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, Electrical Engineering 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:

To be an excellent learning centre in Electrical Engineering providing long term benefits to the society

Mission:

- To impart knowledge in the field of Electrical Engineering using contemporary learning tools
- To promote research culture among students and faculty
- To serve society with deep awareness of social responsibility and ethics
- To collaborate with industry for value addition in academics

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 modeling 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, modeling, 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 modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The Engineer and The World: Analyze 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 Electrical engineering graduate will be able to:

- **PSO1**: Demonstrate comprehensive knowledge and technical competence in analyzing and solving problems related to Power and Energy Systems, Control and Drives.
- **PSO2:** Obtain industrial exposure through internship and hands-on training, enabling them to apply theoretical knowledge to real-world engineering practices and adapt to modern technologies.
- **PSO3:** Exhibit their abilities of soft skills and self-learning skills through teamwork, while emphasizing professional ethics.

Program Educational Objectives (PEOs)

- **PEO1:** Our graduates will be technically competent to solve engineering problems and demonstrate leadership skills at their chosen workplace.
- **PEO2**: Our graduates will exhibit professional and managerial skills while working in professional organizations and simultaneously acquire higher education as per the job needs.
- **PEO3:** Our graduates will be sensitive to the contemporary techno - social issues and committed to serve the society locally and globally with strong ethics

B.Tech. Degree Options as per NEP

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

(b) B.Tech. Honors 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.

(c) B.Tech. Honors 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.

(d) 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 Electrical Engineering. A student will be eligible to get Undergraduate degree with Honors 18 to 20 credits, Double Minor for 18 to 20 credits and Multidisciplinary Minors for 14 credits, if he/she completes additional credits.

C. Exit:

A student will be eligible to get Diploma in Electrical Engineering 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. Electrical Engineering (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. Electrical Engineering (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: Electronics

Semester	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
SEM-3	25ETMDM201B	Signals and Systems	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-4	25ETMDM202B	Microcontroller and embedded systems	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-5	25ETMDM301B	Power Electronics	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-5	25ETMDM301BL	Power Electronics	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-6	25ETMDM302B	Embedded System Applications	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-7	25ETMDM401B	Fundamentals of Artificial Intelligence & Machine Learning (AI & ML)	2	-	-	20	30	50	-	-	-	100	2	-	-	02
SEM-8	25ETMDM402B	AI Applications in Electrical Engineering	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Total			**14**	**8**	**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 Behavior	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	Foreign Language Module– I	Foreign Language Module– II	Foreign Language Module -III
	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: Electric Vehicle (EV) Technology

Semester	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
SEM-3	25ELHNR201	Fundamentals of EV	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-3	25ELHNR201L	Fundamentals of EV Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-4	25ELHNR202	EV Drive Systems	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-4	25ELHNR202L	EV Drive Systems Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-5	25ELHNR301	Energy storage systems for EV	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-5	25ELHNR301L	Energy storage systems for EV Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-6	25ELHNR302	EV standards regulation and economics	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-6	25ELHNR302L	EV standards regulation and economics Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
SEM-7	25ELHNR401	EV Design, Integration and Applications	2	-	-	20	30	50	-	-	-	100	2	-	-	02
Total			**14**	**8**	**0**	**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 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: Renewable Energy systems

Semester	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
SEM-3	25ELMNR201	Renewable Energy Sources for Sustainable Development	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-3	25ELMNR201L	Renewable Energy Sources for Sustainable Development Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-4	25ELMNR202	Solar Photovoltaic Systems	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-4	25ELMNR202L	Solar Photovoltaic Systems Lab		2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-5	25ELMNR301	Wind Energy Conversion Systems	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-5	25ELMNR301L	Wind Energy Conversion Systems Lab	-	2	-	-	-	-	25	-	-	25	-	1	-	01
SEM-6	25ELMNR302	Power Electronics and Control for RES	3	-	-	20	30	50	-	-	-	100	3	-	-	03
SEM-6	25ELMNR302L	Power Electronics and Control for RES Lab	-	2	-	-	-	-	-	25	-	25	-	1	-	01
SEM-7	25ELMNR401	Renewable Energy: Policies, Planning & Audit	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. Electrical Engineering (2025 Pattern)

Curriculum Structure: Semester III

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 (PCC)	25ELPCC201	Electrical Machines – 1	3	-	-	20	30	50	-	-	-	**100**	3	-	-	03
	25ELPCC202	Power System Engineering	3	-	-	20	30	50	-	-	-	**100**	3	-	-	03
	25ELPCC203	Analog & Digital Electronics	3	-	-	20	30	50	-	-	-	**100**	3	-	-	03
Multidisciplinary Minor (MDM)	25ETMDM201B	Multidisciplinary Minor-I	2	-	-	20	30	50	-	-	-	**100**	2	-	-	02
Open Elective Course (OEC)	25OEC201	Open Elective Course-I	2	-	-	20	30	50	-	-	-	**100**	2	-	-	02
Program Core Course Lab	25ELPCC201L	Electrical Machines – 1 Lab	-	2	-	-	-	-	25	-		**25**	-	1	-	01
Program Core Course Lab	25ELPCC202L	Power System Engineering Lab	-	2		-	-	-	25	-	-	**25**	-	1	-	01
Program Core Course Lab	25ELPCC203L	Analog & Digital Electronics Lab	-	2	-	-	-	-	-	25	-	**25**	-	1	-	01
Vocational and Skill Enhancement Course (VSEC)	25ELVSE201	Vocational and Skill Enhancement Course-I	-	2	-	-	-	-	25		-	**25**	-	1	-	01
Entrepreneurship/Economics/ Management Courses (HSSM)	25HSM201	Entrepreneurship/Economics/ Management Course-I	-	-	2	-	-	-	-	-	50	**50**	-	-	2	02
Value Education Course (VEC)	25VEC201	Universal Human Values	-	-	2	-	-	-	-	-	50	**50**	-	-	2	02
Community Engagement Project (ELC)	25ELELC201	Community Engagement Project	-	2	-	-	-	-	-	-	25	**25**	-	1	-	01
Total			**13**	**10**	**04**	**100**	**150**	**250**	**75**	**25**	**125**	**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-I:

Sr. No.	Course Code	Course Name
1.	25ETMDM201B	Signals and Systems

Open Elective-I

Sr. No.	Course Code	Course Name
1.	25OEC201A	Principles of Management and Organizational Behavior
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.	25ELVSE201	Python Based Programming of Numerical Methods

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. Electrical Engineering (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 (PCC)	25ELPCC204	Electrical Measurement and Instrumentation	3	-	-	20	30	50	-	-	-	**100**	3	-	-	03
	25ELPCC205	Network Analysis	3	-	1	20	30	50	-	-	-	**100**	3	-	-	03
	25ELPCC206	Applied Engineering Mathematics	3	-	-	20	30	50	-	-	-	**100**	3	-	-	03
Multidisciplinary Minor (MDM)	25ETMDM202B	Multidisciplinary Minor-II	2	-	-	20	30	50	-	-	-	**100**	2	-	-	02
Open Elective Course (OEC)	25OEC202	Open Elective Course-II	2	-	-	20	30	50	-	-	-	**100**	2	-	-	02
Program Core Course Lab	25ELPCC204L	Electrical Measurement and Instrumentation Lab	-	2		-	-	-	25	-	-	**25**	-	1	-	01
Program Core Course Lab	25ELPCC205L	Network Analysis Lab	-	2	-	-	-	-		25	-	**25**	-	1	-	01
Vocational and Skill Enhancement Course (VSE)	25ELVSE202	Vocational and Skill Enhancement Course-II	-	2	1	-	-	-	-	25	25	**50**	-	2	-	02
Ability Enhancement Course (AEC)	25AEC201	Modern Indian Language (MIL)	2	-	-	-	-	-	-	25	25	**50**	2	-	-	02
Entrepreneurship/Economics/ Management Courses (HSSM)	25HSM202	Entrepreneurship/Economics/ Management Course-II	-	-	2	-	-	-	-	-	50	**50**	-	-	2	02
Value Education Course (VEC)	25VEC202	Indian Constitution and Governance	-	-	1	-	-	-	-	-	25	**25**	-	-	1	01
	Total		**15**	**06**	**05**	**100**	**150**	**250**	**50**	**50**	**125**	**725**	**15**	**04**	**03**	**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.	25ETMDM202B	Microcontroller And Embedded Systems

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.	25ELVSE202	Electrical Workshop

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: Electrical Machines – 1				Code: 25ELPCC201
Teaching Scheme (Hrs /Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:

1. Basic concepts of electrical circuits, Ohm's law, Kirchhoff's laws and AC fundamentals.
2. Knowledge of magnetic circuits, electromagnetic induction and alternating quantities.
3. Understanding of single-phase and three-phase power systems.
4. Familiarity with electrical measuring instruments and power calculations.
5. Basic understanding of electrical machines and electromechanical energy conversion.

Course Objectives: The objectives of the course are

1. To understand the construction, working principle and performance characteristics of transformers.
2. To analyze single-phase transformer performance parameters ,explain three-phase transformer operations, testing and applications.
3. To study the operating principles, characteristics and control methods of DC motors.
4. To understand the construction, working, equivalent circuit and performance analysis of three-phase induction motors.
5. To study the operating principles, characteristics and applications of single-phase induction motors.

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

CO1: Explain the operation, equivalent circuit, performance parameters, and testing of single-phase transformers and analyze their performance parameters-efficiency and voltage regulation.

CO2: Explain three-phase transformer connections, vector groups, and parallel operation and state applications of special connections such as Scott and V-V connections.

CO3: Explain the construction, operating principle, characteristics, and speed control methods of DC motors.

CO4: Explain the working principle, torque-slip characteristics, equivalent circuit, and analyze the performance of three-phase induction motors using lab experiment data and circle diagram.

CO5: Explain the operation, starting methods, equivalent circuit, and performance characteristics of single-phase induction motors and compare them with three-phase induction motors.

Course Contents:

Unit I	Single Phase Transformer	8 Hours

Single phase Transformer: Concept of ideal transformer. Useful and leakage flux, its effects. Resistance, leakage reactance and leakage impedance of transformer windings & their effects on voltage regulation and efficiency. Exact and approximate equivalent circuits referred to L.V. and H. V. side of the transformer. Phasor diagrams for no-load and on-load conditions. Efficiency and condition for maximum efficiency. Concept of all day efficiency. Auto transformers and their applications. Polarity test. Parallel operation of single-phase transformers, conditions of parallel operations and load sharing.

Unit II	Three Phase Transformer and DC Motor	8 Hours

Three Phase Transformers: Standard connections of three phase transformers and their suitability for various applications, voltage Phasor diagrams and vector groups. Descriptive treatment of Parallel operation of three phase transformers Scott connection and V-V connections. Three winding (tertiary windings) transformers. **DC Motors**: Operation, characteristics and Applications. Types of starters, Speed control methods.

Unit III	Three Phase Induction Motor (Part-A)	8 Hours

Construction and types of induction motor, working principle, concept of rotating magnetic field, slip, frequency of rotor emf and rotor currents, mmf produced by rotor currents, its speed w.r.t. rotor and stator mmf. Production of torque, torque equation, torque-slip characteristics, effect of rotor resistance on torque-slip characteristics, condition for maximum torque. Relation between starting torque, full load torque and maximum torque. Losses in three phase induction motor, power-flow diagram, relation between rotor input power, rotor copper loss & gross mechanical power developed, efficiency.

Unit IV	Three Phase Induction Motor (Part-B)	8 Hours

Induction motor as a generalized transformer; phasor diagram. Exact & approximate equivalent circuit. No load and blocked rotor tests to determine the equivalent circuit parameters and plotting the circle diagram. **Self-study** : Necessity & types of starters for 3-phase induction motors.

Unit V	Single Phase Induction Motor	8 Hours

Construction of single phase induction motor, double field revolving theory. Equivalent circuit and torque-slip characteristics on the basis of double revolving field theory. Tests to determine the parameters of equivalent circuit and calculation of performance characteristics of motor. Methods of self-starting. Types of single phase induction motors: Split-phase motors (Resistor split-phase motor, Capacitor-start motor, Capacitor start and capacitor run motor and permanent capacitor motor). Universal motor characteristics. **Self-study :** Comparison of 1-phase induction motor with 3-phase induction motor.

Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**

1. **Performance Analysis of Single-Phase Transformer**
   Students shall calculate transformer parameters and evaluate performance characteristics such as efficiency and voltage regulation under different loading conditions using given data. Students shall prepare tables, plot graphs/charts for performance analysis, and present the observations in graphical form with proper interpretation of results.
2. **Preparation of Vector Group and Transformer Connection Charts**
   Students shall prepare charts/models showing star-star, delta-delta, star-delta and delta-star transformer connections along with vector group representation and applications.
3. **Study of DC Machine constructional details**
   Students shall click photographs of DC machine and its parts available in the laboratory, study the constructional details by identifying various parts, prepare a labeled chart/model indicating the name of each part, material used and function of the part, and present the details in the classroom.
4. **Demonstration of Torque-Slip Characteristics of Induction Motor**
   Students shall study the effect of slip and rotor resistance on induction motor performance using simulation/software or laboratory setup and record observations.
5. **Study of Induction Motor Nameplate Details and Industrial Applications**
   Students shall collect and study nameplate details of different three-phase induction motors available in the laboratory/workshop. Students shall interpret parameters such as rated voltage, current, power, speed, frequency, efficiency, insulation class and duty cycle, and prepare a report on the selection and industrial applications of induction motors.

7. **Building a Working Physical Model from Scratch-**

A] Simple DC Motor or AC Generator: Construct a basic homopolar motor or a hand-cranked AC generator to demonstrate Faraday's Laws of Electromagnetic Induction.

B] Transformer Construction: Wind your own small-scale step-up or step-down transformer. Calculate the turns ratio ($N_1/N_2 = V_1/V_2$) and measure the voltage output

CCA 2	**Study / Survey Activities (Any 01)**	**10 Marks**

1. **Survey of Transformer Applications in Power Systems**
   Students shall study different types of transformers used in generation, transmission and distribution systems and prepare a report on their applications.
2. **Comparative Study of Auto Transformer and Two-Winding Transformer**
   Students shall compare construction, working, advantages, disadvantages and applications of auto transformers and conventional transformers.

3. **Study of Industrial Applications of DC Motors**
   Students shall survey industries/workshops to identify applications of DC shunt, series and compound motors in cranes, rolling mills, conveyors and electric vehicles.
4. **Survey of Starting Methods of Induction Motors**
   Students shall collect information about DOL, star-delta, autotransformer and rotor resistance starters and prepare comparative analysis based on cost and applications.
5. **Study of Energy Efficient Induction Motors**
   Students shall study energy-efficient motors used in industries and prepare a report on energy saving, efficiency improvement and IE standards.
6. **Comparative Study of Single-Phase and Three-Phase Induction Motors**
   Students shall compare construction, starting methods, efficiency, torque characteristics and applications of single-phase and three-phase induction motors. Prepare a chart of this data and explain the same

CCA 3	Seminar / Blog Writing Activities (Any 01)	10 Marks

1. **Seminar on Modern Transformer Technologies**
   Students shall deliver seminar presentations on dry-type transformers, smart transformers, energy-efficient transformers and their industrial applications.
2. **Blog Writing on Importance of Transformer Testing and Maintenance**
   Students shall write technical blogs on polarity test, parallel operation, cooling methods and preventive maintenance of transformers.
3. **Seminar on Electric Drives and DC Motor Applications**
   Students shall present seminar topics related to electric traction, cranes, elevators and electric vehicle drive systems using DC motors.
4. **Blog Writing on Induction Motor Starters and Protection Systems**
   Students shall prepare blogs explaining various starting methods, protection techniques and troubleshooting of induction motors.
5. **Seminar on Energy Conservation using Efficient Electrical Machines**
   Students shall present seminars on energy-efficient motors, loss reduction techniques and sustainable electrical machine technologies.
6. **Blog Writing on Recent Trends in Electrical Machines**
   Students shall write blogs on smart motors, variable frequency drives (VFDs), industrial automation and advancements in electrical machine technology.

Textbooks:

1. B.L. Theraja, A.K. Theraja, "A Textbook of Electrical Technology: Volume II", Dhanpat Rai & Sons
2. S. K. Bhattacharya, "Electrical Machine", Tata McGraw Hill publishing Co. Ltd, 2nd Edition.
3. K Krishna Reddy, "Electrical Machines- I and II", SCITECH Publications (India) Pvt. Ltd. Chennai

Reference Books:

1. A.E. Clayton and N. N. Hancock, "Performance and Design of Direct Current Machines", CBS Publishers, Third Edition.
2. A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electrical Machines", Tata McGraw Hill Publication Ltd., Fifth Edition.
3. A.S. Langsdorf, "Theory and performance of DC machines", Tata McGraw Hill.
4. M.G. Say, "Performance and Design of AC. Machines", CBS Publishers and Distributors.
5. Smarajit Ghosh, "Electrical Machines", Pearson Education, New Delhi.
6. R K Rajput, "Direct Current Machines", Laxmi Publications
7. R K Rajput, "AC Machines", Laxmi Publications

MOOC / NPTEL Courses:

1 NPTEL course on Electrical Machines - I , Prof. Tapas Kumar Bhattacharya , IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc20_ee60/preview

2 NPTEL Course on Electrical Machines, Prof. G.Bhuvaneshwari, IIT Delhi , nptel.ac.in/courses/108102146

Course: Power System Engineering				Code: 25ELPCC202
Teaching Scheme (Hrs. /Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:

Knowledge of power generation techniques, R-L-C Parameters, Working of Power system components

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

1. To describe load curve and its associated factors and tariff calculations.
2. To estimate sag calculations of transmission line
3. To calculate inductance and capacitance of three phase transmission line.
4. To develop analytical ability to estimate power flow analysis of transmission line.
5. To understand working of EHVAC and HVDC transmission system.

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

CO1: Understand load curve and tariff calculation for electrical energy.

CO2: Evaluate basic calculations for Cables, Sag and Insulators.

CO3: Calculate Inductance and Capacitance for different configurations of transmission line.

CO4: Estimate ABCD constants and power flow in long transmission line

CO5: Understand EHV AC and HVDC transmission system.

Course Contents:

Unit I	Basics of Power System & Tariff	8 Hours

Basics of power systems: Structure of electrical power system, Load curve, Load duration curve, Concept of base load and peak load stations, Different factors associated with generating stations such as Connected load, Maximum demand, Demand factor. **Tariff:** Introduction of Tariff, Tariff setting principles, desirable characteristics of tariff, Time of day tariff for H.T and L.T industrial and commercial consumers, Introduction to Availability based tariff (ABT), kVAh tariff (Descriptive treatment only). Numerical based on Load curve

Unit II	Cables, Mechanical Design & Sag Calculation	8 Hours

A) Underground Cables: Overview on Construction and Classification of Cables, Dielectric stresses in single core cable, Importance of grading of cables.

B) Mechanical Design of Overhead lines: Main components of overhead lines, Calculation of sag for equal and unequal supports, effect of ice and wind loading (with its numerical).

C) Overhead Line Insulators: Types of insulators (Pin type, Post Insulator, Suspension type, Strain type,

Shackle type) their construction and applications. Potential distribution over suspension insulators, String efficiency, (Numerical on string efficiency up to four discs), Methods of improving string efficiency (Descriptive treatment only).

Unit III	Inductance and Capacitance Calculations	8 Hours

Inductance Calculation: Internal and external flux linkages of single conductor, Inductance of single phase two wire line, Concept of G.M.R and G.M.D, Necessity of transposition, Inductance of three phase line with symmetrical configuration, Inductance of bundled conductors. Numerical based on: Inductance calculation

Capacitance Calculation: Capacitance of single-phase line (with and without effect of earth's surface), Concept of G.M.R and G.M.D for capacitance calculations, need of transposition for capacitance calculations, Capacitance of three phase line with symmetrical spacing. Effect of earth on capacitance calculation. Numerical based on: Capacitance calculation

Self-Study: Inductance & Capacitance for unsymmetrical spacing

Unit IV	Performance of transmission lines	8 Hours

Evaluation of ABCD constants of Long transmission lines, Concept of complex power, power flow using generalized constants, Characteristic Impedance and Surge impedance loading, Numerical based on: Calculation of ABCD constants of Long transmission line, Complex power flow calculation at sending end and receiving end, Concept of reactive power (VAR) compensation.

Unit V	EHV AC & HVDC Transmission System	8 Hours

Single line diagram of Power System, Voltage levels used for transmission, Merits and demerits of EHV AC transmission, Corona loss and its calculation, Introduction to HVDC transmission system, Types of HVDC system, Single line diagram of HVDC substation.

Self-Study: Prepare technical specification chart on different HVAC- HVDC N/W & stations in India

Continuous Comprehensive Assessment (CCA) (Any Two)		20 Marks
CCA 1	List of Course Activity (Any 01)	10 Marks

1. Plot load curve pattern for different types of loads. (Use of software)
2. Study and compare types of insulators used for different voltage levels in power system.
3. Calculate Inductance of equilateral spaced conductors with some software code.
4. Develop simple calculations of ABCD parameters in software.
5. Calculate Capacitance of equilateral spaced conductors with some software code.
6. Develop 2D model for HVDC links and EHV AC transmission lines in India.

CCA 2:	Group Discussion / Case Study / Survey (Any 01)	(10 Marks)

1. Case Study on HT consumer bill.

2. Survey on types of underground cables and its fault calculations.
3. Case study on Corona formation.
4. Group discussion on HVDC transmission system with its merits and demerits.

CCA 3:	Seminar / Presentation / Blog Writing (Any 01)	(10 Marks)

1. Load curve and its importance in Power System (Seminar)
2. Selection of underground cables for electrification. (Presentation)
3. Effect of Inductance and Capacitance for transmission line performance (Presentation)
4. Comparison between EHV AC and HVDC transmission systems (Seminar/Presentation)

Textbooks:

1. I.J. Nagrath and D.P. Kothari, "Modern Power System Analysis", TMH New Delhi.
2. Dr B R Gupta, "Power System Analysis and Design", S. Chand and Co.
3. C.L. Wadhwa, "Power System Analysis", New Age International.

Reference Books:

1. Stevenson W.D., "Elements of Power System Analysis" (4th Ed.) Tata McGraw Hill, New Delhi.
2. Hadi Sadat, "Power System Analysis", Tata McGraw-Hill New Delhi.
3. J. B. Gupta, "A course in power systems", S.K. Kataria Publications.
4. Ashfaq Hussain - "Electrical Power Systems", CBS Publication 5th Edition.
5. V. K. Chandana, "Power Systems", Cyber tech Publications.

MOOC / NPTEL Courses:

1. NPTEL Course on Power System Engineering, Debpriya Das, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ee67
2. NPTEL Course on Power System Analysis, Dr. A.K. Sinha, IIT Kharagpur
   https://nptel.ac.in/courses/108105067

Course: Analog & Digital Electronics				Code: 25ELPCC203
Teaching Scheme (Hrs. /Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:

Basic Electronics Engineering, Numbering system, Logic Gates and flip flops, Diode and BJT.

Course Objectives: The objectives of the course are

1. To use K map for Boolean algebra reduction and design digital circuit
2. To construct sequential and combinational circuits using flip flops and K map.
3. To develop the concept of basics of Operational Amplifier and its applications
4. To design of IC 555 timer, its applications. and uncontrolled rectifier
5. To Understand Memories and microprocessor

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

CO1: Simplify complex logic expression by using K Map and design combinational circuit.

CO2: Design logical, sequential digital circuit using K-Map.

CO3: Apply and analyze applications of OPAMP in open and closed loop configuration.

CO4: Understand different analog circuits - multivibrators (IC 555), voltage regulators and rectifiers

CO5: Analyze Memories and microprocessor

Course Contents:

Unit I	**Design of combinational circuit**	**8 Hours**

Structure for two, three and four variables, SOP and POS form, reduction of Boolean expressions by K-map. Design of combinational circuits using Boolean expression and K-map, half and full adder , encoder, decoder, multiplexers, demultiplexers.

Unit II	**Design of Sequential circuit**	**8 Hours**

Shift Registers- serial and parallel and mixed modes, Counters-Binary, Ripple, Synchronous, asynchronous, Mod-N and decade counters and their design.

Unit III	**Operational Amplifier (Op-Amp) Applications**	**8 Hours**

Applications of Op-Amp zero crossing detectors, Comparator, Schmitt trigger, V-I and I-V converters, Instrumentation amplifier, peak detector, Waveform generation using Op-Amp - sine, square, saw tooth and triangular generator. PLL concept, Active filters-Its configuration with frequency response, Analysis of first order low pass and high pass filters using Op-Amp

Unit IV	**Analog Integrated Circuits and Rectifier**	**8 Hours**

IC 555 –construction, working and modes of operation- Astable and Monostable multivibrators, Sequence generator, voltage regulators using IC78xx, 79xx, LM 317. Single phase full wave Rectifier-Centre tap and bridge rectifier supplying R load and performance parameters. Three phase full wave bridge rectifier with R load.

Self-Study: Single phase full wave Rectifier-Centre tap and bridge rectifier supplying R-L load.

Three phase full wave bridge rectifier with R-L load.

Unit V	**Digital memories and processor**	**8 Hours**

A) Digital memories: SRAM, DRAM, ROM, EPROM

B) Digital logic families: PAL, PLA, CPLD, FPGA

C) 8051 Architecture block diagram, Instructions of ALU, registers, ports. DAC, ADC operation.

Self-study: 8051 applications

Continuous Comprehensive Assessment (Any Two)		**20 Marks**
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**

1. Mini project on timers/counters.
2. Mini project using rectifiers.
3. Mini project on Application of Op-Amp.
4. Mini project using voltage regulator.
5. Mini project on any combinational circuit.

CCA 2	**Study / Survey Activities (Any 01)**	**10 Marks**

Any one from the list below

List of Case Study:

1. Advanced Electronic Equipment and their application in electrical power /control system.
2. Advanced Microcontrollers and its applications in electrical power /control system.

List of Surveys:

1. Advanced Semiconductor technology
2. Advanced Electronic Sensors and their applications in electrical power /control system.

CCA 3	**Seminar / Blog Writing Activities (Any 01)**	**10 Marks**

Any one from the list below

1. Power MOSFETs in EV Chargers
2. Application of Op-Amp in Solar MPPT
3. Design of Wideband Sigma-Delta PLL Modulators
4. Analog Circuits for Biomedical Signal Processing
5. Field Programmable Gate Array (FPGA) in Power Systems
6. Digital Image Processing for Safety Inspection

7. Hardware Accelerators for AI in IoT Devices

Textbooks:

1. Floyd and Jain, “Digital Fundamentals”, Pearson Education.
2. Gaikwad Ramakant, “Operational Amplifier”, PHI New Delhi.
3. V.K Mehtha and Rohit Mehtha, “Principles of Electronics”, S Chand Publication

Reference Books:

1. Tokheim, “Digital Electronics-Principles and Application”, 6th edition, Tata McGraw Hill, New Delhi.
2. K. R. Botkar, “Integrated Circuits”, Khanna Publication, New Delhi.
3. James, “Operational Amplifier and Linear Integrated Circuits Theory and Application.”
4. P John Paul, “Electronics Devices and circuits”, New Age International Publications.
5. Leach & Malvino, “Digital Principles and Application”, McGraw Hill Education
6. Agarwal Anant , “Foundations of Analog and Digital Electronic Circuits”, Morgan Kaufmann Series

MOOC / NPTEL Courses:

1. NPTEL course on Digital Electronics Circuit, Prof. Santanu Chattopadhyay, IIT Kharagpur, https://nptel.ac.in/courses/108105113
2. NPTEL course on Integrated circuit, MOSFET, OPAMP and their applications, Prof Hardik Pandya, IISC Banglore, https://nptel.ac.in/courses/108108111

Course: Signals and Systems				Code: 25ETMDM201B
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

Prerequisites:

Knowledge of Basic Mathematics

Course Objectives:

1. To introduce signals, its operations with examples and to classify signals into different categories.
2. To classify systems into different categories.
3. To acquire knowledge about Fourier Series and Transform and its significance in signal analysis.
4. To study z transform and analysis using z transform.

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

CO1: To Classify signals based on their characteristics and perform basic operations on signals

CO2: To learn properties of systems and find impulse response of system

CO3: To Analyze the spectral properties of continuous signals using Fourier analysis.

CO4: To Analyze the spectral properties of discrete signals using Fourier analysis.

CO5: To Apply Z- transform to study discrete-time signals and systems.

Course Contents:

Unit I	**Fundamentals of Signals and Systems**	**6 Hours**

Classification of signals: Continuous-time (CT) and Discrete-time (DT), Shannon's sampling theorem, deterministic vs. random, periodic vs. aperiodic, energy vs. power signals.

Elementary signals: Unit step, unit ramp, unit impulse, exponential, sine, and rectangular functions.

Signal operations: Time shifting, scaling, reversal, and amplitude scaling.

Unit II	**System Classification and Properties**	**6 Hours**

Systems: Introduction to systems, Classification of systems (linearity, time-invariance, causality, stability, Properties of systems, Impulse response convolution for CT-LTI and DT-LTI systems

Unit III	**Fourier Analysis of Continuous signals**	**6 Hours**

Fourier analysis for continuous time signals, continuous time fourier transform its properties, frequency response

Unit IV	**Fourier Analysis of Discrete time signals**	**6 Hours**

Fourier analysis for discrete time signals, discrete time fourier transform its properties, frequency response

Unit V	Z transform	6 Hours
Z-Transform (ZT): The concept of the z-plane, ROC, properties, inverse Z-transform, and discrete-time system analysis using difference equation		

Continuous Comprehensive Assessment (Any Two)		*20 Marks*
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**
1. MATLAB / Python Programming**:** Implement fundamental discrete-time signal operations 2. Program a script to generate sinusoidal signals, step functions 3. Write program to compute the convolution of discrete-time signals		
CCA 2	**Study / Survey Activities (Any 01)**	**10 Marks**
1. Solve numerical on Z transform. 2. Assignment on Inverse Z transform. 3. Convolution numerical.		
CCA 3	**Seminar / Blog Writing Activities (Any 01)**	**10 Marks**
1. Blog Writing on signals and systems. 2. Seminar on any one application of signals and systems in Electrical domain. 3. Blog Writing on Students shall write blogs on comparison of various signals, sampling theorem, its necessity.		

Textbooks:

1. Ramesh Babu, “Signals and systems” , 4th SCITECH Publication
2. Kumar A. Anand, “Signals and systems”,3rd edition PHI Learning
3. Tarun Kumar Rawat, “Signals and systems”, Oxford Higher Education

Reference Books:

1. Alan Oppenheim, “Signals & Systems”, Pearson New International

MOOC / NPTEL Courses:

1. Signals and Systems, Prof. Aditya Jagannatham, IIT Kanpur, https://nptel.ac.in/courses/108104100
2. Signals and Systems, Prof. Hitesh Shrimali, Prof.Kushal Shah, IISER Bhopal https://nptel.ac.in/courses/108106163

Course: Principles of Management and Organizational Behavior				Code: 25OEC201A
Teaching Scheme (Hrs/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. To Evaluate leadership styles, communication processes, and team dynamics.

4. To Apply decision-making, planning, organizing, and controlling techniques in practical scenarios.

5. To 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, behavioral, 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		
Continuous Comprehensive Assessment (Any Two)		**20 Marks**
CCA 1	**List of Course Activity (Any 02)**	

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/start up 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, Prof. Susmita Mukhopadhyay, Prof. S. Srinivasan, IIT Kharagpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg88
2. NPTEL course on Organizational Behavior , Prof. M. P. Ganesh, IIT Hyderabad: https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_mg51

Course: Circular Economy for Sustainable Development				Code: 25OEC201B
Teaching Scheme (Hrs/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. To Understand the fundamentals principles of circular economy, sustainability, environmental systems, and resource cycles.
2. To Apply sustainable development goals (SDGs), life-cycle thinking, and circular economy models in real-world contexts.
3. To Develop the ability to assess materials, energy, and waste flows in businesses and communities to optimize resource use and reduce environmental impact.
4. To Examine environmental governance, global sustainability policies, and circular strategies for industry and society.
5. To Foster creative and practical solutions for sustainable consumption, production, and cleaner technologies.

Course Outcomes: After successful completion of the 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: Analyze 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.

Continuous Comprehensive Assessment (Any Two)	20 Marks
List of Course Activity (Any 02)	

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. NPTEL course on Environment and Development, Prof. Ngamjahao Kipgen, IIT Guwahati https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs83
3. NPTEL course on Education for Sustainable Development, Prof. Atasi Mohanty, IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_hs61
4. NPTEL course on Environmental Planning and Management, Prof. Sonal K. Thengane, IIT Roorkee https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ge08
5. NPTEL course on Corporate social responsibility 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 (Hrs/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. To Understand the fundamentals of startup management and venture creation.
2. To Develop the ability to identify, evaluate and validate startup ideas.
3. To Gain knowledge of business models, funding mechanisms, and startup operations.
4. To Understand legal, ethical and IPR aspects related to startups.
5. To Build entrepreneurial skills, teamwork, leadership, and lifelong learning orientation.

Course Outcomes: After successful completion of the 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, Start-up vs MSME vs traditional business, Start-up lifecycle and growth stages,Role of start-ups in innovation and economic development Case studies of successful start-ups (Indian & global).

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

Entrepreneurial mind set and ideation techniques, Problem identification and solution fit, Design Thinking and Lean Start-up 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 start-ups

Unit IV	Startup Ecosystem, Funding & Legal Aspects	6 Hours

Start-up ecosystem in India and globally, Government initiatives: Start-up 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

Continuous Comprehensive Assessment (Any Two)	20 Marks
List of Course Activity (Any 02)	

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 start up 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 and Bob Dorf, “The Startup Owner’s Manual: The Step-by-Step Guide for Building a Great Company”, Wiley.
2. Alexander Osterwalder and Yves Pigneur, “Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers”, Wiley.

3. Bruce R. Barringer and R. Duane Ireland, “Entrepreneurship: Successfully Launching New Ventures”, Pearson Education.
4. Peter F. Drucker, “Innovation and Entrepreneurship: Practice and Principles”, Harper Business.

MOOC / NPTEL Courses:

1. NPTEL course on Entrepreneurship, Prof. C Bhaktavatsala Rao, IIT Madras https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg70
2. NPTEL course on Entrepreneurship Essentials By Prof. Manoj Kumar Mondal, IIT Kharagpur https://onlinecourses.nptel.ac.in/e-learning/preview/noc20_ge08
3. NPTEL course on Innovation, Business Models and Entrepreneurship, Prof. Vinay Sharma, Prof. Rajat Agrawal, IIT Roorkee: https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg95
4. NPTEL course on Entrepreneurship Essentials, 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 (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

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

Continuous Comprehensive Assessment (Any Two)	**20 Marks**

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

Reference Books:

1. M. Swaminathan, “Food and Nutrition”, Bangalore Printing & Publishing Co. Ltd., Bangalore.
2. M. Swaminathan, “Essentials of Food and Nutrition, Volume I & II”, Ganesh & Co., Madras (Chennai), 1974.
3. National Institute of Nutrition (ICMR), “Dietary Guidelines for Indians: A Manual”, Indian Council of Medical Research (ICMR), Hyderabad.
4. Roger L. Brauer, “Safety and Health for Engineers”, John Wiley & Sons, Inc.

MOOC / NPTEL Courses /Online Resources:

1. Adolescent Health and Well-Being: A Holistic Approach , 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 , 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 (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

Prerequisites: --

Course Objectives:

1. To introduce students to basic French pronunciation and vocabulary.
2. To develop elementary listening and speaking skills in French.
3. To familiarize students with simple French sentence structures.
4. To enable students to communicate in everyday situations.
5. To develop readiness for beginner-level French language learning.

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

CO 1:Understand basic French vocabulary and pronunciation.

CO 2:Introduce themselves using simple French expressions.

CO 3:Read and write basic French sentences.

CO 4:Communicate in simple everyday situations.

CO 5: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		

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

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.

French Culture Presentation: Students give a short presentation on French culture, food, or festivals.

Text Books:

1 Annie Berthet, Catherine Hugot, Véronique M. Kizirian and Béatrix Sampsonis, "Alter Ego A1", Hachette FLE (Goyal Publishers).

2 Régine Mérieux and Yves Loiseau, "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 Education, ISBN-13: 978-0071453875.

2 Eugene Jackson, Antonio Rubio, Julien J. Lafontant and Pamela Haze, "French Made Simple", Crown Publishers, ISBN-13: 978-0767918596.

3 Claire Miquel, "Communication Progressive du Français – Niveau Débutant (A1)", CLE International, Atlantic Publishers & Distributors (P) Ltd., New Delhi.

4 Mahita Ranjit and Monica Singh, "Apprenons le Français – Part 1", 2nd Revised Edition, Saraswati House Pvt. Ltd., New Delhi, 2007.

5 Mahita Ranjit and Monica Singh, "Cahier d'Exercices (Apprenons le Français – Part 1)", 2nd Revised Edition, Saraswati House Pvt. Ltd., New Delhi, 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

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

Prerequisites: Nil

Course Objectives: The objectives of the course are

1. To introduce students to basic German pronunciation and vocabulary.
2. To develop elementary communication skills in German.
3. To familiarize students with simple German sentence structures.
4. To enable students to communicate in everyday situations.
5. To develop awareness about German culture and traditions.

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

CO 1: Understand basic German pronunciation and vocabulary.

CO 2: Communicate using simple expressions.

CO 3: Read and write elementary German sentences.

CO 4: Use common phrases in daily situations.

CO 5: Demonstrate awareness about German culture.

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

Course: Japanese Language Module-I			**Code: 25OEC201G**	
Teaching Scheme (Hrs/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	**Unit I**	**Unit I**
Hiragana, Greetings and introductions, Numbers and dates, Pronunciation practice		
Unit II	**Unit II**	**Unit II**
Sentence patterns, Basic Particles, Basic verbs, Pronouns and nouns		
Unit III	**Unit III**	**Unit III**
Self-introduction, Family and hobbies, Daily activities, Asking simple questions		
Unit IV	**Unit IV**	**Unit IV**
Reading simple scripts, Daily Vocabulary, Writing practice, Sentence construction		
Unit V	**Unit V**	**Unit V**
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

1. 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
  1. 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

1. Learn Japanese Language: Free Online Courses: https://www.busuu.com/en/course/learn-japanese-online

Course: Electrical Machines-I Laboratory				Code: 25ELPCC201L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical/Tutorial	2	1	Practical	Marks: 25

Prerequisites:

Basic knowledge of electrical circuits and AC/DC fundamentals, Understanding of transformer principles and electromechanical energy conversion, Familiarity with three-phase systems and electrical measuring instruments, Basic understanding of safety precautions while handling electrical machines and laboratory equipment

Course Objectives: The objectives of the course are

1. To provide practical exposure to testing and performance evaluation of transformers
2. To study parallel operation and characteristics of transformers through laboratory experiments.
3. To analyze the operation, speed control, and starting methods of DC motors.
4. To determine performance parameters of three-phase induction motors using standard tests and circle diagram.
5. To evaluate the performance characteristics of single-phase induction motors using load tests and simulations.

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

CO1: Perform standard tests on transformers (O.C., S.C., polarity, waveform analysis) and determine equivalent circuit parameters, voltage regulation, and efficiency.

CO2: Analyze the parallel operation of transformers and evaluate load sharing under different operating conditions.

CO3: Demonstrate speed control methods and starter operation of DC shunt motors.

CO4: Conduct no-load, blocked rotor, and load tests on three-phase induction motors and determine equivalent circuit parameters and performance characteristics using circle diagram.

CO5: Evaluate the performance of single-phase induction motors through load testing and virtual laboratory experiments.

List of Experiments

Perform any 6 experiments should be conducted from following list:

1. O.C. and S.C. test on single phase Transformer and determination of equivalent circuit parameters, voltage regulation and efficiency from the test data.
2. Polarity test on single phase, three phase transformer.
3. Measurements of non-sinusoidal current waveform of transformer at no load to determine harmonic content.
4. Parallel operation of two single phase transformers and study of their load sharing under various conditions of voltage ratios and leakage impedances.
5. Speed control of D.C. Shunt motor and study of starters.
6. No Load test & blocked-rotor test on 3-phase induction motor to determine equivalent circuit parameters.
7. No load & blocked-rotor test on 3-phase induction motor: Plotting of circle diagram. Calculation of motor performance from (a) & (b) above
8. Load test on 3 phase induction motor to determine performance parameters
9. Load test on single phase induction motor
10. Study of V-V Connection of transformer
11. Study of various starters used for 3 phase induction motor

Virtual Laboratories: Any 2

1. Familiarization of the electrical machine laboratory apparatus
   https://ems-iitr.vlabs.ac.in/exp/lab-equipment-familiarization/

2. Speed Control of DC motor by field resistance control
   https://ems-iitr.vlabs.ac.in/exp/dcmotor-field-resistance-control/

3. Speed Control of DC motor by Armature Resistance Control
   https://ems-iitr.vlabs.ac.in/exp/dcshunt-motor-armature-control/

4. Determination of Transformer equivalent circuit from Open Circuit and Short Circuit Test.
   https://ems-iitr.vlabs.ac.in/exp/circuit-parameters-oc-test/

5. Speed control of slip-ring Induction Motor.
   https://ems-iitr.vlabs.ac.in/exp/speed-control-slip-ring/

6. Load Test On Separately Excited DC Motor
   https://em-coep.vlabs.ac.in/exp/load-test-dc-motor/

7. No load test on three phase induction motor
   https://em-coep.vlabs.ac.in/exp/no-load-test-induction-motor/

8. Blocked rotor test on three phase induction motor
   https://em-coep.vlabs.ac.in/exp/blocked-rotor-test-induction-motor/

Course: Power System Engineering				Code: 25ELPCC202L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical/Tutorial	2	1	Practical	Marks: 25

Prerequisites:

Knowledge of Power generation techniques, R-L-C Parameters, Working of Power system components.

Course Objectives: The objectives of the course are

1. To describe load curve and its associated factors and tariff calculations.
2. To estimate sag calculations of transmission line
3. To calculate inductance and capacitance of three phase transmission line.
4. To develop analytical ability to estimate power flow analysis of transmission line.
5. To understand working of EHVAC and HVDC transmission system.

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

CO1: Understand load curve and tariff of electrical energy.

CO2: Evaluate basic calculations for Cables, Sag and Insulators.

CO3: Calculate Inductance and Capacitance for different configurations of transmission line.

CO4: Estimate ABCD constants and power flow in long transmission line

CO5: Understand EHV AC and HVDC transmission system.

List of Experiments

1. To collect the data form energy bill of LT/ HT consumer and plot annual load curve.
2. To find inductance of a given transmission line configuration with any software.
3. To find capacitance of a given transmission line configuration with any software.
4. To determine ABCD parameters of medium transmission line (200 km). (angle and magnitude)
5. To determine ABCD parameters of long transmission line (200 km). (angle and magnitude)
6. To plot receiving end power circle diagram for medium transmission line.
7. To apply static VAR compensation and find voltage and current profile.
8. To develop HVDC converter side model (open loop) with any software.

Course: Analog & Digital Electronics Laboratory				Code: 25ELPCC203L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical	2	1	Oral	Marks: 25

Prerequisites:

Basic Electronics Engineering, Numbering system, Logic Gates and flip flops, Diodes, Basic operation of Cathode Ray Oscilloscope (CRO), Colour coding and decoding of resistors..

Course Objectives: The objectives of the course are

1 To familiarize students with analog and digital circuits, different ICs
2 To study Operational Amplifier for various applications
3 To design regulated power supply

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

CO1: Design logical, sequential and combinational digital circuits.
CO2: Design and demonstrate various types of counters and Registers using Flip-flops.
CO3: Demonstrate and Analyze Operational Amplifier circuits and their applications
CO4: Understand different analog circuits e.g. filters, IC555, voltage regulators and uncontrolled rectifiers

List of Experiments

Perform any eight (three experiments should be on bread board/trainer kit) experiment from following list:

1. Design of logical circuit for display of decimal number on seven segment display.
2. Deign 3:8 decoders for binary to octal decoding.
3. Design three-bit full adder using any open-source software.
4. Design a digital clock or stopwatch using decade counter. (IC74192)
5. Design and perform a 4 bit asynchronous and synchronous counter.
6. Design of comparator and Schmitt trigger.
7. Study of Instrumentation amplifier using three Op-amp, CMRR measurement
8. Design sine, and triangular wave generator.
9. Design first order high pass and low pass filter using OPAMP in any open-source software.
10. Design of monostable mutivibrator and astable multivibrator using IC555.
11. Design of regulated power supply
12. Design of single -phase bridge rectifier with output voltage and specified ripple.

Virtual Laboratories: Perform any two experiment from following list:

1. To design a regulated power supply.
2. To analyze Wein bridge oscillator using operational Amplifier.

3. Washing machine control using basic AND & NOT gates.
4. Seat belt warning system using basic AND & NOT gates
5. Design and simulate analog to digital converter and digital to analog converter.

Course: Python Based Programming of Numerical Methods				Code: 25ELVSE201
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Practical	2	1	Practical	Marks: 25

Prerequisites:

Basic Programming Skills, Basic Calculus, Linear Algebra, Basic Electrical Engineering

Course Objectives: The objectives of the course are

- To promote computational thinking and problem-solving using numerical methods.
- To develop multidisciplinary analytical skills through the use of Python in engineering applications.
- To enable experiential learning through hands-on projects, simulations, and coding.
- To nurture lifelong learning habits through use of open-source tools and online platforms.
- To encourage teamwork, communication, and ethics through collaborative project work.

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

CO1: Identify the suitable numerical techniques for solving engineering problems.

CO2: Write Python programs to implement numerical methods for real-time scenarios.

CO3: Apply problem-solving skills in electrical signals & systems and machines.

CO4: Analyze the results and errors for various computational methods.

CO5: Work in teams to build solutions and present projects using Python

List of Experiments

Perform **any eight** experiments from following list: (using any open-source python software, Electrical Engineering based numerical)

1. Python Programming Basics with control statements, loops and functions
2. Programs using Numpy, Matplotlib, SymPy and SciPy
3. Write a Python program to compute and plot truncation and round-off error.
4. Implement root-finding methods and compare their performance.
5. Solve a system of linear equations derived from mesh or node analysis.
6. Interpolate values from a lookup table using Lagrange's method.
7. Interpolate values from a lookup table using Newton forward difference method.
8. Calculate current/voltage waveform area using Simpson’s 1/3rd rule.
9. Calculate current/voltage waveform area using Simpson’s 3/8th rule.
10. Simulate an RL circuit’s transient response using RK4 method.
11. Fit a curve to noisy voltage-time data and analyze goodness of fit.
12. Mini project: Create a Python GUI (Tkinter or Streamlit) for solving numerical problems in electrical

engineering.

Virtual Laboratories:

1. https://nm-re-iitb.vlabs.ac.in/
2. https://nm-differentiation-iitb.vlabs.ac.in/
3. https://nm-integration-iitb.vlabs.ac.in/
4. https://nm-interpolation-iitb.vlabs.ac.in/
5. https://nm-ode-iitb.vlabs.ac.in/
6. https://nm-sle-iitb.vlabs.ac.in/

Course: Entrepreneurship/Economics/ Management Course-I			Code: 25HSM201
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**
Tutorial	2	2	TW	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.

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: Universal Human Values	Code: 25VEC201

Teaching Scheme (Hrs/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: The objectives of the course are

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 behavior 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 behavior 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 behavior for a balanced life. Importance of healthy lifestyle: discipline, proper habits, and value-based living for overall well-being.

Textbooks:

1. R. R. Gaur, R. Sangal, and G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi.
2. R. R. Gaur, R. Sangal, and G. P. Bagaria, "Universal Human Values – Understanding Harmony", AICTE / Excel Books.

Reference Books:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill.
2. Charles B. Fleddermann, "Engineering Ethics" Pearson.

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

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

Course: Community Engagement Project				Code: 25ELELC201
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Practical	2Hrs/Week	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: The objectives of the course are

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 The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
5. To The skills 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 engineer- ing principles to address community issues.

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

Guidelines:

- 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.
- Each group is allotted to a faculty member of the department as a mentor.
- The group of students will be associated with a government official/village authority /NGOs etc. concerned, allotted by the district administration, during the duration of the project.
- The Community Engagement Project should be different from the regular programs of NSS/NC-C/Green Club/Hobby Clubs, Special Interests Groups etc.
- An activity book has to be maintained by each of the students to record the activities undertake/involved and will be countersigned by the concerned mentor/HOD.
- Project report shall be submitted by each student/group of students.
- An internal evaluation shall also be conducted by a committee constituted by the HOD.
- Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor/HOD.
- Students' groups can conduct an awareness program 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 programs
- 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 sustainability, 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: Electrical Measurement and Instrumentation				Code: 25ELPCC204
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:

1. Basics of Electrical Engineering (AC/DC circuits, power, energy)
2. Basic Electronics and Measuring Instruments
3. Circuit Analysis and Bridge Circuits
4. Fundamentals of Transformers and Electromagnetism
5. Basic Mathematics and Numerical Skills
6. Introductory knowledge of Sensors, Transducers and Digital Systems

Course Objectives: The objectives of the course are

1. To Understand the principles and construction of electrical measuring instruments used for measurement of electrical quantities.
2. To Apply bridge methods and practical techniques for measurement of resistance, inductance, and capacitance.
3. To Explain measurement techniques for electrical power and energy in single-phase and three-phase systems.
4. To Understand the working and applications of various transducers and sensors used for measurement of physical parameters.
5. To introduce students to modern measurement and instrumentation techniques including PLC, wave and power analyzers, fiber optic transducers, micro and smart sensors, virtual instrumentation, and Hall effect transducers, and to develop understanding of their principles, operation, and applications in electrical engineering systems.

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

CO1: Explain the construction, working principle, and range extension methods of electrical measuring instruments.

CO2: Apply bridge methods and practical techniques for measurement of resistance, inductance, and capacitance.

CO3: Analyze measurement of electrical power and energy in single-phase and three-phase systems and perform calibration of measuring instruments.

CO4: Explain the working principles and applications of various transducers used for measurement of

pressure, strain, displacement, and level.

CO5: Explain the principles, operation, and applications of modern measurement and instrumentation technologies including PLC, wave and power analyzers, fiber optic transducers, micro and smart sensors, virtual instrumentation, and Hall effect transducers

Course Contents:

Unit I	Measuring Instruments and Range extension of meters	8 Hours

Measuring Instruments: Classification of instruments: absolute and secondary instruments. Types of secondary instruments: indicating, integrating, and recording. Descriptive treatment to indicating instruments: deflecting, controlling and damping systems. Construction, working of Permanent Magnet Moving Coil (PMMC) and Moving Iron (MI) instruments. Digital instruments-Block diagram and description of Digital Ammeter, Voltmeter.Range extension methods using shunt and multiplier

Instrument Transformers: Construction, connection of CT & PT in the circuit, advantages and need of CT / PT for range extension of MI Instruments, effect of sudden open circuit on current transformer. Transformation ratio, Turns ratio, Nominal ratio, Burden. Advancements in CT/PT.

Unit II	Measurement of Resistance, Inductance and Capacitance	8 Hours

Measurement of Resistance: Classification of resistances. Measurement of low resistance by Kelvin's Double Bridge and Ammeter-voltmeter method. Measurement of medium resistance by Wheatstone bridge. Measurement of high resistance by loss of charge method and Megger.

Measurement of Inductance and Capacitance: Sources and detectors for A.C. bridge, general equation for bridge balance, Maxwell's Inductance Bridge, Maxwell's Inductance – Capacitance Bridge, Schering Bridge. Numerical on bridges.

Unit III	Measurement of Power and Energy	8 Hours

Measurement of Power: Construction, working principle, torque equation, errors and their compensation, advantages and disadvantages of dynamometer type single phase wattmeter, poly-phase wattmeter, Active & reactive power measurement in a three-phase system for balanced and unbalanced load using one, two and three wattmeter method.

Measurement of Energy: Block diagram and operation of single phase and three phase static/digital energy meter. TOD meter. Concept of Net metering. Digital power manager block diagram and working. Bidirectional meters block diagram and working. Necessity of Calibration, Calibration of wattmeter & energy meter. Numerical on Calibration of wattmeter & energy meter. Bi-Directional Net metering concept.

Unit IV	Transducers-Pressure, Strain, Level, Displacement Measurement	8 Hours

Transducers: Introduction, classification, basic requirements for transducers selection, and its applications. Analog signals- 0-10v/4-20mA concept. Digital output standards.

Pressure Measurement: Introduction, Pressure measurement using electrical methods: resistive, inductive, capacitive. Pressure measurement by McLeod gauge and Pirani gauge.

Strain Gauges: Construction, working principle and types of strain gauges – wire wound strain gauge, foil strain gauge and semiconductor strain gauge. Gauge factor and its significance. Selection and characteristics of strain gauges.

Strain Gauge Circuits: Use of Wheatstone bridge for strain measurement. Quarter bridge, half bridge and full bridge configurations.

Displacement Measurement: LVDT & RVDT: construction, working, specifications, advantages and disadvantages, applications. Rotary – Variable Differential Transformer, Synchros and Resolvers, Induction Potentiometers.

Level Measurement: Introduction and importance of level measurement. Methods of level measurement: resistive, inductive, capacitive, ultrasonic. Measurement of liquid level using float.

Self Study : advance sensors, Functions of Signal Conditioning Equipment

Unit V	Sensor Interfacing and Display Systems	8 Hours

Signal Conditioning -Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Electrical and electronic Amplifiers. Data Acquisition Systems and Conversion: Introduction, Objectives and Data Acquisition Systems, Data Conversion

Introduction to PLC, PLC interface with sensors, Wave Analyzers and Harmonic Distortion, Fiber Optic Transducers, Micro sensors, Smart Sensors, Virtual Instrumentation. Hall effect transducers

Self Study : Power Analyzer, DSO, MFM,

Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**

1. **Demonstration and Comparison of PMMC and MI Instruments**
   Students shall observe the construction and working of PMMC and MI instruments and prepare a comparison report based on operating principle, accuracy, sensitivity, damping and applications.
2. **Preparation of CT and PT Connection Chart / Model**
   Students shall prepare charts or working models showing the circuit connection of Current Transformer (CT) and Potential Transformer (PT), including precautions and industrial applications.
3. **Resistance Measurement using Bridge Methods**
   Students shall perform measurement of low, medium and high resistance using Wheatstone bridge, Kelvin double bridge or Megger and record observations with calculations.
4. **Study of Calibration Report as per Relevant Standards**
   Students shall study a sample calibration certificate/report of electrical measuring instruments and identify important parameters such as accuracy class, permissible error, calibration date, standards followed and traceability.
5. **Demonstration of LVDT / RVDT Working**
   Students shall study the construction and operation of LVDT and RVDT using laboratory setup, animation or simulation and prepare a brief application report.
6. **Mini Activity on Sensor Interfacing and PLC**
   Students shall perform basic interfacing of sensors/transducers with PLC or digital display systems and observe the output response for different input conditions.

CCA 2	**Study / Survey Activities (Any 01)**	**10 Marks**

1. **Survey of Digital Energy Meters and TOD Meters**
   Students shall survey different types of digital energy meters used in homes and industries and study features such as TOD tariff, net metering and bidirectional operation.
2. **Study of Industrial Transducers**
   Students shall collect information about pressure, level, displacement and strain transducers used in industries and prepare a comparative study based on working principle and applications.
3. **Comparative Study of Analog and Digital Instruments**
   Students shall compare analog and digital measuring instruments with respect to accuracy, response time, maintenance, cost and industrial use.

4. **Survey on Smart Sensors and Virtual Instrumentation**
   Students shall study modern smart sensors, virtual instrumentation systems and their role in automation, IoT and process industries.
5. **Study of Net Metering and Bidirectional Meters**
   Students shall investigate the implementation of net metering systems in solar power installations and prepare a report on bidirectional energy meters.
6. **Survey of Power Quality Measuring Instruments**
   Students shall study harmonic analyzers, wave analyzers and power analyzers for monitoring power quality and energy management.

CCA 3	Seminar / Blog Writing Activities (Any 01)	10 Marks

1. **Seminar on Modern Electrical Measuring Instruments**
   Students shall deliver seminar presentations on recent developments in electrical measuring instruments and digital measurement techniques.
2. **Blog Writing on PLC Applications in Industries**
   Students shall write a technical blog describing the role and applications of PLC systems in industrial automation and control.
3. **Seminar on Smart Sensors and IoT-Based Instrumentation**
   Students shall present seminar topics related to smart sensors, wireless sensing and IoT-based monitoring systems.
4. **Blog Writing on Importance of Calibration and Standards**
   Students shall prepare blogs highlighting the importance of calibration, accuracy and standardization in electrical measurements.
5. **Seminar on Fiber Optic and Hall Effect Transducers**
   Students shall present the construction, working and applications of fiber optic and Hall effect transducers in modern industries.
6. **Blog Writing on Energy Monitoring and Power Management Systems**
   Students shall write blogs on digital power managers, energy monitoring systems and their role in efficient energy utilization.

Textbooks:

1. E. W. Golding and F. C. Widdis, “Electrical Measurements and Measuring Instruments”, Wheeler Publishing.
2. A. K. Sawhney, “A Course in Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai & Co
3. Albert D. Helfrick and William D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques,” Pearson Education

Reference Books:

1. Dr. Rajendra Prasad, “Electronic Measurements & Instrumentation”, Khanna Publishers.
2. C.T. Baldwin, “Fundamentals of Electrical Measurements”, George G.Harrap & Co Ltd
3. Smith S. Parker, “Problems in Electrical Engineering”, Asia Publications
4. C. Rangan, G Sarma, V.S.V. Mani, “Instrumentation: Devices and Systems”, McGraw Hill Education
5. Massimo Banzi, Michael Shiloh, “Getting Started with Arduino”, Maker Media.
6. D. Patranabis,“Sensors and Transducers”, Prentice Hall of India

MOOC / NPTEL Courses:

1. NPTEL course on Digital Electronics Circuit, Goutam Saha, IIT Kharagpur, https://nptel.ac.in/courses/108105132/
2. NPTEL Course on Industrial Instrumentation, Prof. Alok Barua, IIT Kharagpur, https://nptel.ac.in/courses/108105064

Course: Network Analysis			Code: 25ELPCC205
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**
Lecture	3	3	CCA: 20
			ISE: 30
			ESE: 50

Prerequisites:

Terminology of electrical networks, series and parallel combinations of resistance, linear differential equations

Course Objectives: The objectives of the course are

1. To develop the strong foundation for Electrical Networks.
2. To develop analytical qualities in Electrical circuits by application of various theorems.
3. To understand the behavior of circuits by analyzing the transient response using classical methods and Laplace Transform approach.
4. To develop understating of basics of Network Functions and parameters.

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

CO1: Calculate current/voltage in electrical circuits using simplification techniques, Mesh, Nodal analysis.

CO2: Solve the given network by applying Superposition, Thevenin's, Norton, Reciprocity, Maximum power transfer and Millman's theorems.

CO3: Analyze the response of RLC circuit in transient and steady state condition.

CO4: Apply Laplace transform to analyze behavior of an electrical circuit.

CO5: Apply the knowledge of network theory to find transfer function, network parameters

- **Course Contents:**

Unit I	Types of Networks, Mesh and Nodal analysis	8 Hours

Independent and Dependent (controlled) voltage and current sources. Concept of voltage and current divider, Source transformation. Network equations on Loop basis and Node basis, Dot convention for coupled circuits (series only)

Unit II	Network Theorems	8 Hours

Superposition Theorem, Thevenin Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem applied to electrical AC networks with independent sources.

Unit III	Transient Analysis in RLC circuit-Time domain approach	8 Hours

Initial and Final Conditions in Network Elements, Forced and free response, Basic concept of time constants of RL and RC circuit, Steady-state and transient state response. Solutions of differential equations using classical method for R-L, R-C and R-L-C circuits (series and parallel).

Unit IV	Transient Analysis in RLC circuit: Laplace Transform approach	8 Hours
Laplace Transform of Basic R, L and C components, Solutions of differential equations and network equations using Laplace transform method for RL, R-C and R-L-C circuits (series circuit), Inverse Laplace transforms, transformed networks with initial conditions.		
Unit V	**Network Functions**	**8 Hours**
Network functions for the one port and two port networks, calculation of network functions. Two Port Network: Z, Y, H and transmission parameters, Interrelations between parameters.		

Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**

1. Mesh and Nodal Analysis
2. Students will solve a given electrical network using Mesh Analysis and Nodal Analysis methods. They will compare the obtained results and verify the solutions using simulation software such as LTspice. A report containing detailed calculations, simulation screenshots, and conclusions shall be submitted.
3. Verification of Network Theorems
4. Students will verify Superposition, Thevenin's, Norton's, and Maximum Power Transfer Theorems for a given AC or DC network using manual calculations and simulation. Observations and conclusions shall be documented in a concise report.
5. Transient Response of RC/RL Circuits
6. Students will simulate charging and discharging of RC and RL circuits, determine the time constant, and compare theoretical and simulated responses. A report with waveforms and analysis shall be submitted.

CCA 2	Case Study/Survey (Any 01)	10 Marks

List of Case Studies

1. **Case Study on Maximum Power Transfer Theorem**
   Study the practical application of impedance matching in audio amplifiers, communication systems, and antennas. Prepare a report explaining the significance of maximum power transfer.
2. **Case Study on Transient Response in Electrical Systems**
   Study switching transients in electrical circuits and their impact on circuit components and protective devices.
3. **Case Study on Two-Port Networks**
   Investigate the use of Z, Y, H, and ABCD parameters in transmission lines, filters, and amplifier circuits.

List of Surveys

1. Survey different circuit simulation software such as MATLAB Simulink, PSpice, and LTspice and prepare a comparative report.
2. Survey commercially available resistors, capacitors, and inductors based on ratings, tolerances, and applications.
3. Survey practical applications of network theorems in power systems, electronics, and communication systems.

CCA 3	Group Discussion/Seminar/ Blog writing (Any 01)	10 Marks

List of Group Discussion Topics

1. Importance of Network Theorems in Electrical Engineering.
2. Applications of Laplace Transform in Circuit Analysis.
3. Role of Two-Port Networks in Modern Communication Systems.

List of Seminar Topics

1. Demonstration of Mesh and Nodal Analysis.
2. Simulation of Transient Response of RLC Circuits.
3. Two-Port Network Parameters and their applications.

List of Blog Topics

1. Real-Life Applications of Network Analysis.
2. Why Laplace Transform is Important for Engineers.
3. Understanding Time Constants in Electrical Circuits.

Textbooks:

1. M. E. Van Valkenburg, “Network Analysis” Third Edition, Prentice Hall of India Private Limited
2. G. K. Mittal, “Network Analysis & Synthesis”, Khanna Publication
3. Ravish R Singh, “Network Analysis and Synthesis”, McGraw Hill
4. Alexander & Sadiku, “Introduction to Electric Circuits”, McGraw Hill.

Reference Books:

1. Cramer, “Network Analysis”, McGraw Hill Publication.
2. William H. Hayt, Jr. Jack E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Publication
3. “Schaum's Outline of Electric Circuits”, McGraw-Hill Education; 7 edition
4. Syed A. Nasar, “3000 solved problems in Electrical circuits”, McGraw-Hill

MOOC / NPTEL Courses:

NPTEL course on Network Analysis, Prof. Tapas Kumar Bhattacharya, IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc20_ee46/preview

Course: Applied Engineering Mathematics				Code: 25ELPCC206
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:

Knowledge of Engineering Mathematics I and II, including differential equations, Fourier series, complex numbers, and basic linear algebra.

Course Objectives: The objectives of the course are:

1. To understand the basics of signals and systems
2. To equip students with mathematical tools such as transform techniques and complex variable methods for analyzing signals, systems, and electrical engineering problems,
3. To strengthen their analytical and problem-solving skills for advanced electrical engineering subjects.

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

CO1: Apply Laplace transform techniques to solve differential equations and analyze electrical circuit responses.

CO2: Use Fourier transform methods to analyze signals in the frequency domain and apply Z-transform techniques to analyze discrete-time systems and solve difference equations.

CO3: Identify and represent continuous-time and discrete-time signals and analyze basic properties of linear time-invariant (LTI) systems.

CO4: Use complex variable methods to evaluate integrals and solve engineering problems related to electrical and electromagnetic systems.

CO5: Apply numerical methods to obtain approximate solutions of algebraic and differential equations arising in engineering problems.

Course Contents:

Unit I	**Signals and Linear Systems (Mathematical Foundations)**	**8 Hours**

Continuous-time and discrete-time signals, Signal energy and power, CT and DT exponential and sinusoidal signals, Unit impulse and unit step signals, Continuous and discrete time systems. Basic system properties (linearity, time invariance, causality), Linear Time Invariant (LTI) systems, Convolution sum (DT systems).

Unit II	**Laplace Transform**	**8 Hours**

Laplace transform and properties, Inverse Laplace transform, Convolution theorem, Solution of linear differential equations, Application in Engineering.

Unit III	**Fourier Transforms**	**8 Hours**

Fourier Transform: Fourier integral theorem, Fourier transform and inverse transform, Application in Engineering.		
Unit IV	**Z-Transforms**	**8 Hours**
Z-Transform: Z-transform and inverse Z-transform, Initial & final value theorems, Solution of difference equations, Application in Engineering		
Unit V	**Numerical Methods**	**8 Hours**
Solution of algebraic equations (Newton–Raphson method), Numerical solution of linear systems (Gauss–Seidel method), Interpolation, Extrapolation methods, Numerical solution of ODE (Euler / Runge–Kutta method), Application in Engineering.		

Continuous Comprehensive Assessment (Any Two)		**20 Marks**
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**

Simple Course Activities (Report Writing / Mini-Project)

1. **Analysis of RLC circuit response using Laplace Transform**
2. **Signal convolution and LTI system simulation using MATLAB/Python**
3. **Fourier Transform analysis of real-world electrical signals**
4. **Numerical solution of differential equations using Euler and Runge–Kutta methods**

Mathematical modelling of electrical systems using differential equations

CCA 2	**Case Study/Survey (Any 01)**	**10 Marks**

Seminar Topic

1. **Applications of Laplace Transform in Electrical Engineering**
2. **Fourier Transform in Signal Processing and Communication Systems**
3. **Z-Transform and its applications in Digital Signal Processing**
4. **Complex Variable Techniques in Electromagnetic Field Analysis**

Numerical Methods in Engineering Simulations and Control Systems

CCA 3	**Group Discussion/Seminar/ Blog writing (Any 01)**	**10 Marks**

Blog Topic

1. **Importance of Signals and Systems in Modern Electrical Engineering**
2. **Real-life applications of Laplace and Fourier Transforms**
3. **How Numerical Methods help engineers solve complex problems**
4. **Role of Complex Numbers and Residue Theorem in Engineering**

Applications of Z-Transform in Digital Electronics and DSP

Text books:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Willy and Sons INC ,10th Edition
2. B. S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers
3. K. F. Riley, M. Hobson & S. Bence, “Mathematical Methods for Engineers and Scientists”, Dokumen Publication

Reference Books:

1. A. V. Oppenheim & A. S. Willsky, “Signals and Systems”, 2nd Edition, Prentice Hall
2. Hwei P. Hsu, "Schaum's Outline of Signals and Systems", 3rd Edition, McGraw-Hill Education.
3. S. C. Chapra & R. P. Canale, "Numerical Methods for Engineers", 8th Edition, McGraw-Hill.
4. R. V. Churchill & J. W. Brown, "Complex Variables and Applications", 9th Edition, McGraw-Hill.

MOOC / NPTEL Courses:

NPTEL course on Laplace Transform, Prof. Indrava Roy, Institute of Mathematical Sciences, Chennai
https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_ma54

NPTEL course on Introduction to Fourier Analysis, Prof. Parasar Mohanty ,IIT Kanpur
https://nptel.ac.in/courses/111104519

Course: Microcontroller and Embedded systems				Code: 25ETMDM202B
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	2	CCA	20
			ISE	30
			ESE	50

Prerequisites: Programming Fundamentals: Basic C programming (variables, loops, functions, arrays) Digital Electronics : Logic gates, number systems, flip-flops, basic digital circuits Basic understanding of registers, memory.

Course Objectives: The objectives of the course are to:

1. To understand the fundamentals of embedded systems and their design methodology.
2. To familiarize students with the architecture and features of the ESP32 microcontroller.
3. To develop programming skills using Embedded C/Arduino for hardware interfacing.
4. To design real-time embedded and IoT-based systems using ESP32.

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

CO1: Explain embedded system concepts and design flow

CO2: Understand ESP32 architecture and development tools

CO3: Develop programs and interface hardware components

CO4: Implement IoT communication and cloud-based systems

CO5: Design real-time embedded applications using ESP32

Course Contents:

Unit I	**Fundamentals of Embedded Systems**	**6 Hours**

Introduction to Embedded Systems , Characteristics and classification of embedded systems, Applications of embedded systems, Microcontroller vs Microprocessor, Embedded system design cycle, Real-time systems (hard, soft, firm real-time) , Overview of development tools (IDE, compiler, debugger)

Unit II	**ESP32 Architecture and Development Setup**	**6 Hours**

Introduction to ESP32 microcontroller, Architecture: CPU, memory, peripherals, Features: Wi-Fi, Bluetooth, dual-core processing, ESP32 variants and development boards, GPIO architecture and pin configuration, Setting up Arduino IDE / PlatformIO, Writing and uploading simple program (LED blink, timer)

Unit III	**Programming and Peripheral Interfacing**	**6 Hours**

Embedded C / Arduino programming for ESP32, Digital I/O programming, Analog interfacing (ADC, DAC)

PWM generation, Interfacing sensors: Temperature (DHT11/DHT22), LDR, Ultrasonic sensor

Interfacing actuators: Relay, Servo motor, DC motor Serial communication (UART, I2C, SPI)

Self Study- Interfacing of electrical and non electrical sensors		
Unit IV	**Communication Protocols and IoT Integration**	**6 Hours**
Wi-Fi configuration and networking basics, Bluetooth (Classic and BLE), TCP/IP fundamentals, IoT protocols: HTTP, MQTT, Cloud platforms (ThingSpeak, Blynk, Firebase basics), Data acquisition and remote monitoring. Introduction to edge computing		
Unit V	**Real-Time Applications and System Design**	**6 Hours**
Real-time task scheduling basics, Introduction to FreeRTOS in ESP32, Multitasking and inter-task communication, Low power modes and energy optimization, Security basics in embedded systems, Self Study: Smart home automation, Smart irrigation system, Industrial monitoring system		

• **Continuous Comprehensive Assessment (Any Two)**		**20 Marks**
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**

1. Identify 10 hidden embedded systems in your own households. Are these hard or soft real time systems? Are these microprocessor or microcontroller based?
2. Build two circuits—one where a button turns on an LED via a battery, and one where the button goes to an input pin and code controls the LED. Explain the difference between these activities.
3. Map the 0–4095 analog values from an LDR (Light Dependent Resistor) to a 0–255 PWM signal to dim or brighten an LED automatically based on ambient light.
4. Program two LEDs to blink at different rates

CCA 2	**Study / Survey Activities (Any 01)**	**10 Marks**

1. Create a survey on IoT security and privacy awareness.
2. Find which microcontrollers professionals prefer for specific tasks. Compare features (ESP32, STM32, Arduino)

CCA 3	**Seminar / Blog Writing Activities (Any 01)**	**10 Marks**

1. Why the ESP32's dual-core architecture is a game-changer for IoT.
2. A comparative analysis: ESP32 vs. Arduino Nano vs. STM32.
3. How an ESP32 interprets the analog world using ADC and DAC.
4. Mastering Low Power modes to make an IoT device last for months.

Textbooks:

1. Neil Kolban, "Getting Started with ESP32", 1st Edition, Independently Published.
2. Dogan Ibrahim, "Internet of Things with ESP32", 1st Edition, Elektor International Media.
3. Jonathan W. Valvano, "Embedded Systems: Introduction to ARM Cortex-M Microcontrollers", 5th Edition, CreateSpace / Texas Instruments.

Reference Books:

1. M. A. Mazidi, “The 8051 Microcontroller and Embedded Systems”, 2nd Edition, Pearson Education.
2. Jonathan W. Valvano, “Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers”, 4th Edition, CreateSpace / Texas Instruments.
3. Espressif Systems, “ESP32 Technical Reference Manual”, Espressif Systems.
4. David Hanes et al., “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases”, 1st Edition, Cisco Press.

MOOC / NPTEL Courses:

1. NPTEL course on Introduction to Internet of Things, Prof Sudeep Misra, IIT Kharagpur https://nptel.ac.in/courses/106105166

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

Prerequisites: Basic communication and interpersonal skills

Course Objectives: The objectives of the course are-

1. To Introduce concepts of leadership, organizational behavior, and group dynamics.
2. To Develop communication, interpersonal, and collaborative leadership skills.
3. To Explain leadership styles, motivation theories, and team processes.
4. To Enhance conflict resolution, negotiation, and decision-making abilities.
5. To 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 Behavior	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 behavioral 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 Behavior	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):

1. **Leadership Style Role Play**
   Students perform role plays demonstrating different leadership styles, communication approaches, and conflict management situations.
2. **Team Building & Group Dynamics Activity**
   Practical activities/games to study teamwork, cooperation, delegation, trust-building, and group decision-making.
3. **Case Study Analysis on Organizational Behavior**
   Analyze real-life organizational situations related to motivation, leadership challenges, ethics, or team conflicts and present solutions.
4. **Communication & Negotiation Workshop**
   Hands-on practice sessions on verbal/non-verbal communication, negotiation skills, feedback mechanisms, and interpersonal behavior.
5. **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. NPTEL course on Organizational Behavior: Individual Dynamics in Organization ,Prof. Abraham Cyril Issac: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg20
2. Online course on Leadership and Team Effectiveness ,Prof. Santosh Rangnekar: https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_mg39
3. Course on Leadership & Management , Ms. Shipra Thappa 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 https://www.edx.org/learn/leadership

Course: Green Practices & ESG Frameworks				Code: 25OEC202B
Teaching Scheme (Hrs/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 analyze 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: Analyze 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. Colin Read, "Understanding Sustainability Principles and ESG Policies**",** Springer Nature, Year: 2023
2. Kristyn Noeth, "The ESG and Sustainability Deskbook for Business", Springer, 2024

Reference Books:

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

MOOC / NPTEL Courses /Online Resources Online Resources:

1. NPTEL course on Sustainability through Green Manufacturing Systems an applied approach, Prof. Deepu Philip and Prof. Amandeep Singh, IIT Kanpur: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg85
2. NPTEL course on Sustainable Energy Technology, Prof. Sayak Banerjee, IIT Hyderabad: https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_me138
3. NPTEL course on Corporate social responsibility, Prof. Aradhna Malik, IIT Kharagpur : https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg54
4. Swayam course on Implementing ESG and Sustainability in Business, Dr. Aditya Gupta, Indian Institute of Management, Bangalore: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb25_mg77
5. Swayam course on Business Ethics and Corporate Governance, 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 (Hrs/Week)		Credit	Evaluation Scheme	
Tutorial	2	2	CCA	20
			ISE	30
			ESE	50

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

Course Objectives: The objectives of the course are-

2. To Introduce concepts of innovation, creativity, and business strategy.
3. To Develop strategic thinking and innovation management skills.
4. To Explain business models, entrepreneurship, and technology innovation processes.
5. To Familiarize students with sustainability, intellectual property rights, and innovation ecosystems.
6. To 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

Continuous Comprehensive Assessment (Any Two)	**20 Marks**

List of Course Activity

1. **Innovation Idea Pitch Presentation**
2. Students identify a real-world problem and present an innovative product, service, or business solution using creativity and design thinking tools.
3. **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.
4. **Prototype Development & Demonstration**

   Students create a basic prototype/mock-up of an innovative product or digital solution and demonstrate its functionality and market relevance.
5. **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.
6. **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:

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

Reference Books:

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

MOOC / NPTEL Courses /Online Resources:

1. NPTEL course on Innovation Business Models and Entrepreneurship, Prof. Vinay Sharma, Prof. Rajat Agrawal : https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg95
2. NPTEL course on Entrepreneurship & IP strategy, Prof. Gouri Gargate : https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_hs213
3. Swayam course on Managing Innovation, Rishikesha T Krishnan and Vinay Dabholkar: https://onlinecourses.swayam2.ac.in/e-learning/preview/imb19_mg05
4. Coursera, Business Strategy Specialization, University of Virginia: https://www.coursera.org/specializations/business-strategy
5. Udemy, Design Thinking for Beginners: Develop Innovative Ideas 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 (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	2	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 analyze 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.

Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA	List of Course Activity (Any 02)	

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, 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, Prof. Dilwar Hussain, IIT Guwahati: https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_hs29

Course: French Language Module-II			Code: 25OEC202E	
Teaching Scheme (Hrs/Week)		Credit	Evaluation Scheme	
Tutorial	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

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

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

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 (Hrs/Week)		Credit	Evaluation Scheme	
Tutorial	2	2	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 (Hrs/Week)		Credit	Evaluation Scheme	
Tutorial	2	2	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		
Continuous Comprehensive Assessment (Any Two)		**20 Marks**
CCA	**List of Course Activity (Any 02)**	

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", Create space 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 Language : 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: Electrical Measurement and Instrumentation Lab				Code: 25ELPCC204L
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Practical/Tutorial	2	1	Practical	Marks: 25

Prerequisites:

1. Basic knowledge of electrical circuits and network analysis.
2. Fundamental understanding of electrical measuring instruments such as ammeter,
3. voltmeter, wattmeter and energy meter.
4. Basic concepts of AC bridges, transducers and sensors.
5. Introductory knowledge of microcontrollers/Arduino and basic programming.

Course Objectives: The objectives of the course are to:

1. To familiarize students with range extension techniques of electrical measuring instruments using instrument transformers.
2. To provide practical understanding of AC bridge methods for measurement of electrical parameters such as inductance, resistance and capacitance.
3. To develop skills for measurement of power and energy in single-phase and three-phase circuits.
4. To introduce calibration procedures and standards used in measurement systems.
5. To provide information about various standards and their relevance

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

CO1: Perform range extension of electrical measuring instruments using CT, PT and evaluate their applications in measurement systems.

CO2: Apply AC bridge techniques and modern measuring instruments such as LCR meter to measure electrical parameters like resistance, inductance and capacitance.

CO3: Measure and analyze active and reactive power in single-phase and three-phase systems using different wattmeter methods.

CO4: Conduct calibration of electrical measuring instruments such as energy meters and understand applicable standards and safety requirements.

CO5: Explain various standards related to electrical measurements and instruments

List of Experiments

Perform **any six** experiments from following list:

1. Extension of ammeter range using CT, voltmeter range using PT and watt meter range using CT / PT.
2. Measurement of inductance using Maxwell's bridge
3. Study of programmable LCR meter; Measure L, C, R, Q Factor, dissipation factor, and power factor of the given component
4. Measurement of active & reactive power in three phase balanced circuit using one wattmeter method with two-way switch
5. Measurement of three phase active & reactive power by two wattmeter method
6. Calibration of single-phase static energy meter at different power factors.
7. To study and plot the characteristics of LVDT.
8. Use of frequency meter, synchroscope, MFM

Perform **any two** experiments from following list:

1. Study of various standards (IS/IEC) related to calibration process of various instruments and NABL accredited Test Laboratory visit. Such as ----

   IS 13779 (Energy Meter)

   IS 12346 (Calibration Techniques)

   IEC 61010 (Safety)

   IEC 61557 (Electrical testing)

2. Measurement of electrical parameters using Power Analyzer
3. Measurement of electrical parameters using DSO.
4. Study of PLC

Virtual Laboratories: Perform experiment on -

1. Characterize the LVDT-https://sl-coep.vlabs.ac.in/ exp/lvdt/
2. Characterize the temperature sensor(RTD): https://sl-coep.vlabs.ac.in/exp/characterize-temperature-sensor/simulation.html
3. Measurement of unknown resistance by Wheatstone's Bridge: https://elms-iitr.vlabs.ac.in/exp/wheatstone-bridge/index.html
4. Calibration and Testing of Single Phase Energy Meter. https://elms-iitr.vlabs.ac.in/exp/energy-meter/simulation.html

Course: Network Analysis Lab				Code: 25ELPCC205L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical/Tutorial	2	1	Oral	Marks: 25

Prerequisites:

Terminology of electrical networks, series and parallel combinations of resistance, Laplace transforms, linear differential equations

Course Objectives: The objectives of the course are to

1.To analyze electrical networks using various theorems.

2.To learn applications of maximum power transfer theorem.

3.To determine time response of RL, RC, RLC series circuit for step DC voltage input.

4.To study different parameter sets such as Z, Y, H, and ABCD (transmission) parameters.

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

CO1: Analyze the given electrical network using Superposition, Thevenin's and Norton theorems.

CO2: Calculate maximum power and load impedance of a given electrical network by using maximum power transfer network.

CO3: Determine the time response of a given RL, RC, RLC series circuit by step input DC voltage.

CO4: Analyze circuit behavior using appropriate two-port parameters for given conditions.

List of Experiments

Any **four** experiments from the first six of the following and any **four** experiments from rest of the list.
(Minimum four experiments should be performed on both hardware and simulation environment.)

1. Verification of Superposition Theorem in A.C. circuits.
2. Verification of Thevenin's Theorem in A.C. circuits.
3. Verification of Norton's Theorem in A.C. circuits.
4. Verification of Reciprocity Theorem in A.C. circuits.
5. Verification of Millman's Theorem.
6. Verification of Maximum Power Transfer Theorem in A.C. circuits.
7. Determination of time response of series R-C circuit to a step D.C. voltage input. (Charging and discharging of a capacitor through a resistor)
8. Determination of time response of series R-L circuit to a step D.C. voltage input. (Rise and decay of current in an inductive circuit)
9. Determination of time response of series R-L-C circuit to a step D.C. voltage input.
10. Determination of Two-Port Network Parameters

Virtual Laboratories: https://ec-amrt.vlabs.ac.in/List%20of%20experiments.html

Course: Electrical Workshop				Code: 25ELVSE202
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical	2	2	Term Work	Marks: 25
			Oral	Marks: 25

Prerequisites:

Knowledge of working of different electrical domestic and industrial appliances.

Course Objectives: The objectives of the course are

1 To develop hardware skills such as soldering and winding etc

2. To develop debugging skills.

3. To increase ability of analysis and test circuits.

4. To give an exposure to market survey for available components.

5. To develop an ability to do proper documentation of experimentation.

6. To enhance employability of a student.

7. To prepare students for working on various hardware projects

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

CO1: Design/draw the electrical circuit for given application.

CO2: Read data manuals/data sheets for a specified application.

CO3: Repair and test electrical appliances/circuits.

CO4: Acquire Hardware skills to fabricate designed Circuits.

CO5: Test and Debug circuits.

CO6: Write the test report of a given electrical system.

List of Experiments

Group A (Electrical Components) (Minimum 3 Exercises from this group)

1. Design and fabrication of reactor for various inductance values.

2. Wiring and realization of contactor-based Star Delta starter.

3. Distribution box wiring for components like MCB, MCCB, ELCB, RCCB.

4. Repairing of Mixer/Grinder, Electric Iron.

5. Repairing of Ceiling / Table fan.

6. Demonstrative model of domestic wiring to control one fan and two lamps through switch board.

7. Wring of DOL starter and forward Reverse control of three phase induction motor

Group B (Arduino/ ESP32 based applications) (Perform any 3 experiments from this group)

(Interfacing circuits for Arduino / ESP32 based boards assembled on PCB's / Bread board)

1. Switch based Relay and 16 X 2 LCD display control.
2. DC motor speed control.
3. Stepper motor speed control.
4. Measurement and display of voltage, current, phase detect, Temperature, Humidity, IR, proximity sensors.
5. Generate Square, Triangular wave, PWM, SPWM signal

Group C (Electronic Circuits) (Minimum 2 Exercises from this group)

Electronic Circuits assembly and testing on general purpose PCB.

1. Design and Development of combined +/- 12 volt and +/- 5 volt regulated power supply.
2. Design and Development of Electronic Fan speed regulator using TRIAC
3. Design and Development of LM 317 and LM 337 based variable DC supply

Virtual Laboratories: Min 3 experiments covering all groups

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

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. डॉ. रमेश वरखडे, "सायबर संस्कृती", इन्स्टिट्यूट ऑफ नॉलेज इंजिनिअरिंग (Institute of Knowledge Engineering) / साकेत प्रकाशन

२. डॉ. ल. रा. नसिराबादकर, "व्यावहारिक मराठी", फडके प्रकाशन, कोल्हापूर

३. डॉ. केतकी मोडक, संतोष शेणई, सुजाता शेणई, "उपयोजित मराठी" , पद्मगंधा प्रकाशन

४. दीपक शिक्रापूरकर, "आधुनिक माहिती तंत्रज्ञानाच्या विश्वात" , उज्ज्वल मराठे, उत्कर्ष प्रकाशन, पुणे

५. "व्यावहारिक मराठी", पुणे विद्यापीठ प्रकाशन, पुणे

६. "प्रसारमाध्यमांसाठी लेखन कौशल्य", यशवंतराव चव्हाण मुक्त विद्यापीठ, नाशिक

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

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

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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 (Hrs/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 निभन्धसोपनः

Reference Books:

1. Panini Ashtadhyayi – Panini

Selected Sanskrit texts related to science and mathematics.

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: Business Fundamentals for Entrepreneurs			Code: 25HSM202
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**
Tutorial	2	2	TW	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
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: Indian Constitution and Governance				Code: 25VEC202
Teaching Scheme (Hrs/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		

Textbooks:

1. M. V. Pylee, "An Introduction to the Constitution of India", Vikas Publishing
2. D. D. Basu, "Introduction to the Constitution of India", LexisNexis

Reference Books:

1. Granville Austin, "The Indian Constitution: Cornerstone of a Nation", Oxford University Press
2. Subhash Kashyap, "Our Constitution: An Introduction to India's Constitution and Constitutional Law", National Book Trust

MOOC / NPTEL Courses:

1. NPTEL1, Introduction to Indian Constitution, 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, Prof. Sairam Bhat, National Law School of India University: https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_lw05
3. NPTEL3, Constitutional Studies, 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, Dr. A. Sridhar Raj, Institute of Public Enterprise: https://onlinecourses.swayam2.ac.in/e-learning/preview/cec24_hs38

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

Course: Fundamentals of Electric Vehicle (EV)				Code: 25ELHNR201
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:
Electrical Machines, Power Electronics, Digital Electronics

Course Objectives: The objectives of the course are

1. To Understand evolution, classification, and fundamental concepts of electric vehicles (EVs).
2. To Analyze the architecture and major components of electric vehicles.
3. To Apply the principles of vehicle dynamics to evaluate EV performance parameters.
4. To Explain electric propulsion concepts, torque-speed characteristics, regenerative braking techniques, for analysis in electric vehicles.
5. To Explore charging technologies, charging infrastructure, standards and smart mobility solutions.

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

CO1: Explain the evolution, classifications, advantages, limitations, and applications of electric vehicles in comparison with conventional vehicles.

CO2: Describe the architecture, construction, and functions of major electric vehicle components including motors, batteries, controllers, converters, chargers, and transmission systems.

CO3: Analyze vehicle dynamic parameters such as tractive effort, rolling resistance, aerodynamic drag, gradeability, acceleration, power, and torque requirements for electric vehicles.

CO4: Apply the principles of electric propulsion systems to evaluate torque-speed characteristics, regenerative braking, energy consumption, and overall vehicle efficiency.

CO5:Evaluate various EV charging technologies, charging standards, charging infrastructure, and emerging trends in electric mobility for sustainable transportation solutions.

Course Contents:

Unit I	**Introduction to Electric Vehicles**	**8 Hours**

Evolution of electric mobility, classification of EVs (BEV, HEV, PHEV, FCEV), comparison with conventional vehicles, advantages and limitations of EVs.

Unit II	**EV Architecture and Components**	**8 Hours**

Basic construction and layout of EVs, electric motors, battery packs, controllers, converters, chargers, transmission systems, and auxiliary systems.

Unit III	**Vehicle Dynamics and Performance Parameters**	**8 Hours**

Tractive effort, rolling resistance, aerodynamic drag, gradeability, acceleration, power and torque calculations, driving cycles.		
Unit IV	**Electric Propulsion Principles**	**8 Hours**
Fundamentals of electric traction, torque-speed characteristics, regenerative braking, efficiency considerations, and energy consumption analysis		
Unit V	**Charging Infrastructure and Emerging Trends**	**8 Hours**
Types of charging systems, charging standards, public charging infrastructure, wireless charging, smart mobility, and future trends in EV technology.		

Continuous Comprehensive Assessment (Any Two)		**20 Marks**
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**

1. Discuss the advantages and limitations of EVs compared with Internal Combustion Engine (ICE) vehicles.

2. Group discussion on the role of EVs in achieving sustainable transportation and reducing carbon emissions.

3.Debate: "Battery Electric Vehicles (BEVs) are better than Hybrid Electric Vehicles (HEVs)."

4. Debate: "Public charging infrastructure is the biggest challenge to EV adoption in India."

CCA 2	**Study / Survey Activities (Any 01)**	**10 Marks**

1. Analyze the success of EV adoption policies implemented in a selected Indian state.
2. Case study on the design and performance features of a commercial EV model (e.g., Tata Nexon EV, Mahindra BE 6, etc.).
3. Visit an EV charging station and prepare a report on charging standards, charger types, and operational features.
4. Visit an EV dealership/service center and prepare a report on EV components, battery systems, and maintenance practices.

CCA 3	**Seminar / Blog Writing Activities (Any 01)**	**10 Marks**

1] Presentation on classification and evolution of electric vehicles (BEV, HEV, PHEV, FCEV).

2] Seminar on emerging EV technologies such as wireless charging, smart mobility, and vehicle-to-grid (V2G) systems

3] Design a poster illustrating the architecture and major components of an electric vehicle.

4] Create an awareness poster on environmental and economic benefits of EV adoption

Text Books:

1. James Larminie and John Lowry, “Electric Vehicle Technology Explained” Wiley Publications
2. Iqbal Husain , “Electric and Hybrid Vehicles”, CRC press

Reference Books:

1. K. T. Chau and Chan C. C., “Electric Vehicle Machines and Drives”, Wiley-IEEE Press

MOOC / NPTEL Courses:

Fundamentals of Electric vehicles: Technology & Economics, Prof. Ashok Jhunjhunwala IIT Madras

https://nptel.ac.in/courses/108106170

Course: EV Drive Systems				Code: 25ELHNR202
Teaching Scheme (Hrs/Week)		Credit	Evaluation Scheme	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:
Electrical Machines, Power Electronics, Digital Electronics

Course Objectives: The objectives of the course are

1. To Understand the fundamentals, architecture, and operational requirements of electric vehicle drive systems.
2. To Analyze the operation and performance of power electronic converters employed in EV drive systems.

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

CO1: Explain the fundamentals, configurations, and operational requirements of electric vehicle drive systems.

CO2: Analyze the characteristics and suitability of various electric motors such as DC, BLDC, PMSM, induction, and switched reluctance motors for EV applications

CO3: Apply the principles of power electronic converters and inverter technologies used in EV propulsion systems

CO4: Evaluate speed control, torque control, regenerative braking, and energy management techniques for efficient EV drive operation.

CO5: Analyze integrated EV powertrain systems considering transmission, thermal management, fault diagnosis, and performance optimization

Course Contents:

Unit I	Introduction to EV Drive Systems	8 Hours
Fundamentals of electric drive systems, requirements of EV propulsion, comparison of different drive configurations.		
Unit II	**Electric Motors for EV Applications**	**8 Hours**
Construction, working, characteristics, and applications of DC motors, BLDC motors, PMSM, induction motors, and switched reluctance motors		
Unit III	**Power Electronic Converters**	**8 Hours**

DC-DC converters, inverters, choppers, PWM techniques, bidirectional converters, and their role in EV propulsion systems.

Unit IV	Control of EV Drives	8 Hours

Speed and torque control methods, vector control, regenerative braking control, motor protection, and energy-efficient drive operation.

Unit V	Integrated EV Powertrain Systems	8 Hours

Transmission systems, differential mechanisms, drive integration, thermal management, fault diagnosis, and performance optimization of EV drives.

Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	**List of Course Activity (Any 01)**	**10 Marks**

1. Group Discussion: Comparison of EV drive configurations (single motor, dual motor, and in-wheel motor drives) and their suitability for different vehicle types.
2. Debate: "BLDC Motors are more suitable than PMSMs for mass-market electric vehicles."
3. Assignment: Comparative analysis of DC, BLDC, PMSM, Induction Motor, and Switched Reluctance Motor based on efficiency, torque density, cost, and applications.
4. Assignment: Numerical problems on motor power, torque requirements, converter ratings, and regenerative braking energy calculations for EVs

CCA 2	Study / Survey Activities (Any 01)	10 Marks

1. Case Study Analysis: Study of the EV drive system used in a commercial electric vehicle, focusing on motor selection, converter topology, and control strategy.
2. Poster Making: Development of a poster illustrating the architecture of an integrated EV powertrain system including motor, inverter, transmission, and battery.
3. Quiz / Awareness Activity: Technical quiz on EV motors, converters, PWM techniques, regenerative braking, and drive control systems.
4. Field Visit / Report: Visit to an EV manufacturing facility, motor testing laboratory, EV service center, or power electronics laboratory and submission of a technical report

CCA 3	Seminar / Blog Writing Activities (Any 01)	10 Marks

1. Blog Writing: "Emerging Trends in Electric Vehicle Drive Systems and Smart Powertrains."
2. Seminar: Advanced motor control techniques for EVs including vector control, field-oriented control, and regenerative braking control.
3. Essay Writing: "Role of Power Electronic Converters in Improving EV Performance and Efficiency."
4. Seminar / Technical Presentation: Integrated EV powertrain systems, thermal management, fault diagnosis, and performance optimization techniques.

Text Books:

1. Iqbal Husain, “Electric and Hybrid Vehicles”, CRC Press
2. Mehrdad Ehsani, Yimin Gao, “Modern Electric, Hybrid Electric Vehicles and Fuel Cell”, CRC Press

Reference Books:

1. K. T. Chau and Chan C. C., “Electric Vehicle Machines and Drives”, IEEE Press

2. Ned Mohan, Tore M. Undeland and William P. Robbins, “Power Electronics”, Wiley

MOOC / NPTEL Courses:

EV - Vehicle Dynamics and Electric Motor Drives, Prof. Amit Jain, Prof. Avanish Tripathi ,IIT Delhi

https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee27

Course: Fundamentals of EV Lab				Code:25ELHNR201L
Teaching Scheme (Hrs./Week)		**Credit**	**Evaluation Scheme**	
Practical	2	1	Pr.	Marks: 25

Prerequisites:
Electrical Machines, Power Electronics, Digital Electronics

Course Objectives: The objectives of the course are

1. To Understand evolution, classification, and fundamental concepts of electric vehicles (EVs).
2. To Analyze the architecture and major components of electric vehicles.
3. To Apply the principles of vehicle dynamics to evaluate EV performance parameters.
4. To Explain electric propulsion concepts, torque-speed characteristics, regenerative braking techniques, for analysis in electric vehicles.
5. To Explore charging technologies, charging infrastructure, standards and smart mobility solutions.

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

CO1: Explain the evolution, classifications, advantages, limitations, and applications of electric vehicles in comparison with conventional vehicles.

CO2: Describe the architecture, construction, and functions of major electric vehicle components including motors, batteries, controllers, converters, chargers, and transmission systems.

CO3: Analyze vehicle dynamic parameters such as tractive effort, rolling resistance, aerodynamic drag, gradeability, acceleration, power, and torque requirements for electric vehicles.

CO4: Apply the principles of electric propulsion systems to evaluate torque-speed characteristics, regenerative braking, energy consumption, and overall vehicle efficiency.

CO5: Evaluate various EV charging technologies, charging standards, charging infrastructure, and emerging trends in electric mobility for sustainable transportation solutions.

List of Experiments (Any 8)

1] Identify and understand the functions of major EV components such as battery pack, motor, controller, charger, DC-DC converter, and transmission system using physical models or simulation tools

2] Prepare a comparative study of BEV, HEV, PHEV, and FCEV based on specifications, performance, advantages, and applications.

3] Plot and analyze torque-speed and power-speed characteristics of BLDC, PMSM, and induction motors using simulation software

4] Determine tractive effort, rolling resistance, aerodynamic drag, and gradeability for a given electric vehicle under different operating conditions.

5] Calculate power demand, energy consumption, and driving range for a selected electric vehicle based on standard driving cycles

6] Compare Lithium-ion, Lead-acid, Nickel Metal Hydride, and Solid-State batteries with respect to energy density, charging characteristics, efficiency, and lifecycle

7] Analyze energy recovery during braking and evaluate the impact of regenerative braking on vehicle efficiency using MATLAB/Simulink or equivalent software.

8] examine Level-1, Level-2, and DC Fast Charging systems, charging curves, charging standards, and safety requirements.

9] Study standard driving cycles (IDC, MIDC, WLTP, FTP-75) and evaluate their effect on EV performance, energy consumption, and battery utilization.

10] Investigate recent developments such as wireless charging, vehicle-to-grid (V2G), smart charging, battery swapping, or autonomous electric mobility and present findings in a technical report.

Course: EV Drive Systems Lab				Code:25ELHNR202L
Teaching Scheme (Hrs./Week)		Credit	Evaluation Scheme	
Practical	2	1	Pr	Marks: 25

Prerequisites:
Electrical Machines and Drives, Power Electronics, Digital Electronics

Course Objectives: The objectives of the course are

1. To Understand the fundamentals, architecture, and operational requirements of electric vehicle drive systems.
2. To Analyze the operation and performance of power electronic converters employed in EV drive systems.

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

CO1: Explain the fundamentals, configurations, and operational requirements of electric vehicle drive systems.

CO2: Analyze the characteristics and suitability of various electric motors such as DC, BLDC, PMSM, induction, and switched reluctance motors for EV applications

CO3: Apply the principles of power electronic converters and inverter technologies used in EV propulsion systems

CO4: Evaluate speed control, torque control, regenerative braking, and energy management techniques for efficient EV drive operation.

CO5: Analyze integrated EV powertrain systems considering transmission, thermal management, fault diagnosis, and performance optimization

List of Experiments (Any 10)

1. Study of EV drive system architecture and identification of propulsion system components.
2. Performance analysis of DC motor characteristics for EV propulsion applications.
3. Experimental study of BLDC motor speed-torque characteristics and efficiency.
4. Simulation and analysis of PMSM drive for electric vehicle applications using MATLAB/Simulink or equivalent software.
5. Study and implementation of DC-DC buck, boost, and bidirectional converters used in EVs.
6. Design and simulation of PWM-controlled inverter for EV motor drives.
7. Speed control of electric motor using closed-loop control techniques and performance evaluation.
8. Simulation of regenerative braking and analysis of recovered energy under different operating conditions.
9. Thermal performance analysis of EV drive components and cooling system evaluation.
10. Mini Project: Design and performance evaluation of an integrated EV powertrain system

Course: Renewable Energy Sources for Sustainable Development			Code: 25ELMNR201	
Teaching Scheme (Hrs/Week)		Credit	Evaluation Scheme	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:
Basic electrical energy Conversions.

Course Objectives: The objectives of the course are

1. To Understand global energy challenges, environmental impacts of conventional energy systems, and the need for renewable energy technologies.
2. To Study the principles, technologies, and applications of geothermal and ocean energy systems.
3. To Analyze advanced renewable energy conversion technologies including MHD and thermoelectric generators.
4. To Understand hydrogen energy systems and fuel cell technologies for sustainable energy applications.
5. To Evaluate emerging trends and future advancements in renewable energy systems for sustainable development.

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

CO1: Explain energy-related environmental issues and various renewable energy technologies for sustainable development.

CO2: Analyze the operating principles and applications of geothermal and ocean energy conversion systems.

CO3: Evaluate the performance and working of MHD generators and thermoelectric energy conversion systems.

CO4: Assess emerging technologies and future advancements in renewable energy systems for sustainable energy solutions

Course Contents:

Unit I	Energy Related Environmental Problems and Renewable Energy Technologies	8 Hours

Global energy scenario and sustainable development, Environmental impacts of conventional energy sources, Climate change, greenhouse gas emissions, and energy security, Overview of renewable energy resources, Solar, wind, biomass, hydropower, geothermal, and ocean energy, Renewable energy potential in India and worldwide, Energy conservation and sustainability concepts

Unit II	Geothermal and Ocean Energy	08 Hours

Geothermal Energy: Origin and classification of geothermal resources, Geothermal power generation systems, Dry steam, flash steam, and binary cycle plants, Advantages, limitations, and applications,

Ocean Energy: Ocean thermal energy conversion (OTEC), Tidal energy systems, Wave energy conversion technologies, Salinity gradient energy, Environmental and economic considerations

Unit III	MHD Generator and Thermoelectric Generators	08 Hours

Magneto Hydrodynamic (MHD) Power Generation:Principle of MHD generation Open-cycle and closed-cycle MHD systems, Components and working, Advantages and limitations, Applications and future prospects,

Thermoelectric Generators (TEG): Seebeck, Peltier, and Thomson effects, Construction and working of thermoelectric generators, Materials used in TEGs, Performance parameters and efficiency, Waste heat recovery applications

Unit IV	Fuel Cells and Hydrogen Energy	08 Hours

Hydrogen Energy: Hydrogen production methods, Electrolysis and thermochemical processes, Hydrogen storage technologies, Transportation and safety issues

Fuel Cells: Principles of fuel cell operation, Types of fuel cells: PEMFC, SOFC, AFC, PAFC, MCFC, Fuel cell characteristics and performance, Applications in transportation and stationary power generation

Unit V	Future Advancements in Renewable Energy Systems	08 Hours

Smart grids and renewable energy integration, Hybrid renewable energy systems, Energy storage technologies, Artificial intelligence in renewable energy management, Internet of Things (IoT) for energy monitoring, Vehicle-to-Grid (V2G) systems, Green hydrogen economy, Net-zero energy systems, Emerging renewable energy technologies, Future challenges and opportunities

Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	List of Course Activity (Any 01)	10 Marks

1. Group Discussion: Role of renewable energy technologies in achieving sustainable development and energy security.
2. Debate: "Green Hydrogen will replace fossil fuels as the primary energy carrier in the future."
3. Assignment: Comparative study of renewable energy resources (solar, wind, biomass, hydropower, geothermal, and ocean energy) with respect to efficiency, cost, and environmental impact.
4. Assignment: Analysis of renewable energy potential and deployment status in India, including government policies and initiatives.

CCA 2	Study / Survey Activities (Any 01)	10 Marks

1. Case Study Analysis: Evaluation of a successful renewable energy project (solar park, wind farm, geothermal plant, or hydrogen energy project) with emphasis on technical and economic aspects.
2. Poster Making: Design a poster illustrating climate change mitigation through renewable energy technologies and sustainable energy practices.
3. Quiz / Awareness Activity: Conduct a technical quiz or awareness campaign on renewable energy resources, fuel cells, hydrogen economy, and future energy systems.
4. Field Visit / Report: Visit a solar power plant, wind energy installation, smart grid facility, or renewable energy research center and submit a technical report.

CCA 3	Seminar / Blog Writing Activities (Any 01)	10 Marks

1. Blog Writing: "Future of Renewable Energy and Net-Zero Energy Systems in India."
2. Seminar: Emerging technologies in geothermal energy, ocean energy, and advanced renewable power generation systems.
2. Essay Writing: "Hydrogen Energy and Fuel Cells: Opportunities and Challenges for Sustainable Development."
3. Seminar / Technical Presentation: Smart grids, AI-enabled energy management, IoT-based energy monitoring, and Vehicle-to-Grid (V2G) integration.

Text Books:

1. John Twidell and Tony Weir, “Renewable Energy Resources” , Routledge pub
2. Godfrey Boyle et al , “Renewable Energy”, Oxford University Press

Reference Books:

1. G. D. Rai, “Non-Conventional Energy Sources”, Khanna Publishers
2. Bent Sørensen , “Hydrogen and Fuel Cells”, Academic Press

MOOC / NPTEL Courses:

NPTEL Course on Sustainable Power Generation Systems , Dr. Pankaj Kalita| ,IIT Guwahati

https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_ge47

Course: Solar Photovoltaic Systems				Code: 25ELMNR202
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Lecture	3	3	CCA	20
			ISE	30
			ESE	50

Prerequisites:
Electrical and Electronic circuits, Physics concepts

Course Objectives:

1. To Understand solar radiation concepts and estimate solar energy availability for photovoltaic applications.
2. To Study the construction, characteristics, and operating principles of solar photovoltaic cells, modules, and systems.
3. To Analyze the configuration, operation, and performance of solar PV power plants.
4. To Understand off-grid and grid-connected photovoltaic systems and their applications.
5. To Design and evaluate photovoltaic systems considering technical, economic, and environmental factors

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

CO1: Calculate solar radiation parameters and assess solar energy availability for photovoltaic applications.

CO2: Explain the operating principles and performance characteristics of solar PV cells, modules, and arrays.

CO3: Analyze the configuration, operation, and performance of solar PV power plants.

CO4: Evaluate off-grid and on-grid photovoltaic systems for various applications.

CO5: Design photovoltaic systems considering load requirements, component sizing, safety, and economic factors

Course Contents:

Unit I	Solar Radiation Calculation	08 Hours

Solar energy potential and solar spectrum, Sun–Earth relationship, Solar angles and solar geometry, Solar time and standard time, Measurement of solar radiation, Beam, diffuse, and global solar radiation, Extraterrestrial radiation calculations, Estimation of solar radiation on horizontal and inclined surfaces, Solar radiation data analysis, Solar resource assessment techniques

Unit II	Solar PV System Fundamentals	08 Hours

Principle of photovoltaic energy conversion, Semiconductor fundamentals, Construction and operation of solar cells, Types of solar cells: Monocrystalline, Polycrystalline, Thin-film, Bifacial and advanced PV cells, Solar cell equivalent circuit, I-V and P-V characteristics, PV modules and arrays, Maximum Power Point Tracking (MPPT), Efficiency and performance parameters, Factors affecting PV performance

Unit III	Solar PV Power Plants	09 Hours

Utility-scale solar PV power plants, Components of PV power plants, Array configuration and sizing, Inverters and power conditioning units, Transformers and switchgear, Plant monitoring and SCADA systems, Energy yield assessment, Performance ratio and capacity utilization factor, Operation and maintenance of PV plants, Case studies of large-scale solar installations

Unit IV	Off-Grid and On-Grid PV Applications	08 Hours

Off-Grid Systems, Stand-alone PV systems, Battery-based PV systems, Charge controllers, Rural electrification applications, Solar street lighting and water pumping systems, On-Grid Systems, Grid-connected PV systems, Net metering and gross metering, Grid synchronization

Grid codes and standards, Rooftop solar systems, Hybrid PV systems, Economic analysis of PV applications

Unit V	PV System Design Considerations	08 Hours

Load assessment and energy requirement analysis, PV array sizing, Battery bank sizing, Inverter selection, Cable and protection system design, Tilt angle optimization, Shading analysis, Reliability and safety considerations, Economic analysis and life cycle costing, Environmental impacts and sustainability assessment, Introduction to PV system simulation software

Continuous Comprehensive Assessment (Any Two)		20 Marks
CCA 1	List of Course Activity (Any 01)	10 Marks

1. Group Discussion: Challenges and opportunities in large-scale deployment of solar photovoltaic systems in India.
2. Debate: "Rooftop Solar Systems are more beneficial than Utility-Scale Solar Power Plants for sustainable energy development."
3. Assignment: Solar radiation calculations including solar angles, extraterrestrial radiation, and estimation of radiation on inclined surfaces for a selected location.
4. Assignment: Design and sizing of a solar PV system for a residential or commercial load considering energy demand, battery capacity, and inverter selection.

CCA 2	Study / Survey Activities (Any 01)	10 Marks

1. Case Study Analysis: Technical and economic evaluation of a large-scale solar PV power plant, including performance ratio, energy yield, and operational aspects.

2. Poster Making: Development of a poster illustrating the working principle, components, and environmental benefits of solar photovoltaic systems.

3. Quiz / Awareness Activity: Conduct a quiz or awareness campaign on solar energy potential, PV technologies, net metering, and renewable energy policies.

4. Field Visit / Report: Visit a solar PV power plant, rooftop solar installation, solar manufacturing facility, or renewable energy laboratory and submit a technical report.

CCA 3	**Seminar / Blog Writing Activities (Any 01)**	**10 Marks**

1. Blog Writing: "Future Trends in Solar Photovoltaic Technology and Smart Solar Energy Systems."

2. Seminar: Advanced solar cell technologies such as bifacial, thin-film, perovskite, and tandem solar cells.

3. Essay Writing: "Role of Solar Photovoltaic Systems in Achieving Sustainable and Carbon-Neutral Energy Goals."

4. Seminar / Technical Presentation: PV system design considerations including shading analysis, MPPT techniques, system protection, reliability, and simulation tools.

Textbooks:

1. Chetan Singh Solanki, “Solar Photovoltaics”, PHI Learning
2. John A. Duffie, William A. Beckman and Nathan Blair, “Solar Engineering of Thermal Processes, Photovoltaics and Wind Energy Systems”, Wiley Publication.

Reference Books:

1. Roger A. Messenger and Jerry Ventre, “Photovoltaic Systems Engineering”, CRC Press.
2. German Solar Energy Society (DGS), “Planning and Installing Photovoltaic Systems: A Guide for Installers, Architects and Engineers”, Earthscan / Routledge.

MOOC / NPTEL Courses:

NPTEL Course on Design of Photovoltaic Systems, Prof. L. Umanand, IISc Bangalore, https://nptel.ac.in/courses/117108141

Course: Renewable Energy Sources for Sustainable Development Lab				Code: 25ELMNR201L
Teaching Scheme (Hrs/Week)		Credit	Evaluation Scheme	
Practical	2	1	Pr	Marks: 25

Prerequisites:

Basic Electrical and Electronics Engineering Lab

Course Objectives: The objectives of the course are

1. To Understand global energy challenges, environmental impacts of conventional energy systems, and the need for renewable energy technologies.
2. To Study the principles, technologies, and applications of geothermal and ocean energy systems.
3. To Analyze advanced renewable energy conversion technologies including MHD and thermoelectric generators.
4. To Understand hydrogen energy systems and fuel cell technologies for sustainable energy applications.
5. To Evaluate emerging trends and future advancements in renewable energy systems for sustainable development.

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

CO1: Explain energy-related environmental issues and various renewable energy technologies for sustainable development.

CO2: Analyze the operating principles and applications of geothermal and ocean energy conversion systems.

CO3: Evaluate the performance and working of MHD generators and thermoelectric energy conversion systems.

CO4: Analyze hydrogen production, storage methods, and fuel cell technologies for clean energy applications.

CO5: Assess emerging technologies and future advancements in renewable energy systems for sustainable energy solutions

List of Experiments: (Any 08)

1. Assessment of renewable energy resources using available datasets.
2. Performance analysis of geothermal and ocean energy systems.
3. Simulation of thermoelectric generator characteristics.
4. Hydrogen production through electrolysis experiment/simulation.
5. Fuel cell performance analysis.
6. Hybrid renewable energy system design using simulation software.
7. Energy storage system modeling.
8. Smart grid integration study.

9. Case study on green hydrogen projects.
10. Mini-project on sustainable renewable energy solutions.

Virtual Laboratories:

1. Renewable energy Lab: https://re-iitb.vlabs.ac.in/

Course: Solar Photovoltaic Systems Lab				Code: 25ELMNR202L
Teaching Scheme (Hrs/Week)		**Credit**	**Evaluation Scheme**	
Practical/Tutorial	2	1	Pr	Marks: 25

Prerequisites:
Electrical and Electronic circuits, Physics concepts

Course Objectives:

1. To Understand solar radiation concepts and estimate solar energy availability for photovoltaic applications.
2. To Study the construction, characteristics, and operating principles of solar photovoltaic cells, modules, and systems.
3. To Analyze the configuration, operation, and performance of solar PV power plants.
4. To Understand off-grid and grid-connected photovoltaic systems and their applications.
5. To Design and evaluate photovoltaic systems considering technical, economic, and environmental factors

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

CO1: Calculate solar radiation parameters and assess solar energy availability for photovoltaic applications.

CO2: Explain the operating principles and performance characteristics of solar PV cells, Module and arrays.

CO3: Analyze the configuration, operation, and performance of solar PV power plants.

CO4: Evaluate off-grid and on-grid photovoltaic systems for various applications.

CO5: Design photovoltaic systems considering load requirements, component sizing, safety and economic factors

List of Experiments (Any 08)

1	Determination of solar angles and estimation of solar radiation for a given location and day.
2	Measurement and analysis of solar irradiance using a solar radiation meter/pyrometer.
3	Study of construction and operating characteristics of a solar photovoltaic cell.
4	Plotting and analysis of I–V and P–V characteristics of a solar PV module under varying irradiation conditions.

5	Determination of maximum power point and efficiency of a solar PV module.
6	Performance evaluation of MPPT techniques using simulation or experimental setup.
7	Study and testing of charge controllers and battery charging characteristics in PV systems.
8	Design and performance analysis of a stand-alone (off-grid) solar PV system for a specified load.
9	Study of grid-connected solar PV system, inverter operation, and synchronization requirements.
10	Design project: Sizing of a rooftop solar PV system including PV array, inverter, battery (if required), protection devices, and economic analysis.

Virtual Laboratories

Solar PV experiments on Virtual Lab: https://ep-iitb.vlabs.ac.in/exp/characteristics-solar-cell/theory.html

Dr. A A. Apte
BOS Chairman, Electrical Engineering

Dr. D. Y. Dhande
Dean Academics

Dr. D.S. Bormane
Principal