder and full subtractor function using IC-74138.
3. Design and implement 3-bit Binary to Gray code converter and BCD to Excess-3 code converter using IC-74138.
4. Design and Implement 1-digit BCD adder using IC-7483.
5. Design and Implement 4-bit Binary adder and subtractor with mode control using IC-7483.

Group B: (Any 3)

6. Design and Implement MOD-N and MOD-NN using IC-7490 and draw Timing diagram.
7. Design & Implement Up/down Counter with mode control using IC-74191 / IC-74193.Draw Timing Diagram.
8. Design and Implement 4-bit right shift and left shift register using D-flip flop IC-7474.
9. Design and Implement Pulse train generator using IC-74194 / IC-7495 (Use right/left Shift).
10. Design and Implement 4-bit Ring Counter / Twisted ring Counter using shift registers IC-74194 / IC-7495.

Group C: (Any 1)

11. Simulate VHDL code for 4:1 multiplexer & 1:4 Demultiplexer.
12. Simulate VHDL code for Hall Adder and Half Subtractor.

Virtual Laboratories:

1. Digital Applications Lab: https://da-iitb.vlabs.ac.in/List%20of%20experiments.html
2. Hybrid Electronics Lab: https://he-coep.vlabs.ac.in/List%20of%20experiments.html

Course: System Design Using Verilog Lab				**Code: 25VDMNR202L**
Teaching Scheme (Hours/Week)		**Credit**	**Evaluation Scheme**	
Practical/Tutorial	2	1	Practical	Marks: 25

- **Prerequisites:**
  Electronic Circuits and Digital Circuits
- **Course Objectives:**
  1. To provide hands-on experience in FPGA design flow including simulation, synthesis, implementation, and hardware verification using tools such as Xilinx ISE/Vivado.
  2. To develop practical skills in HDL coding (Verilog/VHDL) for combinational and sequential digital systems.
  3. To implement digital systems on FPGA boards and interface them with external peripherals such as LEDs, switches, LCDs, and sensors.
  4. To analyze timing reports, resource utilization, and constraints (Design Summary) for optimizing FPGA designs.
  5. To design and test FSM-based applications

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

CO1: Write, simulate, and verify HDL programs for combinational and sequential circuits.

CO2: Perform synthesis, implementation, and generate bitstream files using FPGA development tools.

CO3: Design and implement FSM-based applications such as sequence detectors, traffic light controllers, vending machines on FPGA boards.

List of Experiments (Any 8)

Group A

1. To design, write test bench, simulate, synthesis, download and verify full adder.
2. To design, write test bench, simulate, synthesis, download and verify 4 bit ALU.
3. To design combinational digital logic circuit using structural modelling, write test bench, simulate, synthesis, download and verify.
4. To design, write test bench, simulate, synthesis, download and verify 8:1 Mux.
5. To design, write test bench, simulate, synthesis, download and verify 4-bit comparator.

Group B to design, write test bench and simulate JK, D and T flip flops.

6. To design, write test bench and simulate 4 bit counter.
7. To design, write test bench and simulate 4 bit shift register for SISO and SIPO modes.
8. To design, write test bench and simulate Moore Sequence Detector using FSM
9. To design, write test bench and simulate traffic light controller.
10. To design, write test bench and simulate Vending machine.

Virtual Laboratories:

1. Logic Design and Computer Organization Virtual Lab: https://cse.iitkgp.ac.in/~chitta/coldvl/index.html
2. DLD with Verilog Virtual Laboratory: https://dldv-iiith.vlabs.ac.in

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Dean Academics

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