NEW HORIZON COLLEGE OF ENGINEERING

Department of
Electrical and Electronics Engineering

Academic Year 2026-27



5rd and 6th Semester Scheme and Syllabus

BATCH - 2024-2028
CREDITS: 160

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Contents		
S.No	**Vision, Mission, POs, PSOs & PEOs**	**P.No**
1	Institution Vision, Mission, Goals and Quality policy	**4**
2	Department Vision, Mission and Program Educational Objective (PEO)	**5**
3	Knowledge and Attitude Profile (Wk)	**6**
4	Program Outcomes (PO) with Graduate Attributes	**7**
5	Program Specific Outcomes (PSOs)	**9**
	Scheme	
6	Scheme of Fifth and Sixth Semester B.E	**10**
	Syllabus	
7	**Syllabus of Fifth Semester BE:**	
	a)24EEE51- Engineering Management and Entrepreneurship	**18**
	b)24EEE52- CMOS VLSI Design	**21**
	c)24EEL52- CMOS VLSI Design Laboratory	**24**
	d)24EEE53- Control Systems	**26**
	e)24EEL53- Control Systems Laboratory	**28**
	f)24EEE54-Industrial Automation	**30**
	g) 24RMK55-Research Methodology and IPR	**33**
	h)24SDK56- Problem Solving Methodologies	**35**
	i) 24EEE57-Societal Based Mini Project	**38**
	j)26NHOP5XX-Industrial Open Elective Course-I	
8	**Syllabus of Sixth Semester BE:**	
	a)24EEE61- Power Electronics	**41**
	b)24EEL61- Power Electronics Laboratory	**43**
	c)24EEE62-Generation, Transmission and Protection	**45**
	d)24EEL62- Power System Protection Laboratory	**48**
	e)24EEE63- Advanced Industrial and Building Automation	**50**
	f) 24EEE64X-Professional Elective Course-II 24EEE641- Advanced control Systems 24EEE642- Signals and DSP 24EEE643- High Voltage Engineering 24EEE644-Web Design Technologies 24EEE645- Introduction to Cybersecurity	 **53** **55** **58** **60** **62**
	g)24EEE65X- Ability Enhancement Course – V 24EEE651-Transducers and Sensors Laboratory 24EEE652-Multisim for Electrical design	 **65** **67**

	24EEE653-LAB View for Electrical Applications 24EEE654- AI Assisted Technical Writing Using Latex 24EEE655-Electronics Circuit Design Using Proteus	**69** **71** **73**
	h)24SDK66- Advanced Problem Solving Methodologies	**75**
	i)24EEE67-Capstone Project	**77**
	j)26NHOP6XX - Industrial Open Elective Course-II	
9	**Syllabus of NSS/PED/YOGA**	
	k) 24NSS50/60-National Service Scheme (NSS)	**79**
	l) 24PED50/60-Physical Education (PE) (Sports and Athletics)	**83**
	m) 24YOG50/60-Yoga	**86**
	Appendix A: List of Assessment Patterns	**88**
	Appendix B: Outcome Based Education	**89**
	Appendix C: The Graduate Attributes of NBA	**90**
	Appendix D: Bloom's Taxonomy	**92**

NEW HORIZON COLLEGE OF ENGINEERING

VISION

To emerge as an institute of eminence in the fields of engineering, technology and Management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

- To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.
- To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.
- To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

QUALITY POLICY

To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level

VALUES

- Academic freedom
- Integrity
- Inclusiveness
- Innovation
- Professionalism
- Social Responsibility

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To evolve into a centre of excellence in Electrical and Electronics Engineering for bringing out contemporary engineers, innovators, researchers and entrepreneurs for serving nation and society.

MISSION

- To provide suitable forums to enhance the teaching-learning, research and development activities.
- Framing and continuously updating the curriculum to bridge the gap between industry and academia in the contemporary world and serve society.
- To inculcate awareness and responsibility towards the environment and ethical values.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To provide good learning environment to develop entrepreneurship capabilities in various areas of Electrical and Electronics Engineering with enhanced efficiency, productivity, cost effectiveness and technological empowerment of human resource.

PEO2: To inculcate research capabilities in the areas of Electrical and Electronics Engineering to identify, comprehend and solve problems and adopt themselves to rapidly evolving technology.

PEO 3: To create high standards of moral and ethical values among the graduates to transform them as responsible citizens of the nation.

PEO TO MISSION STATEMENT MAPPING

PEOs	MISSION OF THE DEPARTMENT		
	M1	M2	M3
PEO1	3	3	2
PEO2	3	3	2
PEO3	2	2	3

KNOWLEDGE AND ATTITUDE PROFILE (WK)

S. No	Knowledge and Attitude Profile (WK)
1	WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
2	WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
3	WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
4	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.
5	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.
6	WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
7	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.
8	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.
9	WK9: Ethics, inclusive behaviour 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)

S.No	Graduate Attributes	Program Outcomes (POs)
1	Engineering Knowledge	PO1: 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.
2	Problem Analysis	PO2: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3	Design/Development of Solutions	PO3: 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)
4	Conduct Investigations of Complex Problems	PO4: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5	Engineering Tool Usage	PO5: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
6	The Engineer and The World	PO6: 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).

7	Ethics	PO7: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8	Individual and Collaborative Team work	PO8: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9	Communication	PO9: 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
10	Project Management and Finance	PO10: 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.
11	Life-Long Learning	PO11: 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)

PEOs to POs mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
PEO1	3	3	3	3	3	2	2	2	2	2	2	3	3
PEO2	3	3	3	3	3	2	2	2	2	2	2	3	3
PEO3	2	2	2	2	2	3	3	3	3	2	2	2	2

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Apply knowledge of electrical machines, circuit analysis, electronics, power systems, control, instrumentation, power electronics, signal processing, and embedded systems to analyse, design, and implement solutions for real-world applications using modern hardware and software tools.

PSO2: Design and develop innovative solutions in renewable energy, electric vehicles, smart grids, and automation with focus on environmental sustainability and societal needs.

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Electrical and Electronics Engineering

Scheme of Teaching and Examinations for 2024- 2028 BATCH (2024 Scheme)

V Semester													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	HSMS	24EEE51	Engineering Management and Entrepreneurship	EE	3	0	0	0	3	3	50	50	**100**
2	PCC	24EEE52	CMOS VLSI Design	EE	3	0	0	0	3	3	50	50	**100**
3	PCCL	24EEL52	CMOS VLSI Design Laboratory	EE	0	0	1	0	1	2	50	50	**100**
4	PCC	24EEE53	Control Systems	EE	3	0	0	0	3	3	50	50	**100**
5	PCCL	24EEL53	Control Systems Laboratory	EE	0	0	1	0	1	2	50	50	**100**
6	AEC*	24EEE54	Industrial Automation	EE	3	0	0	0	3	3	50	50	**100**
7	AEC	24RMK55	Research Methodology and IPR	EE	1	0	0	0	1	1	50	50	**100**
8	AEC	24SDK56	Problem Solving Methodologies	-	0	0	1	0	1	2	50	-	**50**
9	PROJ**	24EEE57	Societal Based Mini Project	EE	0	0	1	0	1	2	50	50	**100**
10	OEC*	26NHOP5XX	Industrial Open Elective Course-I	EE	3	0	0	0	3	3	50	50	**100**
11	NCMC	24NSS50	National Service Scheme	-	0	0	0	0	0	2	50	--	**50**
		24PED50	Physical Education and Sports	-									
		24YOG50	Yoga	-									
Total									**20**	**26**	**550**	**450**	**1000**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **PROJ**: Mini Project work **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation

AEC* (Skill Based Core Course):

Credit for AEC* with 03 (L: T: P: S) credits can be considered as (3: 0: 0: 0). The teaching and learning of these Courses will be based on hands-on. The Course content will be from Industry Certification Course Content. The Course Assessment will be based on CIE and SEE in practical mode.

24EEE51(HSMS)- This course must be pertaining to economics and management of the concerned degree program. The course syllabus should have both economics and management topics and the course title should bear the word Management.
For IT allied Branches: Software Product/ Project Management
For Core Branches: Engineering Economics and Management / Industrial Management and Entrepreneurship.

Societal Based Mini Project **:

The Mini project can be done in any lab across college. A common slot in time table can be allotted across all departments.

Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

(i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)
(ii) A group of 3- 4 if mini project work is single discipline (applicable to all Core Branches)
(iii) A group of 3 - 4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

Industrial Open Elective Courses-I:
Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0 : 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Electrical and Electronics Engineering

Scheme of Teaching and Examinations for 2024- 2028 BATCH (2024 Scheme)

VI Semester

S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	PCC	24EEE61	Power Electronics	EE	3	0	0	0	3	3	50	50	**100**
2	PCCL	24EEL61	Power Electronics Laboratory	EE	0	0	1	0	1	2	50	50	**100**
3	PCC	24EEE62	Generation, Transmission and Protection	EE	3	0	0	0	3	3	50	50	**100**
4	PCCL	24EEL62	Power System Protection Laboratory	EE	0	0	1	0	1	2	50	50	**100**
5	AEC*	24EEE63	Advanced Industrial and Building Automation	EE	3	0	0	0	3	3	50	50	**100**
6	PEC	24EEE64X	Professional Elective Course-II	EE	3	0	0	0	3	3	50	50	**100**
7	AEC	24EEE65X	Ability Enhancement Course – V	EE	If the course is a laboratory						50	50	**100**
					0	0	1	0	1	2			
8	NCMC	24SDK66	Advanced Problem Solving Methodologies	-	0	0	0	0	0	2	50	--	**50**
9	PROJ	24EEE67	Capstone Project	EE	0	0	2	0	2	4	50	50	**100**
10	PCC	26NHOP6XX	Industrial Open Elective Course-II	Offering Dept.	3	0	0	0	3	3	50	50	**100**
11	NCMC	24NSS60	National Service Scheme	-	0	0	0	0	0	2	50	--	**50**
		24PED60	Physical Education	-									
		24YOG60	Yoga	-									
Total									**20**	**29**	**550**	**450**	**1000**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project work**, L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, C**IE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation.

AEC* (Skill Based Core Course):
Credit for AEC* with 03 (L: T: P: S) credits can be considered as (3: 0: 0: 0). The teaching and learning of these Courses will be based on hands-on. The Course content will be from Industry Certification Course Content. The Course Assessment will be based on CIE and SEE in practical mode.

Professional Elective Course-II			
24EEE641	Advanced Control Systems	24EEE644	Web Design Technologies (2:0:1:0)
24EEE642	Signals and DSP	24EEE645	Introduction to Cybersecurity
24EEE643	High Voltage Engineering		

Ability Enhancement Course – V			
24EEE651	Transducers and Sensors Laboratory	24EEE654	AI Assisted Technical Writing Using Latex
24EEE652	Multisim for Electrical design	24EEE655	Electronics Circuit Design Using Proteus
24EEE653	LAB View for Electrical Applications		

Industrial Open Elective Courses-II:
Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0 : 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses can be added to supplement the latest trend and advanced technology in the selected stream of engineering.

Capstone Project:

Students have to discuss with the mentor /guide and with their help he/she has to define the problem statement for the project.

The objective of the Project is

- To encourage independent learning and the innovative attitude of the students.
- To develop interactive attitude, communication skills, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire team working.
- To expand intellectual capacity, credibility, judgment and intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To install responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

1. **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.
   The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.
2. **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

   SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful

completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

FIFTH SEMESTER
SYLLABUS

ENGINEERING MANAGEMENT AND ENTREPRENEURSHIP

Course Code	**24EEE51**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hours / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE51.1	Understand the concepts, principles, and functions of management and planning.
24EEE51.2	Apply organizing, staffing, directing, and controlling functions in organizations.
24EEE51.3	Analyze entrepreneurial traits, types, and development of entrepreneurship.
24EEE51.4	Understand the role, policies, and support systems for small scale industries.
24EEE51.5	Prepare and evaluate project reports based on feasibility analysis.
24EEE51.6	Analyze industrial ownership forms and entrepreneurship ecosystem.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE51.1	1	2	2	-	-	-	1	2	2	2	-	2	1
24EEE51.2	1	3	2	-	-	-	1	2	2	2	-	2	1
24EEE51.3	1	2	2	-	-	-	1	2	2	2	-	2	1
24EEE51.4	1	2	1	-	-	-	1	2	2	2	-	2	2
24EEE51.5	1	3	3	-	-	-	1	2	2	2	-	3	2
24EEE51.6	1	2	2	-	-	-	1	2	2	2	-	2	2

MODULE-1	**MANAGEMENT & PLANNING**	**24EEE51.1**	**8 Hours**

Management :

Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as art or science, art or profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modem management approaches.

Planning:

Nature, importance and purpose of planning process objectives - Types of plans (meaning only) - Decision making, Importance of planning - steps in planning & planning premises - Hierarchy of plans.

Self Study	Case studies on real-world planning decisions
Text Book	Text Book 1:1.2,1.3,1.6,1.7

MODULE-2	**ORGANIZING, STAFFING, DIRECTING, AND CONTROLLING**	**24EEE51.2**	**8Hours**

Organizing and staffing:

Nature and purpose of organization, Principles of organization – Types of organization-Departmentation Committees-Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning only) Nature and importance of staffing-- :Process of Selection & Recruitment (in brief).

Directing: Meaning and nature of directing Leadership styles, Motivation, Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of coordination.

Controlling: Meaning and steps in controlling - Essentials of a sound control system

Text Book	Text Book 1:2.1,2.2,2.3,2.4,2.5,2.6

MODULE-3	**CONCEPTS OF ENTREPRENEURSHIP**	**24EEE51.3**	**8 Hours**

Scope of Entrepreneurship, Definitions of Entrepreneurship and Entrepreneur, Entrepreneurial Traits, Characteristics and Skills, Stages in entrepreneurial process, Entrepreneurial Development models and Theories, Entrepreneurs Vs Managers, Classification of Entrepreneurs; Major types of Entrepreneurship – Techno Entrepreneurship, Women Entrepreneurship, Social Entrepreneurship, Intrapreneurship (Corporate entrepreneurship), Rural Entrepreneurship, Functions of Entrepreneurs, Role of Entrepreneurship In Economic Development, Current Scenario Of Entrepreneurship In India

Case Study	· Case studies on Indian entrepreneurs · Study on women & social entrepreneurship

Text Book	Text Book 2:3.1,3.2,3.3,3.4,3.5		
MODULE-4	**SMALL SCALE INDUSTRIES**	**24EEE51.4**	**8 Hours**

Small scale industries:
Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support
Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC
SingleWindow Agency; SISI; NSIC; SIDBI; KSFC

Text Book	Text Book 3:4.1,4.2,4.3,4.4,4.5		
MODULE-5	**PROJECT PREPARATION**	**24EEE51.5, 24EEE51.6**	**8 Hours**

Preparation of project:
Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of. Business Opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.
Industrial ownership:
Definition and meaning of Partnership, Characteristics of Partnership, Kinds of Partners, Partnership Agreement or Partnership Deed, Registration of Partnership Firm

Text Book	Text Book 3:5.1,5.2,5.3,5.4,5.5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	5	5	-
L2	Understand	10	10	10
L3	Apply	5	-	5
L4	Analyze	5	-	-
L5	Evaluate		-	-
L6	Create		-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Principles of Management – P. C. Tripathi, P.N. Reddy – Tata McGraw Hill,6th Edition 2023,ISBN: 978-9352838361
2) Dynamics of Entrepreneurial Development & Management-Vasant Desai,Himalaya Publishing House,4th Edition (Reprinted 2023),ISBN: 978-9354425856
3) Entrepreneurship Development – Poornima. M. Charantimath, Small Business Enterprises - Pearson Education,4th Edition 2023,ISBN: 978-9355206447

Reference Books:

1) Management Fundamentals - Concepts, Application, Skill Development –RobersLusier, Thomson,10th Edition,2003,ISBN: 978-0134540529
2) Entrepreneurship Development - S. S. Khanka, S. Chand & Co. New Delhi,3rd Edition ,ISBN: 978-8131785834
3) Management - Stephen Robbins, Pearson Education/PHI ,17th Edition,ISBN: 978-0134540529

Web links and Video Lectures (e-Resources):

- **https://nptel.ac.in/courses/110/105/110105147/**
- **https://swayam.gov.in/explorer?category=Management%20Studies**
- **https://www.startupindia.gov.in/**
- **https://msme.gov.in/**
- **https://www.investindia.gov.in/**
- **https://hbr.org/**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Case studies on management and entrepreneurial success stories
- Group discussions on planning, leadership, and business strategies
- Role plays on leadership, communication, and decision-making

CMOS VLSI DESIGN

Course Code	**24EEE52**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE52.1	Analyze MOSFET characteristics and delay models using standard device equations and graphical interpretation
24EEE52.2	Apply CMOS physical design principles to develop stick diagrams and layout for digital circuits under given specifications
24EEE52.3	Evaluate different MOSFET technologies and fabrication processes to select suitable technology for VLSI design under given constraints
24EEE52.4	Analyze CMOS combinational and sequential circuits to optimize performance parameters such as power, delay, and area
24EEE52.5	Apply delay models and timing analysis techniques to compute propagation delay and timing constraints of CMOS circuits
24EEE52.6	Design CMOS-based digital circuits using appropriate circuit families and timing considerations for given logic requirements

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE52.1	3	2	1	-	-	-	-	-	-	-	-	1	-
24EEE52.2	2	2	3	-	2	-	-	-	-	-	-	2	-
24EEE52.3	2	3	2	2	-	-	-	-	-	-	-	1	1
24EEE52.4	3	3	2	-	-	-	-	-	-	-	-	1	-
24EEE52.5	3	2	2	-	2	-	-	-	-	-	-	2	-
24EEE52.6	2	2	3	1	2	-	-	-	-	-	-	2	1

MODULE-1	**MOS TRANSISTOR THEORY**	**24EEE52.1, 24EEE52.3**	**8 Hours**

Introduction, MOS transistors, CMOS Logic, Design portioning -Introduction, Long-Channel I-V characteristics, C-V Characteristics - Simple MOS Capacitance Models, Non-ideal I-V effects, DC transfer characteristics.

Self-study	Investigate the trends in MOORE's law on MOSFET
Text Book	Text Book 1: 1.3, 1.4, 1.6, 2.1, 2.2, 2.3, 2.4, 2.5 Text Book 2: 2.1, 2.2, 2.3, 2.4

MODULE-2	**CMOS PROCESSING TECHNOLOGY**	**24EEE52.2, 24EEE52.6**	**8 Hours**

CMOS Fabrication and Layout, Exercises for stick diagram and layout, CMOS Technologies, Layout Design Rules, CMOS Process Enhancements, FinFET technology and GateAll around technology.

Case Study	Draw stick diagrams and layouts for developing circuits for given Boolean expressions.
Text Book	Text Book 1: 1.5, 3.1, 3.2, 3.3, 3.4 Text Book 2: 2.5, 2.6, 3.1, 3.2

MODULE-3	**DELAY AND COMBINATIONAL CIRCUIT BASICS**	**24EEE52.1, 24EEE52.5**	**8 Hours**

Introduction, Transient Response, RC Delay Model - Effective Resistance, Gate and Diffusion Capacitance, Equivalent RC Circuits, Transient Response, Elmore Delay, Layout Dependence of Capacitance, Linear Delay Model - Logical Effort, Parasitic Delay, Delay in a Logic Gate, Drive Introduction, Circuit Families - Static CMOS.

Case Study	Analysis and Optimization of Propagation Delay in a CMOS Inverter using RC Delay and Logical Effort Models.
Text Book	Text Book 1: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10 Text Book 2: 3.2, 3.3, 3.4, 3.5, 4.1, 4.2

MODULE-4	**COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN**	**24EEE52.4, 24EEE52.6**	**8 Hours**

Circuit Families - Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits- Domino Logic, Silicon-On Insulator Circuit Design.
Introduction, Sequencing Static Circuits, Circuit Design of Latches and Flip-Flops - Conventional CMOS Latches, Conventional CMOS Flip-Flops, Pulsed Latches, Resettable Latches and Flip-Flops.

Case Study	Design and develop combinational logic circuits and sequential logic circuits using MOSFET.
Text Book	Text Book 1: 9.2, 9.3, 9.4, 9.5, 10.1, 10.2, 10.3. Text Book 2: 4.3, 4.4, 5.1, 5.2, 5.3.

MODULE-5	**TIMING ANALYSIS**	**24EEE52.4, 24EEE52.5**	**8 Hours**

Delay in general, Slew Balancing & Transistor Equivalency, Design of 2-Inputs NAND & NOR Gates for Equal Rise and Fall Slew, MOS Capacitances, Design Techniques for Delay Reduction, Intrinsic Delay of Inverter and its Sizing Effect on Propagation Delay, Inverter Chain Design.

Case Study	Perform timing analysis on the given CMOS circuits
Text Book	Text Book 1: 4.10, 4.11, 4.12, 4.13, 4.14. Text Book 2: 5.4, 5.5, 5.6, 6.1.

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		**Marks Distribution**		
		Test (s)	**AAT1**	**AAT2**
		25	**15**	**10**
L1	**Remember**	**-**	**-**	**-**
L2	**Understand**	-	**-**	**-**
L3	**Apply**	10	5	5
L4	**Analyze**	10	5	5
L5	**Evaluate**	5	5	**-**
L6	**Create**	**-**	**-**	**-**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**--**
L2	**Understand**	**--**
L3	**Apply**	**20**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**--**

Suggested Learning Resources:

Text Books:

1) Neil H. E. Weste, David Money Harris, CMOS VLSI Design: A Circuits and Systems Perspective, Pearson, 2022, ISBN: 9780137981076
2) Veena S. Chakravarthi, A Practical Approach to VLSI System on Chip (SoC) Design: A Comprehensive Guide (2nd Edition), Springer, 2022, ISBN: 9783031183621.

Reference Books:

1) Andrew B. Kahng, Jens Lienig, Igor L. Markov, Jin Hu, VLSI Physical Design: From Graph Partitioning to Timing Closure (2nd Edition), Springer, 2022, ISBN: 9783030964146.
2) Rohit Dhiman, Rajeevan Chandel (Editors), Nanoscale VLSI: Devices, Circuits and Applications, Springer, 2021, ISBN: 9789811579394.
3) Sandeep Saini, Kusum Lata, G. R. Sinha (Editors), VLSI and Hardware Implementations using Modern Machine Learning Methods, CRC Press, 2021, ISBN: 9781032061719.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=Y8FvvzcocT4&t=1427s
- https://ocw.mit.edu/courses/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/

- https://www.youtube.com/watch?v=9Q9yIyNiAJQ&list=PLrjkTql3jnm8CKYCF0ZHyEFnaL-Homy97
- http://icbook.eecs.berkeley.edu/resources/powerpoint-slides

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Problem solving approaches
- Case studies
- Virtual Lab sessions
- Seminars

CMOS VLSI DESIGN LABORATORY

Course Code	**24EEL52**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEL52.1	Analyze CMOS logic circuits using appropriate design and simulation methods, to obtain functional characteristics under given specifications.
24EEL52.2	Apply layout design rules to implement CMOS circuits and perform physical verification, to ensure error-free layouts satisfying design and fabrication constraints.
24EEL52.3	Examine digital circuits modeled using switch-level and behavioral Verilog HDL through test benches to verify logical functionality under simulation condition.
24EEL52.4	Evaluate combinational and sequential circuits using hardware description methods, to meet specified functional and timing requirements.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEL52.1	3	2	3	2	2	-	-	-	-	-	-	1	-
24EEL52.2	3	2	3	2	3	-	-	-	-	-	-	1	-
24EEL52.3	2	2	3	2	3	-	-	-	-	-	-	1	-
24EEL52.4	2	2	3	2	3	-	-	-	-	-	-	1	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Programs / Demo		
	• Introduction to CMOS VLSI Design and Analog VLSI Design. • Introduction to Verilog and System Design using Verilog.	2	NA
	PART-A		
1	Draw the schematic of CMOS Inverter for the given specifications, and verify using Transient and DC analysis.	2	24EEL52.1
2	Draw the schematic of the following circuits for the given specifications, and verify using Transient and DC analysis: i. 2-input CMOS NAND gate ii. 2-input CMOS NOR gate.	2	24EEL52.1
3	Draw the schematic of transmission gate for the given specifications, and verify using Transient and DC analysis.	2	24EEL52.1
4	Draw the schematic of Common Source Amplifier for the given specifications, and verify the same using Transient and DC analysis.	2	24EEL52.1
5	Draw the layout of the CMOS Inverter and perform physical verification using DRC and LVS.	2	24EEL52.2
6	Draw the layout of the following circuits and perform physical verification using DRC and LVS: i. 2-input CMOS NAND gate ii. 2-input CMOS NOR gate.	2	24EEL52.2
	PART-B		
7	Write the switch level Verilog Code of CMOS inverter, and verify using Test Bench. .	2	24EEL52.3
8	For the following circuits, write the switch level Verilog Code and verify using Test Bench: i. 2-input CMOS NAND gate ii. 2-input CMOS NOR gate	2	24EEL52.3

9	Write the switch level Verilog Code of 2-input EXOR gate using CMOS logic and verify using Test Bench. .	2	24EEL52.3
10	For the following circuits, write the Verilog Code and verify using Test Bench: i. 4-bit Parallel adder ii. D Flip-flop.	2	24EEL52.4
11	For the following circuits, write the Verilog Code and verify using Test Bench, and then synthesize with the given Constraints: i. T Flip-flop ii. 4-bit Synchronous counter.	2	24EEL52.4
12	Synthesize the following CMOS inverter circuit using the gate level Verilog Code, with the given constraints.	2	24EEL52.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. **http://vlsi-iitg.vlabs.ac.in/MOSFET_theory.html**
2. **https://cse14-iiith.vlabs.ac.in/exp/transistor-level-inverter/**
3. **https://cse14-iiith.vlabs.ac.in/exp/transistor-level-nand/**
4. **https://cse14-iiith.vlabs.ac.in/exp/layout-design/**
5. **https://cse14-iiith.vlabs.ac.in/exp/d-flip-flop-verilog/**
6. **https://cse14-iiith.vlabs.ac.in/exp/circuits-verilog/**

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	5	10
L4	Analyze	10	10
L5	Evaluate	5	10
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	15
L4	Analyze	15
L5	Evaluate	20
L6	Create	--

Suggested Learning Resources:

Reference Books:

1) Neil H. E. Weste, David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", Publisher: Pearson Education, 5th edition, 2022, ISBN: 978-0135181960.
2) R. Jacob Baker, "CMOS: Circuit Design, Layout, and Simulation", Publisher: John Wiley & Sons, 4th edition, 2022, ISBN: 978-1119481519.

CONTROL SYSTEMS

Course Code	**24EEE53**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hours / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE53.1	Develop mathematical model of mechanical and electrical systems by using transfer function approach.
24EEE53.2	Analyze the time response of systems and examine their stability.
24EEE53.3	Deduce the closed loop frequency response from open loop system and determine their stability.
24EEE53.4	Design a suitable controller/compensator to meet the required frequency response.
24EEE53.5	Evaluate state model's controllability and observability by state space approach.
24EEE53.6	Implement a suitable closed loop system for a given practical application.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE53.1	3	3	2	2	-	-	-	-	-	-	-	-	1
24EEE53.2	3	3	2	2	-	-	-	-	-	-	-	-	1
24EEE53.3	3	3	3	3	-	-	-	-	-	-	-	-	1
24EEE53.4	3	3	3	3	-	-	-	-	-	-	-	-	1
24EEE53.5	3	3	3	3	-	-	-	-	-	-	-	-	1
24EEE53.6	3	3	2	2	-	-	-	-	-	-	-	-	1

MODULE-1	**MATHEMATICAL MODELLING**	**24EEE53.1, 24EEE53.6**	**8 Hours**
Open loop and closed loop systems - Mathematical modelling-Mechanical and electrical systems - electromechanical analogous systems-Block diagram reduction techniques - Signal flow graph.			
Self-study	Investigate the operation of different control systems applications.		
Text Book	Text Book 1: 1.1,2.1,2.2,2.4,2.5,2.6,2.7, Text Book 2: 3.2,3.3,3.4		
MODULE-2	**TIME RESPONSE**	**24EEE53.2, 24EEE53.6**	**8 Hours**
Standard signals-Time response-First and second order systems-Time domain specifications-Steady state error-Static and dynamic error constants - Effect of P-PD-PI-PID controllers.			
Applications	Investigate the different types of applications in industries with motors.		
Text Book	Text Book 1: 5.1,5.2,5.3,5.4,5.5,5.6,6.7,5.10,10.6, Text Book 3: 4.4,4.7		
MODULE-3	**STABILITY AND ROOT LOCUS**	**24EEE53.2, 24EEE53.6**	**8 Hours**
Stability Concepts-Location of closed loop poles-Classification of stability-Routh stability criterion-Root locus construction- Addition of open loop poles and zeros - Assessment of relative stability.			
Text Book	Text Book 1: 6.1,6.2,6.3,6.4,6.5,6.6,7.1,7.2,7.3,7.4, , Text Book 3: 8.10		
MODULE-4	**FREQUENCY RESPONSE**	**24EEE53.3, 24EEE53.6**	**8 Hours**
Frequency domain specifications-Correlation between time and frequency domain specifications-Polar plot-Nyquist stability analysis-Bode plot-Determination of closed loop response from open loop frequency response.			
Text Book	Text Book 1: 8.1,8.2,8.3,8.4,8.5,8.6,9.3, Text Book 2: 9.2, 9.3		
MODULE-5	**COMPENSATOR DESIGN AND STATE SPACE ANALYSIS**	**24EEE53.4, 24EEE53.5**	**8 Hours**
Compensator design: Performance Criteria-Lag compensator design using bode plots. Applications: Temperature control system and Position control system. State Space Analysis: State space representation-State Models-Controllability and Observability.			
Self-study	Investigate the state space analysis of a Temperature control system.		
Text Book	Text Book 1: 10.1,10.2,10.3,10.5,12.1,12.2,12.3,12.4,12.7, Text Book 2: 12.4,12.5,12.7		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	15
L5	Evaluate	15
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Control Systems Engineering, I.J.Nagrath and M.Gopal, New Age International Publishers, Sixth Edition, 2017, ISBN :9386070111.
2) Control Systems, Principles and Design, M. Gopal, Fourth Edition, Tata McGraw Hill, 2015, ISBN: 9780071333269.
3) Control System Engineering, Norman S. Nise, Sixth Edition, Wiley India, 2011. ISBN: 978-1-11880082-9

Reference Books:

1) Farid Golnaraghi and Benjamin C. Kuo, Automatic Control Systems, 11th Edition, 2023, ISBN: 978-1260570912.
2) Gene F. Franklin, J. David Powell and Abbas Emami-Naeini, Feedback Control of Dynamic Systems, 9th Edition, 2023, ISBN: 978-0138245108.
3) Richard C. Dorf and Robert H. Bishop, Modern Control Systems, 14th Edition, 2022, ISBN: 978-0137523900.
4) Katsuhiko Ogata, Modern Control Engineering (SI Version), 6th Edition, 2022, ISBN: 978-9354646750.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_ee90/preview
- https://onlinecourses.nptel.ac.in/noc24_ee65/preview
- https://www.academia.edu/35425584/Control_System_By_Norman_nise_Sixth_Ed
- https://controltheorymaster.files.wordpress.com/2017/11/farid-golnaraghi-benjamin-c-kuo-automatic-control-systems.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in industry applications
- For active participation of students, instruct the students to obtain solution for block diagrams and signal flow graphs
- Organizing Group wise discussions on different control systems applications
- Seminars

CONTROL SYSTEMS LABORATORY

Course Code	**24EEL53**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEL53.1	Determine transfer functions and characteristics of servo motors and synchro systems experimentally
24EEL53.2	Analyze time-domain and frequency-domain responses of control systems using experiments and simulations.
24EEL53.3	Evaluate the performance of controllers and compensators in feedback control systems.
24EEL53.4	Develop state-space models from transfer functions and assess system controllability and observability using appropriate software tools.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEL53.1	3	2	2	1	1	-	-	-	-	-	-	1	1
24EEL53.2	3	2	2	1	1	-	-	-	-	-	-	1	1
24EEL53.3	3	2	2	1	1	-	-	-	-	-	-	1	1
24EEL53.4	3	2	2	1	1	-	-	-	-	-	-	1	1

Exp. No.	List of Experiments/Program	Hours	COs
	Prerequisite Experiments / Demo		
	Introduction to Electric Circuit Theory and Laplace Transform	2	NA
	PART-A		
1	Determination of Transfer function of DC servo motor by obtaining its Torque Speed characteristics.	2	24EEL53.1
2	Determination of Transfer function of AC servo motor by obtaining its Torque Speed characteristics.	2	24EEL53.1
3	Experiment to draw synchro pair characteristics.	2	24EEL53.1
4	Obtain the time response of the second order system and determine the time domain specifications and verify the same by simulation.	2	24EEL53.2
5	To design a passive RC lag compensating network for the given specifications and obtain the frequency response and determine the transfer function experimentally.	2	24EEL53.3
6	To design a passive RC lead compensating network for the given specifications and obtain the frequency response and determine the transfer function experimentally.	2	24EEL53.3
	PART-B		
7	To study the effect of P, PI, PD and PID controller on the step response of a feedback control system and verify the same by simulation.	2	24EEL53.3
8	DC position control system.	2	24EEL53.3
9	Temperature Control system.	2	24EEL53.3
10	Stability analysis using Bode and Nyquist of LTIV system using suitable software.	2	24EEL53.2
11	Stability analysis using Root Locus of LTIV and effect of open loop and zeroes on root locus contour using suitable software.	2	24EEL53.2
12	State space model for classical transfer function and verifying the controllability and observability using suitable software.	2	24EEL53.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. Determination of the incremental transfer function of an AC Servomotor
   http://vlabs.iitkgp.ac.in/psac/newlabs2024/ctrl/Exp4/index.html
2. Study the effect of PI, PD and PID controller on system performance.
   https://ce-dei.vlabs.ac.in/exp/to-study-the-effect-of-pi-pd-and-pid-controller-on-a-control-system/index.html
3. Simulation of control system
   https://vlabs.iitkgp.ac.in/ctrl/Exp12/index.html
4. Obtain root locus for a given Transfer Function
   https://ce-dei.vlabs.ac.in/exp/to-obtain-root-locus-for-a-given-transfer-function-of-the-system/
5. Obtain Bode plot for a given Transfer function
   https://ce-dei.vlabs.ac.in/exp/to-obtain-bode-plot-for-a-given-transfer-function-of-the-system/
6. Temperature Control System
   https://vlabs.iitkgp.ac.in/ctrl/Exp9/index.html

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	5	10
L4	Analyze	10	10
L5	Evaluate	5	10
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	15
L4	Analyze	15
L5	Evaluate	20
L6	Create	--

Suggested Learning Resources:

1) Control Systems Engineering, I.J.Nagrath and M.Gopal, New Age International Publishers, Sixth Edition, 2017, ISBN :9386070111.
2) Control Systems, Principles and Design, M. Gopal, Fourth Edition, Tata McGraw Hill, 2015, ISBN: 9780071333269Control System Engineering, Norman S. Nise, Sixth Edition, Wiley India, 2011. ISBN: 978-1-118-80082-9
3) Modern Control Engineering, K. Ogata, Fifth edition, PHI, 2012, ISBN: 0136156738.
4) Control System Engineering, S.K.Bhattacharya, Third Edition, Pearson, 2013, ISBN: 9788131791653.
5) Control System, Dhanesh. N. Manik, Cengage Learning, 2012, ISBN: 9788131518120.
6) Automatic Control systems, Benjamin C. Kuo, Ninth Edition, Wiley, 2014. ISBN: 78-8126552337
7) https://onlinecourses.nptel.ac.in/noc20_ee90/preview
8) https://onlinecourses.nptel.ac.in/noc24_ee65/preview

INDUSTRIAL AUTOMATION

Course Code	**24EEE54**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE54.1	Analyze fundamental concepts of industrial automation and basic automation components.
24EEE54.2	Interpret PLC architecture and communication principles for industrial control applications.
24EEE54.3	Apply ladder logic programming techniques for implementing sequential control operations.
24EEE54.4	Design automation solutions using advanced ladder-based sequential control strategies.
24EEE54.5	Construct industrial automation workflows using Sequential Function Charts (SFC).
24EEE54.6	Develop HMI-based monitoring and control interfaces incorporating modern connectivity features.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE54.1	3	2	1	1	-	-	-	-	-	-	-	2	-
24EEE54.2	3	3	2	2	2	-	-	-	-	-	-	2	2
24EEE54.3	3	3	3	2	3	-	-	-	-	-	-	3	2
24EEE54.4	3	3	3	3	3	-	-	-	-	-	-	3	2
24EEE54.5	3	3	3	3	3	-	-	-	-	-	-	3	3
24EEE54.6	2	2	3	3	3	-	-	-	-	2	1	2	3

MODULE-1	**BASICS OF INDUSTRIAL AUTOMATION**	**24EEE54.1**	**8 Hours**

Introduction to Automation: Definition and need for automation, Manual vs automatic control
Benefits: productivity, safety, energy efficiency
Components of an Automation System: Sensors, Actuators, Basics of digital input/output

Hands on:

1. Basic ON/OFF Control of a Lamp Using PLC
2. Implement Logic Gates in Ladder Logic
3. Latching Circuit for Lamp Control

Case Study	Automated Street Lighting System

MODULE-2	**PLC ARCHITECTURE & COMMUNICATION PROTOCOLS**	**24EEE54.2**	**8 Hours**

PLC architecture: Scan cycle, operating modes, Addressing methods, PLC communication basics: USB, Ethernet TCP/IP, IP address, subnet mask, advantages and disadvantages of PLC

Hands on:

1. Timer-based Lamp ON/OFF Delay Using TON/TOF
2. Counter-Based Lamp Activation After Certain Pulses
3. Counter-Based Lamp Activation using operator block

Case Study	Automated Conveyor Sorting System

MODULE-3	**PLC-BASED SEQUENTIAL CONTROL**	**24EEE54.3, 24EEE54.4**	**8 Hours**

Basics of Sequential Control, Core Elements in Sequential Control, Ladder-Based Sequential Logic,Transition Logic in Ladder, Limitations of Ladder for Sequential Tasks Real industrial uses: motors, conveyors, heaters, drill presses.

Hands on:

1. Heater–Fan Sequential Automation
2. Water Level Based Sequential Pump Control
3. Sequential control of lamps

MODULE-4	SEQUENTIAL FUNCTION CHARTS (SFC) & INDUSTRIAL PROCESS AUTOMATION	24EEE54.5	8 Hours

Introduction to SFC: Steps, transitions, Characteristics of Transitions, Typical Transition Conditions, actions, SFC vs Ladder logic comparison, Building SFC for Industrial Processes, Suitable Industrial Applications for SFC Concepts

Hands on:

1. Development of Functional Specification SFC Diagram for a Drilling Machine Process
2. Modification of Drilling Machine SFC Using Intermediate Position Detection for Energy Optimization
3. Enhancing Drilling Machine SFC with TON-Based Dwell Timer in the Lowest Position

Case Study	Traffic Light Control

MODULE-5	HMI & INDUSTRY 4.0	24EEE54.6	8 Hours

Introduction to HMI, Purpose, operator interaction, Basic HMI screen design principles, Buttons, indicators, lamps Tag mapping: linking PLC variables to HMI elements, Mimic screen concepts & animations

Basic ideas of Industry 4.0:Device connectivity, real-time monitoring

Hands on:

1. HMI-Based Switch Control and Lamp Actuation
2. Development of a Real-Time Mimic Screen for Process Visualization
3. PLC–HMI Communication Testing

Case Study	Tank Level Monitoring and Pump Control System

CIE Assessment Pattern (50 Marks – Hands On) –

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	-
L4	Analyze	5	5	5
L5	Evaluate	10	5	5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Hands-On)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	15
L4	Analyze	15
L5	Evaluate	20
L6	Create	-

Reference Books:

1) Frank D. Petruzella, *Programmable Logic Controllers*, 6th Edition, McGraw-Hill Education, 2023, ISBN: 9789355325860.
2) Kelvin T. Erickson, *Programmable Logic Controllers: An Emphasis on Design and Application*, 4th Edition, 2023, ISBN: 9780976625964.
3) Terry Borden and Richard A. Cox, *Technician's Guide to Programmable Controllers*, 7th Edition, 2022, ISBN: 9780357622490.
4) Kaushik Kumar and B. Sridhar Babu (Eds.), *Industrial Automation and Robotics: Techniques and Applications*, 1st Edition, 2024, ISBN: 9780367639853
5) Chanchal Dey, Sunit Kumar Sen, Industrial Automation Technologies, 1st Edition, 2022. ISBN-13: 9780367496074

Web links and Video Lectures (e-Resources):

- https://ial-coep.vlabs.ac.in/
- https://plc-coep.vlabs.ac.in/
- https://www.youtube.com/@vinodkumarvino1012
- https://newhorizoncollegeofengineering.in/industrial-automation/
- https://www.plcopen.org/certification/logic/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends and applications in Industrial Automation, Industry 4.0, Smart Manufacturing, PLCs, and HMIs.
- Seminars on emerging automation technologies such as Industrial IoT (IIoT), Digital Twins, Smart Factories, and Cyber-Physical Systems.
- Mini-projects involving PLC programming, HMI design, and automation of industrial processes.
- Industrial visits or virtual plant tours to understand real-time automation and control practices.

RESEARCH METHODOLOGY AND IPR

Course Code	**24RMK55**	**CIE Marks**	**50**
L: T: P: S	**1:0:0:0**	**SEE Marks**	**50**
Hours / Week	**01**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes:
At the end of the course, the student will be able to:

24RMK55.1	Define research problems and formulate research questions and research objectives.
24RMK55.2	Demonstrate research processes, critical thinking, and academic writing skills.
24RMK55.3	Understand the statutory provisions and different forms of Intellectual Property Rights (IPRs).
24RMK55.4	Identify the significance and procedures of patents, including patent filing and protection.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24RMK55.1	3	3	2	2	2	–	–	1	2	–	2	**2**	**-**
24RMK55.2	3	3	2	2	2	–	–	1	2	–	2	**3**	**2**
24RMK55.3	3	3	2	1	1	–	1	1	2	–	2	**3**	**3**
24RMK55.4	3	3	2	1	–	–	1	1	2	–	2	**2**	**2**

MODULE-1	**FORMULATION OF RESEARCH PROBLEM**	**24RMK55.1**	**3 Hours**

Research– Meaning and Objectives–Types of Research–Research Approaches-Research Process–Literature Review–Research Problem– Identification and Defining the Research Problem.

Text Book	Text Book 1: Ch. 1, 2

MODULE-2	**RESEARCH DESIGN PROCEDURES**	**24RMK55.2**	**3 Hours**

Meaning of Research Design – Features of a Good Design –Concepts Related to Research Design– Different Research Designs – Basic Principles of Experimental Designs.

Case Study	To find the solution for the given research problem using different types of research methods
Text Book	Text Book 1: Ch. 3

MODULE-3	**INTERPRETATION AND REPORT WRITING**	**24RMK55.1 24RMK55.2**	**3 Hours**

Meaning and Technique of Interpretation – Precautions in interpretation – Different Steps in Report Writing – Layout of a Research Report– Types of Report – Mechanics of Writing a Research Report –Conclusion-Referencing in Academic Writing –Bibliography.

Text Book	Text Book 2: Ch. 14

MODULE-4	**INTRODUCTION TO IPR**	**24RMK55.3**	**3 Hours**

Introduction and Significance of Intellectual Property Rights –Types of Intellectual Property Rights–Rationale for Protection of IPR–IPR in India and Abroad–Forms of IPR – Royalty – Copyright – Trademark – Patents – Industrial Designs –Application of Different Forms of IPR– Future Aspects of IPR– Some Examples of IPR.

Text Book	Text Book 2: Ch. 1 and 2

MODULE-5	BASICS OF PATENTS	24RMK55.3, 24RMK55.4	3 Hours

Patents and its Basics – Patentable and Non-Patentable Inventions–Patent Application Process (National and International level) –Drafting and Filing a Patent –Types of Patent Applications–Patent Documents–Specification and Claims–Assignment, Licensing, Infringement–Different Layers of International Patent System

Case Study	Analyze different domains of filed patents
Text Book	Text Book 2: Ch. 1 and 2

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1-Patent drafting	AAT2- Review paper writing
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	-	-
L4	Analyze	5	5	5
L5	Evaluate	5	5	5
L6	Create	-	5	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Kothari, C.R., Research Methodology: Methods and Techniques, New Age International, 2024, ISBN-9789389802559
2) Ramakrishna Chintakunta, A Text book of Intellectual Property rights, Blue Hill Publication, ASIN: B09T6YDB5N, 2022

Reference Books:

1) Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K, An Introduction to Research Methodology, RBSA Publishers. 2022, ISBN-13:978-8176111652
2) Ranjith Kumar, Research methodology, Saga publications,5th edition, 2024, ISBN- 9781529788785.
3) Sinha, S.C. and Dhiman, A.K., Research Methodology, EssEss Publications. 2 volumes, 2022. ISBN: 81-7000-324-5(Vol-I), 81-7000-334-2 (Vol-II)
4) Asha Vijay Durafe, Dhanashree K. Toradmalle , Intellectual Property Rights, Dreamtech Press,2024, ISBN: 9789351195191.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=GSeeyJVD0JU
- https://www.youtube.com/watch?v=nv7MOoHMM2k
- https://www.youtube.com/watch?v=BGSgZ1J8-yQ
- https://onlinecourses.nptel.ac.in/noc22_ge08/preview
- https://www.coursera.org/learn/research-methods
- https://www.wipo.int/academy/en/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Sessions
- Organizing Group Wise Discussions
- Paper Presentation
- Review paper writing
- Patent drafting

PROBLEM SOLVING METHODOLOGIES

Course Code	**24SDK56**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**-**
Hrs / Week	**2**	**Total Marks**	**50**
Credits	**1**	**Exam Hours**	**02**

Course outcomes:
Upon successful completion of this course, the student will be able to:

24SDK56.1	Demonstrate proficiency in solving quantitative aptitude problems using fundamental concepts
24SDK56.2	Apply advanced quantitative techniques to address and solve complex real-world problems.
24SDK56.3	Develop and enhance logical reasoning skills essential for problem-solving in various competitive examinations.
24SDK56.4	Cultivate critical and creative thinking skills necessary for analytical reasoning and problem-solving.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24SDK56.1	3	3	-	-	2	-	-	-	-	-	-
24SDK56.2	3	3	-	-	2	-	-	-	-	-	-
24SDK56.3	3	3	-	-	2	-	-	-	-	-	-
24SDK56.4	3	3	-	-	2	-	-	-	-	-	-

MODULE-1	**Critical Thinking through Quantitative Analysis**	**24SDK56.1 24SDK56.2**	**6 Hours**

Number systems: LCM and HCF of numbers, Squaring and Cubing Techniques, Multiplication Tricks, Divisibility rules, Digit sum method, Speed Math, Simplifications, Approximations.

Percentages: Conversion of Fraction to Percentage Table, Percentage Change, Net percentage change/Effective percentage change, Successive Percentage, Concept of more/less percentage, Percentage of percentage, Product constancy, Increased/decreased by P%, Percentage Changes in Numerator and Denominator, Successive Percentage.

Averages: Basic concept, Consecutive Numbers, Non-Consecutive Numbers, Equation Concept, True/False concept, Including/Excluding concept, Replacement concept, Average Speed concept.

MODULE-2	**Numerical Techniques for Problem Solving**	**24SDK56.1 24SDK56.2**	**6 Hours**

Profit and Loss: Basic concept, Profit Percentage, Loss Percentage, Profit/Loss Percentage, Overall Profit/Loss, Dishonest shopkeeper, More/less loss concept, Discounts

Ratio and Proportion: Concept Explanation, Duplicate Ratio, Triplicate Ratio, Direct Proportion, Indirect Proportion, Double rule of three or compound proportion, Ratio in investment, Ratio in partnership, Ratio in averages, Ratio in profit and loss, Ratio in interest rates.

Ages: Ratio and sum of ages, Ratio and Product of Ages, Ratio of Present and Future Ages, Ratio of Past and Present Ages.

Partnership: Simple Partnership, Compound Partnership, Partnership at Will, Partnership for a Fixed Term, Particular Partnership, General Partnership, Limited Partnership, Limited Liability Partnership.

MODULE-3	**Quantitative Techniques**	**24SDK56.1 24SDK56.2**	**6 Hours**

Time and Work: Unit work, Combined work, Individual efficiency, Group efficiencies, Time taken by an individual or a group, Work done by an individual or a group, Total work done, Chain Rule Concept, Pipes and Cisterns, 4 Rules of Pipes and Cistern.

Gamification: Switch Grid, Geo Sudoku, Grid Lock, Number Challenge, Cognitive reasoning games.

Cognitive Ability: Statements & Conclusions, Statements & Assertions, Statements & Assumptions, Causes & Effects and Flow Charts.

MODULE-4	Analytical Reasoning and Creative Problem Solving	24SDK56.3 24SDK56.4	6 Hours

Number Series - Missing numbers, Incomplete series - Odd-even series, primes, Fibonacci series, Arithmetic progression, Geometric progression, Harmonic progression, Squares and cubes, Operations on digits, Exponential series, Increasing multiplication, Hybrid series.

Alphabetical Series- Missing alphabets, incomplete letter series - series of words, series of letters, arrangement of words/letters, letters marked with corresponding numbers sequence, positions of letters, ranking of the word in dictionary; Mixed Series - Missing numbers and words/letters, complete the series. **Analogies:** Alphabet Classification, Word Classification, Number Classification.

Coding and Decoding: Coding based on order, Letter to Letter Mapping, Letter to number mapping, Letter to digit mapping, Re-ordering sequences; Word sequencing, Match the word to code, Symbol Coding.

MODULE-5	Problem Solving through Logical Analysis	24SDK56.3 24SDK56.4	6 Hours

Directions: Eight Directions, Distance, Displacement, Starting and ending points, Referential directions, Directions of shadows, Axis based problems, Actual and conditional directions.

Seating Arrangements: Linear arrangement, Square Arrangement, Rectangular Arrangement, Circular arrangement, Vertical arrangement, Seating arrangement in a photograph, Tabular arrangement, Hexagonal Seating Arrangement, Complex arrangement, Miscellaneous arrangements.

Blood Relations: Relations defined, Generation Verticals, Family Tree, Single Person Blood Relations, Mixed/Chain Blood Relations, Symbol based Blood Relation.

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution
		Tests
		50
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Quantitative Aptitude for Competitive Examinations — R.S. Aggarwal
2. How to Prepare for Quantitative Aptitude for CAT — Arun Sharma

Reference Books:

1. Quantum CAT — Sarvesh K. Verma
2. Fast Track Objective Arithmetic — Rajesh Verma
3. Quantitative Aptitude for Placements — Dinesh Khattar

Web links and Video Lectures (e-Resources):

- Freshersworld: Aptitude & Reasoning
  https://www.youtube.com/results?search_query=Freshersworld+Aptitude+Reasoning
- Adda24/7: Aptitude & Reasoning
  https://www.youtube.com/results?search_query=Adda247+Quantitative+Aptitude+Reasoning

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

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Activity	Aptitude Topic	Description
Math Relay Race	Percentages, Profit & Loss, Time & Work	➢ Divide students into teams. Each student solves one question and passes the sheet to the next teammate. The first team to finish with the most correct answers wins.
Puzzle & Seating Challenge	Seating Arrangements, Logical Reasoning	➢ Give each team a seating arrangement or logic puzzle. Teams compete to solve it within a fixed time.
DI Detective	Data Interpretation	➢ Provide charts, graphs, or tables. Students answer questions individually or in groups, explaining how they arrived at their answers.
Human Number Line	Number System, Averages, Ratio & Proportion	➢ Students hold number cards and physically arrange themselves to solve ordering, averages, ratios, or sequence-based problems.
Aptitude Quiz Bowl	Mixed Aptitude Topics	➢ Conduct a quiz with multiple rounds (MCQs, rapid fire, visual reasoning, puzzles, and calculation challenges). Award points to teams and maintain a leaderboard.

SOCIETAL BASED MINI PROJECT

Course Code	**24EEE57**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEE57.1	Identify and analyze societal problems relevant to the field of electrical and electronics engineering
24EEE57.2	Design a feasible and sustainable solution addressing an identified societal need.
24EEE57.3	Implement and validate the proposed solution using appropriate tools and techniques.
24EEE57.4	Evaluate the project performance and communicate its societal impact, sustainability, and outcomes effectively.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE57.1	3	3	2	3	-	2	2	-	-	-	-	2	-
24EEE57.2	3	3	3	3	2	2	3	2	-	-	2	3	2
24EEE57.3	3	2	3	3	3	-	2	-	-	-	2	3	3
24EEE57.4	2	2	-	2	2	3	3	3	3	3	3	2	2

Societal-Based Mini Project is a laboratory-oriented course that provides a platform for students to enhance their practical knowledge, technical skills, and social responsibility by identifying and addressing real-world societal problems through innovative engineering solutions. Students shall be capable of recognizing issues related to energy conservation, sustainable development, rural electrification, environmental protection, healthcare support, public safety, and smart infrastructure, and developing feasible, cost-effective, and sustainable solutions using modern technologies in the field of Electrical and Electronics Engineering. Based on the abilities of the student and the recommendations of the guide, either a single-discipline or a multidisciplinary project may be assigned to an individual student or to a group consisting of not more than four students.

The project work shall be periodically reviewed by a panel of experts throughout the semester, and the Continuous Internal Evaluation (CIE) marks shall be awarded based on problem identification, societal relevance, innovation, work accomplished, project presentation skills, and performance in the question-and-answer session. Any project found to be plagiarized will automatically be awarded an F grade, and the concerned student shall be liable for further disciplinary action as per institutional regulations. At the completion of the project, the student shall submit a project report documenting the identified societal problem, methodology adopted, implementation details, and outcomes, which will be evaluated by duly appointed examiner.

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Review 1 (25 Marks)	Review 2 (25 Marks)
		25	25
L1	**Remember**	-	-
L2	**Understand**	-	-
L3	**Apply**	5	5
L4	**Analyze**	10	10
L5	**Evaluate**	5	5
L6	**Create**	5	5

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	--
L2	**Understand**	--
L3	**Apply**	10
L4	**Analyze**	20
L5	**Evaluate**	10
L6	**Create**	10

SIXTH SEMESTER
SYLLABUS

POWER ELECTRONICS

Course Code	**24EEE61**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hours / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE61.1	Understand the characteristics of various power semiconductor devices.
24EEE61.2	Investigate the protection, gating and commutation circuits.
24EEE61.3	Examine different types of controlled rectifiers, choppers and inverters.
24EEE61.4	Choose suitable techniques to minimize the harmonics.
24EEE61.5	Analyze the performance of different power converters.
24EEE61.6	Design power converters for industrial applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE61.1	3	2	1	1	-	-	-	-	-	-	-	2	2
24EEE61.2	3	3	2	2	1	-	-	-	-	-	-	2	2
24EEE61.3	3	3	2	2	2	-	-	-	-	-	-	2	2
24EEE61.4	3	3	2	2	2	-	-	-	-	-	-	2	2
24EEE61.5	3	3	2	2	2	-	-	-	-	-	-	2	2
24EEE61.6	3	3	2	2	3	-	-	-	-	-	-	2	2

MODULE-1	**POWER SEMICONDUCTOR DEVICES**	**24EEE61.1, 24EEE61.2**	**8 Hours**

Introduction, Construction, Principle of Operation – IGBT, MOSFET, SCR – Static and Dynamic Characteristics, Two-transistor model of SCR, Protection Circuits, Commutation Techniques, Firing Circuits.

Text Book	Text Book 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 2.4, 2.5, 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.12, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6

MODULE-2	**AC-DC CONVERTER**	**24EEE61.3, 24EEE61.5**	**8 Hours**

Single phase half and fully controlled rectifiers with R and RL Loads, Three-phase half and fully controlled rectifiers with R Load, Dual converters.

Case Study	Understand the operation of converters with respect to different types of power semiconductor devices.
Text Book	Text Book 1: 6.1, 6.2, 6.3, 6.4, 6.6, 6.8

MODULE-3	**DC-DC CONVERTER AND AC-AC CONVERTER**	**24EEE61.3, 24EEE61.5**	**8 Hours**

DC Chopper-Time ratio control and current limit control, Buck Converter, Boost Converter, Classification of Choppers, Four Quadrant Chopper.
ON-OFF Control and Phase Control, Single phase bi-directional controllers with R and RL Loads.

Case Study	Analyze Choppers and AC voltage regulator circuits with respect to different types of power semiconductor devices.
Text Book	Text Book 1: 7.1, 7.2, 7.3, 7.4, 9.1, 9.2, 9.3 & Text Book 2: 5.8.1, 5.8.2, 5.8.3

MODULE-4	**DC-AC CONVERTER**	**24EEE61.3, 24EEE61.4, 24EEE61.5**	**8 Hours**

Inverters-Single phase bridge inverters, Three phase bridge inverters-1800 and 1200 mode of conduction, PWM schemes, Harmonic distortion analysis.

Text Book	Text Book 1: 8.1, 8.2, 8.4, 8.6, 8.7

MODULE-5	**INDUSTRIAL APPLICATIONS**	**24EEE61.6**	**8 Hours**

SMPS, UPS, Residential and Industrial Applications, HVDC Transmission, Static VAR Compensators, Interconnection of Renewable Energy Sources and Energy Storage Systems to the Utility Grid, Active Filters.

Text Book	Text Book 1: 11.1, 11.2, 11.3; Text Book 3: 16.1, 16.2, 16.3, 17.3, 17.4, 17.5; Reference 2: 5.1, 5.2, 5.3, 6.1, 6.2, 7.1

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Ned Mohan, Tore M. Undeland and William P. Robbins, *Power Electronics: Converters, Applications and Design*, 4th Edition, 2021, ISBN: 9781119313908.
2) Muhammad H. Rashid, *Power Electronics Handbook*, 5th Edition, 2023, ISBN: 9780128232910.
3) Bimal K. Bose, *Power Electronics and Motor Drives: Advances and Trends*, 2nd Edition, 2022, ISBN: 9780128238677.

Reference Books:

1) Farzin Asadi, *Simulation of Power Electronics Circuits with MATLAB/Simulink: Design, Analyze and Prototype Power Electronics*, 1st Edition, 2022, ISBN: 9781484282199.
2) Ned Mohan, Tore M. Undeland and William P. Robbins, *Power Electronics: Converters, Applications and Design (Indian Adaptation*), 3rd Edition, 2022, ISBN: 9789354640278.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108101038
- https://www.youtube.com/watch?v=jgh0TNfx0gQ
- https://www.coursera.org/specializations/power-electronics?

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars
- Demonstration of Real time applications using simulation
- Video demonstration of latest trends in power electronics
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
- Encourage collaborative (Group Learning) Learning in the class.
- Lecturer method (L) needs not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.

POWER ELECTRONICS LABORATORY

Course Code	**24EEL61**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEL61.1	Understand the characteristics of various power semiconductor devices.
24EEL61.2	Inspect the protection, gating, control and commutation circuits.
24EEL61.3	Analyze the performance of power converters for various loads.
24EEL61.4	Design the appropriate converters for various applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEL61.1	3	3	2	2	2	-	-	-	-	-	-	2	2
24EEL61.2	3	3	2	2	2	-	-	-	-	-	-	2	2
24EEL61.3	3	3	2	2	2	-	-	-	-	-	-	2	2
24EEL61.4	3	3	2	2	2	-	-	-	-	-	-	2	2

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments		
	Introduction to power semiconductor devices and converters	2	NA
	PART-A		
1	Static characteristics of SCR	2	24EEL61.1
2	Static characteristics of MOSFET	2	24EEL61.1
3	Static characteristics of IGBT	2	24EEL61.1
4	SCR turn-on circuit using synchronized UJT relaxation oscillator	2	24EEL61.2
5	SCR protection circuit, RC firing circuit and digital triggering circuit for a single-phase controlled rectifier and A.C. voltage controller	2	24EEL61.2
6	Single-phase full-wave controlled rectifier with R and RL loads	2	24EEL61.3
	PART-B		
7	A.C. voltage controller using TRIAC and DIAC combination connected to R load	2	24EEL61.3
8	Speed control of DC motor using single phase semi converter	2	24EEL61.4
9	Speed control of a separately excited DC motor using IGBT or MOSFET chopper	2	24EEL61.4
10	MOSFET or IGBT based single-phase full-bridge inverter connected to R load	2	24EEL61.3
11	Speed control of universal motor using A.C. voltage controller and controlled rectifier	2	24EEL61.4
12	Simulation of power converter circuits	2	24EEL61.3

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. MOSFET: Study the transfer and drain characteristics of MOSFET
   https://vlsi-iitg.vlabs.ac.in/MOSFET_theory.html

2. Full Wave Rectification
   https://be-iitkgp.vlabs.ac.in/exp/full-wave-rectification/theory.html

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	5	10
L4	Analyze	10	10
L5	Evaluate	5	10
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	10
L4	Analyze	30
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1) P. S. Bimbhra, Power Electronics, 7th edition. 2022, Khanna Publishers, ISBN: 9788195123124

2) Farzin Asadi Simulation of Power Electronics Circuits with MATLAB/Simulink: Design, Analyze and Prototype, 1st edition, 2022, Apress, ISBN : 9781484282205

GENERATION, TRANSMISSION AND PROTECTION

Course Code	**24EEE62**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hours / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE62.1	Understand the basic concepts of electrical power system.
24EEE62.2	Identify various types of supporting structures, line conductors and insulators.
24EEE62.3	Computation of line parameters in overhead transmission lines.
24EEE62.4	Analyze the performance of short, medium and long transmission lines.
24EEE62.5	Categorize different types of distribution systems, types of grading in underground cables and examine its quality and performance.
24EEE62.6	Application of various types of protective devices in power systems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE62.1	3	2	2	1	-	-	-	-	-	-	-	1	1
24EEE62.2	3	3	2	1	-	-	-	-	-	-	-	1	1
24EEE62.3	3	3	2	1	-	-	-	-	-	-	-	1	1
24EEE62.4	3	3	2	1	-	-	-	-	-	-	-	1	1
24EEE62.5	3	3	2	1	-	-	-	-	-	-	-	1	1
24EEE62.6	3	3	2	1	-	-	-	-	-	-	-	1	1

MODULE-1	**INTRODUCTION TO ELECTRICAL POWER SYSTEM**	**24EEE62.1**	**8 Hours**

Structure of electric power system: generation, transmission and distribution, conventional and non-conventional energy sources, working of power plants (Thermal, Nuclear, Solar, and Thermal), Advantages of higher voltage transmission, Operating level voltages, Introduction to Feeders, distributors and service mains.

Text Book	Text Book 1: 7.1, 7.2, 7.4, 7.5, 7.6,7.9,7.12 Text Book 2: 4.15,4.18

MODULE-2	**MECHANICAL DESIGN OF OVERHEAD LINES**	**24EEE62.2**	**8 Hours**

Types of supporting structures & line conductors used, Sag calculation- Supports at same level, supports at different levels, Effect of wind & ice on sag calculation, Stringing chart, Sag template& Vibrators, Problems on sag calculation, Types of Insulators used, Potential Distribution over suspension insulator string, String efficiency, Methods to improve string efficiency, grading rings, Arching horns, Problems.

Phenomenon of corona, Disruptive & Critical voltages, Power loss due corona, Advantages & Disadvantages of corona, Problems.

Text Book	Text Book 1: 7.15, 7.16, 7.17, 7.19, 7.20 Text Book 2: 4.18

MODULE-3	**ELECTRICAL DESIGN AND PERFORMANCE OF OVERHEAD TRANSMISSION LINES**	**24EEE62.3 24EEE62.4**	**8 Hours**

Introduction, Calculation of inductance of single-phase line, 3phase lines with equilateral spacing, Unsymmetrical Spacing, transposed lines, Inductance of composite conductor lines, Capacitance of single-phase line, 3 phase lines with equilateral spacing, 3 phase lines with unsymmetrical spacing, Skin Effect, Problems.

Introduction, Short transmission lines, medium transmission lines- Nominal T & Π method, End condenser method, long transmission lines, ABCD constants of transmission lines, Ferranti Effect, Line regulation, Problems.

Self-study	Solving numerical on different types of transmission lines
Text Book	Text Book 1: 3.2 ,3.3,3.4,3.5,3.6,3.9Text Book 2: 1.4, 1.7

MODULE-4	**DISTRIBUTION SYSTEMS AND UNDERGROUND CABLE**	**24EEE62.5**	**8 Hours**

Primary and secondary distribution, Connection schemes of Distribution Systems, Design considerations in distribution system, Types of DC Distributors (uniform and concentrated loading), Primary AC distribution systems – Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems, AC distributors, Problems.

Introduction, types, materials used for underground cables, Insulation resistance, thermal rating of cables, charging current, Grading of cables, Capacitance grading and intersheath grading, Testing of cables.

Case study	Prepare a report on different types of cables available in market		
Text Book	Text Book 1: 3.11,3.13,3.16 Text Book 2: 1.12, 1.14		
MODULE-5	**POWER SYSTEM PROTECTION**	**24EEE62.6**	**8 Hours**
Basic Protective devices, Fuse law-cut-off characteristics- Time current characteristics- fuse material- HRC fuse - Liquid fuse- Application of fuse. Circuit breaker- Theory of arcing and arc quenching circuit breakers- RRRV, Resistor switching, Types of Circuit Breaker-Oil, SF_6, Vacuum. Introduction to Relay-General classification, Principle of Operation, Types- Differential, Distance, Relay characteristics. Protection of Alternators and Transmission line.			
Text Book	Text Book 1: 3.14, 3.19, 3.20, 3.21 Text Book 2: 1.18		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	AAT1	AAT2
		25	15	10
L1	Remember	-	-	-
L2	Understand	-	-	-
L3	Apply	10	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Power System Protection and Switchgear, D.N. Vishwakarma, Badri Ram, Soumya R. Mohanty , 3rd Edition, 2022, McGraw Hill Education (India), ISBN: 9789355322852
2) Principles of Power System, V.K. Mehta, Rohit Mehta, 2022 Edition, S. Chand Publishing, ISBN: 9789355010773

Reference Books:

1) Fundamentals of Power System Protection, Paithankar Y. G. and Bhide S. R, 3rd Edition, PHI Learning, 2021.ISBN: 9789391818784.
2) Protective Relaying: Principles and Applications, J. Lewis Blackburn and Thomas J. Domin, 5th Edition, CRC Press, 2022, ISBN: 9780367468095.
3) Electric Power and Energy Distribution Systems: Models, Methods, and Applications, Subrahmanyam S. Venkata and Anil Pahwa, Wiley-IEEE Press, First Edition, 2022, ISBN: 978-1-119-83825-8Principles of Power System, V.K. Mehta, Rohit Mehta, S. Chand, 1st Edition 2013. ISBN: 978-8121924962

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/102/108102047/
- https://electrical-engineering-portal.com/download-center/books-and-guides/electricity-generation-t-d/td-technology
- https://www.beeindia.gov.in/sites/default/files/3Ch2.pdf
- https://www.electricaltechnology.org/2020/04/dc-machine-types-working-applications.html
- https://standards.ieee.org/ieee/1782/10257/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to Power Stations, Receiving Stations.
- Video demonstration of latest trends in modern power system
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing group wise discussions on issues
- Seminars

POWER SYSTEM PROTECTION LABORATORY

Course Code	**24EEL62**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEL62.1	Analyze the different characteristics of microprocessor relays
24EEL62.2	Identify appropriate protection schemes for different power system components
24EEL62.3	Evaluate different faults in a power system and study relay coordination using ETAP software
24EEL62.4	Apply the simulation for motor and generator protection

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEL62.1	3	3	3	3	2	-	-	-	-	-	-	2	-
24EEL62.2	3	3	3	3	2	-	-	-	-	-	-	2	-
24EEL62.3	3	3	3	3	2	-	-	-	-	-	-	2	-
24EEL62.4	3	3	3	3	2	-	-	-	-	-	-	2	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments		
	• Introduction to power system protection devices	2	NA
	PART-A		
1	Motor protection simulation studies	2	24EEL62.1
2	IDMT over current characteristics of Microprocessor relays	2	24EEL62.1
3	DMT under voltage characteristics of Microprocessor relays	2	24EEL62.1
4	Find the Capacitance of an Underground Cable Using Field Mapping of an Electrolytic Tank	2	24EEL62.2
5	Study the characteristics of Negative Sequence Relays	2	24EEL62.2
6	Study the characteristics of Merz price protection scheme	2	24EEL62.2
	PART-B		
7	Fuse characteristics.	2	24EEL62.2
8	Relay Coordination using ETAP software	2	24EEL62.2
9	Generator protection Unit	2	24EEL62.3
10	DMT over current characteristics of Electro mechanical relays	2	24EEL62.3
11	IDMT under voltage characteristics of Electro mechanical relays	2	24EEL62.4
12	Different types of fault analysis in power system using ETAP software	2	24EEL62.4

PART-C

Beyond Syllabus Virtual Lab Content (4 Hours)

(To be done during Lab but not to be included for CIE or SEE)

1) https://www.nitttrkol.ac.in/vlab-ee-psp-exp-1.php#top
2) https://vp-dei.vlabs.ac.in/exp/psm-tsm/
3) https://vp-dei.vlabs.ac.in/exp/gas-actuated-buchholz/
4) https://vp-dei.vlabs.ac.in/exp/shape-electrodes-dielectric/
5) https://vp-dei.vlabs.ac.in/exp/differential-protection-three/
6) https://vp-dei.vlabs.ac.in/exp/induction-motor-numerical/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels	Test (s)	Weekly Assessment
	20	30

L1	**Remember**	**-**	**-**
L2	**Understand**	-	-
L3	**Apply**	10	15
L4	**Analyze**	5	10
L5	**Evaluate**	5	5
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**-**
L2	**Understand**	-
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	10
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1) Power System Protection and Switchgear, D N. Vishwakarma, Badri Ram, Soumya R Mohanty, 3rd Edition, Mc Graw Hill, 2022. ISBN: 978-9355322852

2) Power System Protection: Fundamentals and Applications, John Ciufo, Aaron Cooperberg, John Wiley & Sons, Inc., 2022, ISBN:9781119847397

ADVANCED INDUSTRIAL AND BUILDING AUTOMATION

Course Code	**24EEE63**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**03**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE63.1	Design the SCADA system for Industrial applications
24EEE63.2	Design a automation solution for trolley management system
24EEE63.3	Solve the problems in a building using Building Management System(BMS) and Energy management Systems(EMS)
24EEE63.4	Construct an fire alarm system in building management system.
24EEE63.5	Analyze the configurations of CCTV and access control system.
24EEE63.6	Develop the solution for home automation systems

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE63.1	3	2	3	2	3	-	-	-	-	-	-	3	3
24EEE63.2	3	3	3	2	3	-	-	-	-	-	-	3	3
24EEE63.3	3	3	3	3	3	-	-	-	-	-	-	3	3
24EEE63.4	3	3	3	3	3	-	-	-	-	-	-	3	3
24EEE63.5	2	2	3	3	3	-	-	-	-	2	1	3	3
24EEE63.6	2	3	3	3	3	-	-	-	-	2	1	3	3

MODULE-1	**INTRODUCTION TO ADVANCED PLC AND SCADA:**	**24EEE63.1**	**8 Hours**

Need of SCADA systems, features of SCADA, Block diagram of SCADA, Function of SCADA, Network Protocols, Protocol standards, Serial Communication – Device Net – Control Net – Ethernet -RS232, RS48, Modbus – Field bus – Probus - Subnetting – Subnet mask - File transfer protocol.

Hands On:

1. Design Temperature monitoring system using analog input module
2. Design a basic trolley control system in an industry using SFC
3. Design a basic animation using SCADA

Case Study	Trolley management in all slots using SFC

MODULE-2	**BUILDING MANAGEMENT SYSTEM AND ENERGY MANAGEMENT SYSTEMS**	**24EEE63.2**	**8 Hours**

Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS.-Functions of EMS and Block diagram of EMS

Hands on:

1. Configuration of building management systems using building expert
2. Apply Lua program to make the automatic HVAC system
3. Design a HVAC system with a temperature sensor

Case Study	Energy management system case study

MODULE-3	**FIRE ALARM SYSTEMS**	**24EEE63.3, 24EEE63.4**	**8 Hours**

FAS architecture, Need of fire alarm system Types of Architecture and Examples. Fire Alarm System input and output devices, Devices and Standards.

Hands on:

1. Configuration of fire alarm system using FX.net
2. Design a fire alarm system using Manual call point
3. Design a automatic fire alarm system

Case study	Implementation of a Fire Ala`rm System in a Commercial Building.

MODULE-4	**CCTV AND ACCESS CONTROL SYSTEMS**	**24EEE63.5**	**8 Hours**

Access Components, Access control system Design and Standards. CCTV: Camera: Operation & types, Camera Selection Criteria, Camera Applications, DVR Based system, DVM, Network design, Storage design. Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system Standards.

Hands on:

1. Configuration of CCTV system using PELCO.
2. Design a CCTV system for live monitoring
3. Design a CCTV system for Recorded monitoring

Case Study	Types of access control

MODULE-5	**HOME AUTOMATION SYSTEMS:**	**24EEE63.6**	**8 Hours**

Home automation system necessity-block diagram of home automation system-Introduction to Security Systems, Concepts-Components, Technology, Advanced Applications. Standards for communication, C-BUS and KNX,

Hands on:

1. Configuration of home automation system using C-Bus.
2. Configuration of DLT.
3. Design a DLT switch for kitchen and bed room.

Case Study	Types of communication in home automation

CIE Assessment Pattern (50 Marks – Hands On) –

RBT Levels		**Marks Distribution**		
		Test (s)	**AAT1**	**AAT2**
		25	**15**	**10**
L1	**Remember**	**-**	**-**	**-**
L2	**Understand**	**-**	**-**	**-**
L3	**Apply**	**10**	**5**	**-**
L4	**Analyze**	**5**	**5**	**5**
L5	**Evaluate**	**10**	**5**	**5**
L6	**Create**			

SEE Assessment Pattern (50 Marks – Hands-On)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**-**
L2	**Understand**	**-**
L3	**Apply**	**15**
L4	**Analyze**	**15**
L5	**Evaluate**	**20**
L6	**Create**	**-**

Text books

1) Chanchal Dey and Sunit Kumar Sen, Industrial Automation Technologies, 1st Edition, 2022, ISBN: 9780367496074.
2) Albert Ting-Pat So and Wai Lok Chan, Intelligent Building Systems, 3rd Edition, 2022, ISBN: 9780792384915.
3) Frank D. Petruzella, Programmable Logic Controllers, 6th Edition, 2024, ISBN: 9781264163342.

Reference Books

1) Kaushik Kumar and B. Sridhar Babu, Industrial Automation and Robotics: Techniques and Applications, 1st Edition, 2022, ISBN: 9780367639853.
2) Farzin Asadi, Simulation of Power Electronics Circuits with MATLAB/Simulink: Design, Analyze and Prototype Power Electronics, 1st Edition, 2022, ISBN: 9781484282199.
3) Bimal K. Bose, Power Electronics and Motor Drives: Advances and Trends, 2nd Edition, 2022, ISBN: 9780128238677.

Web links and Video Lectures (e-Resources):

- **https://ial-coep.vlabs.ac.in/**
- **https://plc-coep.vlabs.ac.in/**
- **https://www.youtube.com/@vinodkumarvino1012**
- **https://newhorizoncollegeofengineering.in/industrial-automation/**

24EEE64X-Professional Elective Course-II

ADVANCED CONTROL SYSTEMS

Course Code	**24EEE641**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hours / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE641.1	Understand state space model of a system by applying various techniques.
24EEE641.2	Analyze time response of states and outputs of LTIV systems.
24EEE641.3	Apply the controllability and observability from the state models.
24EEE641.4	Design a state feedback controller that meets the desired specifications.
24EEE641.5	Design full order and reduced order state observers for state measurement.
24EEE641.6	Analyze and evaluate the behavior and stability of nonlinear systems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE641.1	3	3	2	2	-	-	-	1	-	-	-	1	1
24EEE641.2	3	3	2	2	-	-	-	1	-	-	-	1	1
24EEE641.3	3	3	3	3	-	-	-	1	-	-	-	1	1
24EEE641.4	3	3	3	3	-	-	-	1	-	-	-	1	1
24EEE641.5	3	3	3	3	-	-	-	1	-	-	-	1	1
24EEE641.6	3	3	2	2	-	-	-	1	-	-	-	1	1

MODULE-1	**STATE SPACE REPRESENTATION**	**24EEE641.1**	**8 Hours**
Advantages of state space analysis - Introduction – State, state variable, state trajectory, state space, state model - State space representation using physical, phase and canonical variables –Non uniqueness of state model			
Text Book	Text Book 1: 5.1 to 5.7		
MODULE-2	**TIME RESPONSE**	**24EEE641.2**	**8 Hours**
Existence and uniqueness of solutions to Continuous-time state equations – Solution of Linear Time Invariant State equations – Evaluation of matrix exponential			
Applications	Investigate the state space representation in time domain		
Text Book	Text Book 3: 9.1 to 9.4		
MODULE-3	**CONTROLLABILITY AND OBSERVABILITY**	**24EEE641.3**	**8 Hours**
Controllability - Observability – Canonical forms – Stabilizability and Detectability – Output Controllability – Reducibility			
Text Book	Text Book 1: 6.1 to 6.8		
MODULE-4	**STATE FEEDBACK**	**24EEE641.4, 24EEE641.5**	**8 Hours**
Introduction – Necessary and Sufficient Condition for Arbitrary Pole-placement – pole placement design – design of full order and reduced order state observers – State Feedback with integral control			
Self-Study	Analyze the pole placement technique and design the state observers		
Text Book	Text Book 1: 7.1,7.2,7.3,7.4,7.5		
MODULE-5	**ANALYSIS OF NON-LINEARITIES**	**24EEE641.6**	**8 Hours**
Types of non-linearity – Typical examples – Equivalent linearization – Describing function analysis of non-linear systems – limit cycles – Stability of oscillations			
Self-study	Analysis the stability condition of non-linear systems		
Text Book	Text Book 1: 10.1 to 10.5		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution-NPTEL	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	10
L4	Analyze	10	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Digital control and state variable methods: Conventional and Intelligent Control Systems, M Gopal, McGraw Hill Education, Fourth Edition (Reprint 2021).ISBN(13):978-0-07-133327-6
2) Control Systems, Principles and Design, M. Gopal, Fourth Edition, Tata McGraw Hill, 2015. ISBN (13): 978-0071333269
3) Modern Control Engineering, K. Ogata, Fifth edition, PHI, 2012. ISBN-13: 978-9332550162

Reference Books:

1) Control System Engineering, Norman S. Nise, Sixth Edition, Wiley India, 2011 ISBN 978-1-118-80082-9
2) Modern Control Theory, R. V. Parvatikar, Prism Books Pvt. Ltd., 5th Edition,2021 ISBN: 978-93-881-0858-4

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/103/108103007/
- https://distance.mst.edu/distance-programs/distance-graduate-certificates/advanced-control-systems/
- https://www.youtube.com/watch?v=8OVD2BHA5Hg&list=PLLy_2iUCG87CVglDEadTd_PRjA-g1KqVo
- https://www.manchester.ac.uk/study/masters/courses/list/04166/msc-advanced-control-and-systems-engineering/
- https://www.careers360.com/university/indian-institute-of-technology-roorkee/advanced-linear-continuous-control-systems-applications-matlab-programming-and-simulink-certification-course/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any process/manufacturing/aero/auto industry
- Digital simulation of mathematical modelling of physical systems
- Video demonstration of modelling of a non-linear system
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare presentation and Handouts
- Organizing Group wise discussions on issues
- Seminars

SIGNALS AND DSP

Course Code	**24EEE642**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hours / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE642.1	Classify continuous and discrete-time signals and analyze their fundamental operations, and apply the sampling theorem
24EEE642.2	Apply the knowledge of Fourier analysis to compute Discrete Fourier Transforms and Inverse Fourier Transforms of signals and use the concept of convolutional operators for linear filtering techniques.
24EEE642.3	Evaluate Discrete Fourier Transform of a sequence using decimation in time and decimation in frequency methods.
24EEE642.4	To design and represent IIR digital filters using different methods
24EEE642.5	To design FIR filters using windows method and frequency sampling method
24EEE642.6	Illustrate the basic features of programmable Digital Signal Processor and application

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE642.1	3	-	-	-	-	-	-	-	-	-	-	3	2
24EEE642.2	3	3	-	-	3	-	-	-	-	-	-	3	2
24EEE642.3	3	3	2	-	-	-	-	-	-	-	-	3	2
24EEE642.4	3	3	2	-	3	-	-	-	-	-	-	3	2
24EEE642.5	3	-	-	-	-	-	-	-	-	-	-	3	2
24EEE642.6	3	-	-	1	3	-	-	-	-	-	-	3	2

MODULE-1	SIGNALS, SYSTEMS AND FREQUENCY-DOMAIN ANALYSIS	24EEE642.1	8 Hours

Introduction: Classification of signals, Basic Operations on Signals, Basic Elementary Signals, Properties of systems.

Frequency Domain Analysis: Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with other transforms.

Self-Study	To perform basic operations on given sequences- Signal folding, evaluation of even and odd signals
Text Book	Text Book1: 7.1, 7.2

MODULE-2	DFT AND SIGNAL PROCESSING TECHNIQUES	24EEE642.2	8 Hours

DFT and IDFT: Definition of DFT and its inverse, Matrix relation to find DFT and IDFT, Computation of N-point DFT and IDFT, Properties of DFT.

Signal Processing Techniques: Convolution – Linear Convolution, Circular convolution, Linear using Circular Convolution. Signal Segmentation – Overlap-save and Overlap-add method.

Case Study	Evaluation of circular convolution of two sequences using DFT and IDFT approach.
Text Book	Text Book 1: 8.1,8.1.3

MODULE-3	FFT ALGORITHMS	24EEE642.3	8 Hours

FFT algorithm: Need for efficient computation of the DFT, Radix-2 FFT algorithm for the computation of DFT and IDFT, decimation-in time and decimation-in-frequency algorithms.

Self-study	Case study on Designing wind speeds using fast Fourier transform. Realization of FIR and IIR filters -Direct Form 1 and 2, Cascade and Parallel.
Text Book	TextBook1:9.2.1, 10.2.1, 10.2.2 Text Book1: 9.3.1, 9.3.3, 9.3.4, 10.3.2, 10.3.3, 10.3.4, 10.4.1

MODULE-4	FILTER DESIGN AND ITS REALIZATION	24EEE642.4, 24EEE642.5	8 Hours

Design of FIR filter: Need, types and characteristics of window, design of FIR filters using Rectangular and Hamming window.
Design of IIR filter: Classification of analog filters, Design of Butterworth filters – low pass and high pass
Realization of filters: representation using direct form one and two, series form and parallel form.

Applications	Realization of IIR and FIR filters.
Text Book	Text Book2: -1.1,1.2,1.3, 3.1,3.2 ,4.1,4.2,4.3 ,7.2

MODULE-5	**PROGRAMMABLE DSP AND MULTIRATE SIGNAL PROCESSING**	**24EEE642.6**	**8 Hours**

Programmable Digital Signal Processor: DSP system, Features of Digital Signal Processors, Pipelining in DSP Processor.
Multirate Signal Processing: Introduction, decimation by a factor D, Interpolation by a factor I
Application: Radar Signal Processing.

Applications	Noise cancelation using adaptive filters.
Text Book	Text Book2: 1.1,1.2,1.3, 3.1,3.2 ,4.1,4.2,4.3 ,7.2

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution-NPTEL	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	10
L4	Analyze	10	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Digital signal processing: Principles, Algorithms & Applications, Proakis & Monalakis, 4th Edition 2014, Pearson education. ISBN: 978-8131710005
2) Digital Signal Processing, Avtar Singh & S. Srinivasan, Thomson Brooks /Cole, 2004, ISBN: 0534-39123-0
3) Digital Signal Processing, P. Ramesh Babu, 6th Edition, 2014, Scitech Publications, ISBN: 978-8183716307

Reference Books:

1) Discrete Time Signal Processing, Oppenheim & Schaffer, 7th Edition, 2010, TMH. ISBN: 978-0132162920
2) Digital Signal Processing, S. K. Mitra, 4thEdition, 2014, Tata Mc-GrawHill. ISBN: 978-1259098581

Web links and Video Lectures (e-Resources):

- https://youtu.be/QcuIYJZ4RRE
- https://www.youtube.com/watch?v=rwENxNH0zdA
- https://www.youtube.com/watch?v=ADnSkJnprBY
- https://www.youtube.com/watch?v=Bdw3XcXgHa8
- https://www.youtube.com/watch?v=HVGW85eGPQQ&list=PLyqSpQzTE6M_h5UgZWpybzBVDGmHGhQQb
- https://www.youtube.com/watch?v=MQzY8cIBiFs&list=PLgMDNELGJ1CYvviJ_ZHrHy5TKLb- Vn7-r
- https://www.youtube.com/watch?v=Iw77CYUT74c&t=17s

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in Digital Signal Processing
- Contents related activities (Activity-based discussions)
- For active participation of students, conduct problem solving sessions
- Organizing Group wise discussions on issues
- Seminars

HIGH VOLTAGE ENGINEERING

Course Code	**24EEE643**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hours / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE643.1	Understand about electric field distribution in electrode systems.
24EEE643.2	Describe the behavior of gaseous, liquid and solid dielectric under high voltage.
24EEE643.3	Interpret the necessity to generate and measure the voltages and currents for safety of personnel and equipment.
24EEE643.4	Able to analyze various insulation testing of various components in power system.
24EEE643.5	Identify the conditions for over voltages and the principles of insulation coordination.
24EEE643.6	Interpret the different applications of the insulating materials in electrical power apparatus.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE643.1	3	1	-	-	-	-	-	-	-	-	-	-	1
24EEE643.2	3	2	-	-	-	-	-	-	-	-	-	-	1
24EEE643.3	3	3	1	1	-	-	-	-	-	-	-	-	1
24EEE643.4	3	3	1	1	-	-	-	-	-	-	-	-	1
24EEE643.5	3	1	2	-	-	-	-	-	-	-	-	-	1
24EEE643.6	3	3	1	-	-	-	-	-	-	-	-	-	1

MODULE-1	**INTRODUCTION TO HIGH VOLTAGE ENGINEERING**	**24EEE643.1, 24EEE643.6**	**8 Hours**

Electric Field Stresses–Uniform and non–uniform field configuration of electrodes –Estimation and control of electric Stress –Numerical methods for electric field computation, Applications of insulating materials in transformers, rotating machines, circuit breakers, cable power capacitors and bushing.

Text Book	Text Book 1: 1.5, 1.6, 5.1,5.2,5.3,5.4,5.5,5.7

MODULE-2	**BREAK DOWN IN DIELECTRIC MATERIALS**	**24EEE643.2**	**8 Hours**

Gases as insulating media, collision process, Ionization process, Townsend's criteria of breakdown in gases, Paschen's law, electro mechanical breakdown, thermal breakdown, breakdown of liquid dielectrics in practice, Breakdown in composite dielectrics in practice.

Text Book	Text Book 1: 2.1, 2.2 Text Book 2:2.3,2.5,2.6,2.12,2.15

MODULE-3	**GENERATION AND MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS**	**24EEE643.3**	**8 Hours**

Generation of High Direct Current Voltages, Generation of High alternating voltages, Generation of Impulse Voltages, Generation of Impulse currents, Measurement of High Direct Current voltages, Measurement of High Voltages alternating and impulse.

Text Book	Text Book 1: 7.1, 7.2, 7.3Text Book 2: 4.1,4.2,4.4,4.5

MODULE-4	**TESTING OF MATERIALS**	**24EEE643.4**	**8 Hours**

High voltage AC testing methods-Power frequency tests-Over voltage tests on insulators, Isolators, Circuit Breakers and power cables. Artificial Contamination Tests: Contamination flashover phenomena-Contamination Severity-Artificial contamination tests-Laboratory Testing versus in-Service Performance-Case study.

Self-Study	Understand the laboratory testing versus service phenomena effect with contamination.
Text Book	Text Book 1: 10.1,10.2,10.3,10.4,10.5 Text Book 2: 7.1,7.2,7.3,7.9

MODULE-5	**OVER-VOLTAGES AND INSULATION COORDINATION**	**24EEE643.5 24EEE643.6**	**8 Hours**

Natural Causes for Over voltage -Lightning phenomenon, over voltage due to switching surges, Principle of insulation Coordination on High Voltages

Self-study	Investigate the different types of transformers used in industry.
Text Book	Text Book 1: 8.1,8.2,8.3

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution-NPTEL	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	10
L4	Analyze	10	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) High Voltage Engineering, M.S.Naidu and V. Kamaraju – TMH Publications, 6th Edition,2023. ISBN-978-9389811223,
2) High Voltage Engineering, C.L.Wadhwa, New Age Internationals (P) Limited, 4th Edition, 2025, ISBN-9389802091.

Reference Books:

1) Extra High Voltage AC Transmission Engineering, Rakosh Das Begamudre, New Age International (P) Ltd., New Delhi, 5th Edition, 2023,ISBN-978-9395161794
2) High Voltage Engineering, Farouk A.M. Rizk, Giao N. Trinh, CRC Press,2nd Edition, 2026, ISBN-10: 1032969423 ISBN-13: 978-1032969428

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc23_ee92/preview
- https://www.youtube.com/watch?v=DI8Yt1AQrH8
- **https://nptel.ac.in/courses/108/106/108106073/?utm_source=copilot.com**
- **https://ee.iisc.ac.in/research/high-voltage-engineering**
- **https://www.iitg.ac.in/eee/syllabus/insulation-high-voltage-engineering (iit**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any manufacturing high voltage industry, CPRI
- Demonstration of multistage impulse generator
- Demonstration of working of measurement of high voltage
- Video demonstration of latest trends in high voltage
- Contents related activities (Activity-based discussions)

WEB DESIGN TECHNOLOGIES

Course Code	**24EEE644**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE644.1	Design simple web pages using markup languages like HTML and XHTML.
24EEE644.2	Create dynamic web pages using DHTML and java script that is easy to navigate and use.
24EEE644.3	Analyze server-side web pages that have to process request from client-side web pages.
24EEE644.4	Investigate and apply web data using XML and develop web pages using JSP.
24EEE644.5	Solve various web services using PHP.
24EEE644.6	Develop real time application using server side programming and Web Services.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE644.1	3	2	3	2	3	-	-	-	-	3	3	3	3
24EEE644.2	3	3	3	3	3	-	-	-	2	3	3	3	3
24EEE644.3	3	3	3	3	3	-	-	-	-	3	3	3	2
24EEE644.4	3	3	3	3	3	-	-	-	-	3	3	3	3
24EEE644.5	3	2	3	3	3	-	-	-	-	2	3	3	3
24EEE644.6	3	2	3	2	3	-	-	-	-	3	3	3	3

MODULE-1	**INTRODUCTION TO HTML**	**24EEE644.1**	**6 Hours**

what is HTML. HTML Syntax, Semantic Markup, Structure of HTML Documents, Introduction to CSS, what is CSS, CSS Syntax, Location of Styles.

Laboratory Component: **3 Hours**

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient
2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values without table.
3. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.

Text Book	Textbook 1: Ch. 2, 3

MODULE-2	**HTMLTABLESANDFORMS**	**24EEE644.2**	**6 Hours**

Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility

Laboratory Component: **3 Hours**

1. Write a JavaScript code that displays text "TEXT- GROWING" with increasing font size in the interval of 100ms in RED COLOR or other, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color or other color. Then the font size decreases to 5pt.
2. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems: a. Parameter: A string b. Output: The position in the string of the left-most vowel c. Parameter: A number d. Output: The number with its digits in the reverse order.
3. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

Text Book	Textbook 1: Ch. 4,5

MODULE-3	**CLIENT-SIDESCRIPTING**	**24EEE644.3**	**6 Hours**

What is JavaScript and What can it do? JavaScript Design Principles, Syntax, JavaScript Objects, The Document Object Model (DOM), Advantages and Disadvantages with its applications

Laboratory Component: **3 Hours**

1. A program of JavaScript client side script that will run in the browser to display the name of cities.
2. A program to add two numbers by JavaScript client side script by CSS.
3. A program to display even and odd numbers using JavaScript.

Text Book	Textbook 1: Ch. 6, 8		
MODULE-4	**PHPARRAYS**	**24EEE644.4, 24EEE644.5**	**6 Hours**
PHP Classes and Objects, Object- Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, what are Errors and Exceptions.			
Laboratory Component: 1. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings. 2. Write a PHP program to display a digital clock which displays the current time of the server. 3. Write a PHP programs for sum of two digits.			**3 Hours**
Text Book	Textbook 1: Ch. 9, 10		
MODULE-5	**MANAGING STATE**	**24EEE644.6**	**6 Hours**
Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Introduction to JavaScript and jQuery, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.			
Laboratory Component: 1. Write a Scripting code for reading a Cookie. 2. Write a Scripting code for deleting a Cookie. 3. Write a Scripting Code to Parsing a Text String.			**3 Hours**
Text Book	Textbook 1: Ch. 13, 15,17		

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	10	5	10
L4	Analyze	5	-	10
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels	Marks Distribution	
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	-
L6	Create	-

INTRODUCTION TO CYBER SECURITY

Course Code	**24EEE645**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

24EEE645.1	Understand the cybercrime and associated laws.
24EEE645.2	Develop a deeper understanding and familiarity with various types of cyberattacks, cybercrimes, vulnerabilities and remedies thereto.
24EEE645.3	Analyze the various cybercrime tools and methods.
24EEE645.4	Implement, and monitor cyber security mechanisms to ensure the protection of information technology assets against Phishing and Identity Theft.
24EEE645.5	Justify the need of computer forensics in different situations and responsible use of online social media networks.
24EEE645.6	Select suitable ethical principles and commit to professional responsibilities and human values and contribute value and wealth for the benefit of the society.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE645.1	1	-	-	-	-	-	-	-	-	-	-	-	-
24EEE645.2	1	2	-	-	-	-	-	-	-	-	-	-	-
24EEE645.3	1	1	2	-	-	-	-	-	-	-	-	1	-
24EEE645.4	3	1	2	-	-	-	-	-	-	-	-	1	-
24EEE645.5	1	2	3	-	-	-	-	-	-	-	-	2	1
24EEE645.6	1	1	1	1	2	-	-	-	-	-	-	1	1

MODULE-1	**INTRODUCTION TO CYBERCRIME**	**24EEE645.1, 24EEE645.3**	**8 Hours**

Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals, Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

Self-study	Case study on biggest Cyber crimes
Text Book	Text Book 1: 1.1 to 1.5, 1.7-1.9 Text book 2:- 1.1

MODULE-2	**CYBER OFFENSES**	**24EEE645.2, 24EEE645.6**	**8 Hours**

How Criminals Plan Them: Introduction, how criminals plan the attacks, Social Engineering, Cyber Stalking, Cyber Cafe & cybercrimes.
Botnets: The fuel for cybercrime, Attack Vector.

Case Study	Develop a strategy and vision for tackling cyber security
Text Book	Text Book 1: 2.1 to 2.7, Text book 2:-3.1

MODULE-3	**TOOLS AND METHODS USED IN CYBERCRIME**	**24EEE645.3, 24EEE645.6**	**8 Hours**

Tools and Methods used in Cybercrime: Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attacks, Attacks on Wireless networks.

Case Study	Modern AI cyber security techniques
Text Book	Text Book 1: 4.1 to 4.9, 4.12 Text book 2:- 4.2

MODULE-4	**PHISHING AND IDENTITY THEFT**	**24EEE645.4**	**8 Hours**

Introduction, methods of phishing, phishing, vphising techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft

Case Study	Social Media Impersonation

Text Book	Text Book 1: 5.1, 5.2. 5.3 Text book 2: 6.1		
MODULE-5	**UNDERSTANDING COMPUTER FORENSICS**	**24EEE645.5, 24EEE645.6**	**8 Hours**
Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics and real time applications.			
Case Study	Real time forensics cases		
Text Book	Text Book 1: 7.1. to 7.5, 7.7 to 7.9 Text book 2: 10.1		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution-NPTEL	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	**Remember**	-	-
L2	**Understand**	-	-
L3	**Apply**	10	10
L4	**Analyze**	10	10
L5	**Evaluate**	5	5
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**--**
L2	**Understand**	--
L3	**Apply**	**20**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**--**

Suggested Learning Resources:

Text Books:

1) Cyber Security and Digital Forensics: Proceedings of ICCSDF 2021 by Kavita Khanna, Vania Vieira Estrela and Joel José Puga Coelho Rodrigues (Editors), Springer Nature Singapore, First Edition, 2022, ISBN: 978-981-16-3960-9
2) Cybersecurity and Digital Forensics: Challenges and Future Paradigms by Hamid Jahankhani, Babak Akhgar, Richard Hill and other editors, Nova Science Publishers, First Edition, 2022, ISBN: 978-1119795636

Reference Books:

1) Security in Computing, Pfleeger, C.P., 5th Edition, Prentice Hall, Copyright 2010 ISBN 0-13-239077-9.
2) Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010. ISBN: 978-8172730888.
3) Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. Pearson, 13th November, 2015, ISBN: 978-1516821020
4) Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd. ISBN: 0-7645-7397-7

Web links and Video Lectures (e-Resources):

- https://www.codecademy.com/learn/introduction-to-cybersecurity
- https://www.coursera.org/specializations/intro-cyber-security
- https://www.youtube.com/watch?v=yC_hFm0BX28&list=PLxApjaSnQGi6Jm7LLSxvmNQjS_rt9swu

• https://www.youtube.com/watch?v=nzZkKoREEGo&list=PL9ooVrP1hQOGPQVeapGsJCktzIO4DtI_ • https://www.youtube.com/watch?v=6wi5DI6du4&list=PL_uaeekrhGzJlB8XQBxU3z__hDwT95xlk
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning • To familiarize cybercrime terminologies and perspectives • Demonstration of cyber security • Demonstration of working of cyber crime • Video demonstration of latest trends in cyber security • Contents related activities (Activity-based discussions) • Organizing Group wise discussions on issues • Seminars

24EEE65X
Ability Enhancement Course – V

TRANSDUCERS AND SENSORS LABORATORY

Course Code	**24EEE651**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:
At the end of the course, the student will be able to:

24EEE651.1	Demonstrate the characteristics and operation of various transducers used for measurement of physical parameters.
24EEE651.2	Analyze the performance of resistive, inductive and capacitive sensors through experimental investigations.
24EEE651.3	Evaluate the characteristics of temperature, displacement and force measurement sensors.
24EEE651.4	Design and implement sensor interfacing circuits for real-time measurement applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE651.1	3	2	1	2	2	-	-	-	-	-	-	3	1
24EEE651.2	3	3	2	2	2	-	-	-	-	-	-	3	1
24EEE651.3	3	3	2	3	2	-	-	-	-	-	-	3	1
24EEE651.4	3	3	3	3	3	-	-	-	-	-	-	3	2

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments		
	• Introduction of sensors and Transducers	2	NA
	PART-A		
1	Study and calibration of Potentiometric Displacement Transducer	2	24EEE651.1
2	Measurement of displacement using LVDT and determination of characteristics	2	24EEE651.3
3	Study and calibration of Strain Gauge for force measurement	2	24EEE651.3
4	Measurement of pressure using Pressure Transducer	2	24EEE651.3
5	Characteristics of RTD for temperature measurement	2	24EEE651.2
6	Characteristics of Thermistor and comparison with RTD	2	24EEE651.3
	PART-B		
7	Calibration and characteristics of Thermocouple sensor	2	24EEE651.3
8	Measurement of speed using Optical Encoder/Tachogenerator	2	24EEE651.4
9	Study of Capacitive Proximity Sensor characteristics	2	24EEE651.2
10	Study of Inductive Proximity Sensor characteristics	2	24EEE651.2
11	Design and testing of Signal Conditioning Circuit for sensor output	2	24EEE651.4
12	Interfacing of Temperature/Displacement Sensor with Arduino and data acquisition	2	24EEE651.3
	PART-C **Beyond Syllabus Virtual Lab Content** **(To be done during Lab but not to be included for CIE or SEE)**		

1) Characterize the LVDT (Linear Variable Differential Transformer)
https://sl-coep.vlabs.ac.in/exp/lvdt/simulation.html?utm_source

2) Characterize the temperature sensor (RTD)
https://sl-coep.vlabs.ac.in/exp/characterize-temperature-sensor/index.html?utm_source
3) Characterise the Temperature Sensor (Thermocouple)
https://sl-coep.vlabs.ac.in/exp/temperature-sensor/index.html?utm_source
4) Characterize the Strain gauge sensor
https://sl-coep.vlabs.ac.in/exp/characterize-temperature-sensor/index.html?utm_source

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	15
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1) Transducers and Instrumentation, D.V.S. Murthy, PHI Learning Pvt. Ltd., 2022, 3rd Edition, ISBN: 9789391818936
2) Sensors and Transducers, Patranabis D., McGraw Hill Education, 2022, 3rd Edition, ISBN: 9789354602527
3) Industrial Instrumentation and Control, S.K. Singh, McGraw Hill Education, 2023, 4th Edition, ISBN: 9789355324633
4) Measurement Systems: Application and Design, Ernest O. Doebelin and Dhanesh N. Manik, McGraw Hill, 2022, 7th Edition, ISBN: 9781260571360

MULTISIM FOR ELECTRICAL DESIGN

Course Code	**24EEE652**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEE652.1	Understand the basic concepts, basic laws and analysis of DC and AC networks.
24EEE652.2	Analyze the circuits and troubleshoot circuits.
24EEE652.3	Realize and verify the operation of analog integrated circuits .
24EEE652.4	Design real time application circuits .

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE652.1	3	3	3	3	2	-	-	-	-	-	-	2	-
24EEE652.2	3	3	3	3	2	-	-	-	-	-	-	2	-
24EEE652.3	3	3	3	3	2	-	-	-	-	-	-	2	-
24EEE652.4	3	3	3	3	2	-	-	-	-	-	-	2	-

Exp. No.	List of Experiments	Hours	COs
	Prerequisite Experiment		
	Introduction to MULTISIM software, Design Procedure and Steps.	2	NA
	PART-A		
1	To evaluate current and voltage for series and parallel circuit	2	24EEE652.1
2	To evaluate current and voltage using KCL	2	24EEE652.1, 24EEE652.2
3	To evaluate current and voltage using KVL	2	24EEE652.1, 24EEE652.2
4	To design of dependent source circuits for dc excitation	2	24EEE652.1
5	To design of dependent source circuits for ac excitation	2	24EEE652.1, 24EEE652.2
6	To evaluate current and voltage using Voltage divider circuit	2	24EEE652.1, 24EEE652.2
	PART-B		
7	To design half wave and Full wave rectifier circuits	2	24EEE652.3, 24EEE652.4
8	To design Bridge rectifier circuits	2	24EEE652.3, 24EEE652.4
9	To realize using op-amp an Inverting Amplifier and Non-Inverting Amplifier	2	24EEE652.3, 24EEE652.4
10	To realize using op-amps i) Summing Amplifier ii) Difference amplifier	2	24EEE652.3, 24EEE652.4
11	To design LED glow circuit	2	24EEE652.3, 24EEE652.4
12	To design Automatic Door Lock System	2	24EEE652.3, 24EEE652.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1) Full-Wave Bridge Rectifier

https://www.multisim.com/content/HjVJib9TcNYxueUuUH3jYV/full-wave-bridge-rectifier/

2) MultisimLive: https://www.multisim.com/content/BWyLQUVt8MWkVykgTfpodV/virtual-lab/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	15
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Reference Books:

1) Circuit Analysis with Multisim, David Baez-Lopez (Author), Felix Guerrero-Castro (Author) SpringerPublication, ISBN-10: 3031798392
2) NI MULTISIM User manual, https://www.ni.com/docs/enS/bundle/multisim/resource/374483d.pdf

LABVIEW FOR ELECTRICAL APPLICATIONS

Course Code	**24EEE653**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEE653.1	Implement basic arithmetic and Boolean operations using given software.
24EEE653.2	Analyze characteristics of electric circuit elements, and design circuits to verify different electric laws.
24EEE653.3	Simulate voltage dividers, analyze resistor configurations, and investigate circuit theorems .
24EEE653.4	Control, analyze, design and test various circuits.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE653.1	3	3	3	3	2	1	1	-	-	1	1	1	-
24EEE653.2	3	3	3	3	2	1	1	-	-	1	1	1	-
24EEE653.3	3	3	3	3	2	1	1	-	-	1	1	1	-
24EEE653.4	3	3	3	3	2	1	1	-	-	1	1	1	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	Cos
	Prerequisite Experiments		
	Introduction to LabVIEW Environment and Basic Programming Concepts Familiarization with LabVIEW Interface Creating a Simple VI (Virtual Instrument) Running and Debugging Vis. Data acquisition and signal processing.	2	NA
	PART-A		
1	Realize the following: - Basic arithmetic operations: addition, subtraction, multiplication and division; Boolean operations: AND, OR, XOR, NOT and NAND.	2	24EEE653.1
2	Analyzing characteristics of resistors, capacitors, and inductors in DC & AC circuits.	2	24EEE653.2
3	Design a resistor circuit with a variable resistor. Use LabVIEW to adjust the voltage source and measure the current. Verify the Ohm's law by using LabVIEW's tools.	2	24EEE653.2
4	Construct a circuit with a resistor and capacitor (or inductor). Apply a step voltage and to track the voltage across the capacitor (or inductor) over time. Determine the time constant by observing the circuit's charging/discharging behavior.	2	24EEE653.2
5	Test LED Brightness: Connect LED and resistor in series with PWM pin. Use LabVIEW for PWM signal with varying duty cycles. Observe LED brightness changes with duty cycle adjustment.	2	24EEE653.4
6	Build virtual circuits with series and parallel resistors, analyze equivalent resistance, and study voltage/current relationships. Investigate Thevenin's theorem.	2	24EEE653.3
	PART-B		
7	Analyze and simulate half wave and full wave rectifier circuits.	2	24EEE653.3
8	Design and simulate the first order low pass and high pass filter circuits.	2	24EEE653.3
9	Investigate the system stability for the first order and second control system by using Bode plot and Nyquist plot analysis.	2	24EEE653.3
10	Build a Buck & boost converter circuit to simulate its operation to analyze output voltage regulation and efficiency.	2	24EEE653.4

11	Simulate or control a simple power inverter circuit. Analyze the generation of AC waveforms from a DC source through pulse width modulation (PWM) techniques.	2	24EEE653.4
12	Design a PID controller to regulate the speed of a DC motor. Use feedback from a position or speed sensor to adjust the motor's control signal for precise control.	2	24EEE653.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

1. Overview of labVIEW software
   https://www.ni.com/en/shop/labview/virtual-instrumentation.html
2. Introduction to LabVIEW and Basic LabVIEW Based Electrical Projects
   https://www.electricaltechnology.org/2015/10/labview-for-basic-electrical-prijects.html
3. Engineering: LabVIEW Measurements and Instrumentation
   https://virtuallabs.merlot.org/vl_engineering_labview_measurements.html

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	15
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:
Reference Books:

1) LabVIEW for Electrical Engineers and Technologists, Stephen Philip Tubbs, 2011. ISBN-13: 978-0981975337.
2) LabVIEW for Electric Circuits, Machines, Drives, and Laboratories, Nesimi Ertugrul, Pearson, 2002. ISBN-13: 978-0130618863

AI-ASSISTED TECHNICAL WRITING USING LATEX

Course Code	**24EEE654**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEE654.1	Apply AI-assisted writing techniques and LaTeX tools to prepare structured technical documents following engineering writing standards.
24EEE654.2	Develop technical documents incorporating mathematical expressions, tables, figures, cross-references, and bibliographic citations using LaTeX.
24EEE654.3	Analyze and refine AI-generated technical content by ensuring clarity, accuracy, proper referencing, and adherence to ethical writing practices.
24EEE654.4	Create publication-quality engineering documents and technical presentations using LaTeX, AI-assisted writing tools, and standard publication formats.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE654.1	3	1	1	3	2	-	-	2	1	2	1	-	-
24EEE654.2	3	1	1	3	2	-	-	2	1	2	1	-	-
24EEE654.3	3	1	1	3	2	-	-	2	1	2	1	-	-
24EEE654.4	3	1	1	3	2	-	-	2	1	2	1	-	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Demo		
	Overview, Install LaTeX	2	24EEE654.1
	PART-A		
1	Introduction to AI-Assisted Technical Writing: Understanding technical writing, overview of AI writing tools, prompt engineering for technical content, responsible and ethical use of AI.	2	24EEE654.1
2	Creating Technical Documents in LaTeX: Creating the first LaTeX document, document classes, title page, sectioning, table of contents, page layout, and document organization.	2	24EEE654.1
3	Formatting Technical Content: Text formatting, lists, quotations, multicolumn documents, headers and footers, page numbering, footnotes, and handling common LaTeX errors.	2	24EEE654.1
4	Writing Mathematical and Scientific Content: Mathematical expressions, equations, matrices, symbols, aligned equations, theorem and proof environments for engineering documents.	2	24EEE654.2 24EEE654.3
5	Preparing Tables, Figures, and Technical Illustrations: Creating professional tables, inserting figures, captions, labels, cross-references, image positioning, and subfigures.	2	24EEE654.2 24EEE654.3
6	AI-Assisted Content Generation and Refinement: Generating abstracts, summaries, technical descriptions, and documentation using AI; editing AI-generated content for clarity, accuracy, and originality.	2	24EEE654.1 24EEE654.3
	PART-B		
7	Technical Referencing and Bibliography: Cross-referencing, hyperlinks, bibliography generation using BibTeX, IEEE citation style, and integrating references from Zotero/Mendeley.	2	24EEE654.2 24EEE654.3
8	AI-Assisted Literature Review and Report Writing: Preparing a literature review using AI tools, validating information, organizing technical reports, and maintaining academic integrity.	2	24EEE654.2 24EEE654.3
9	Preparing an IEEE Technical Paper: Creating an IEEE conference paper using LaTeX with title, abstract, keywords, equations, tables, figures, references, and AI-assisted proofreading.	2	24EEE654.3 24EEE654.4

10	Technical Presentation using Beamer: Creating professional presentations using Beamer, themes, blocks, columns, overlays, animations, and integrating technical content.	2	24EEE654.4
11	AI-Assisted Patent and Technical Documentation: Drafting patent abstracts, technical specifications, project reports, user manuals, and design documentation using AI and LaTeX.	2	24EEE654.4
12	Mini Project – Publication-Quality Technical Document: Prepare a complete engineering document (research paper, project report, patent draft, or technical manual) using AI-assisted writing, LaTeX formatting, bibliography management, and final document review.	2	24EEE654.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

1. Online LATex editor
   https://www.overleaf.com/learn
2. LaTeX – A document preparation system
   https://www.latex-project.org/
3. The LaTeX Project (aka LaTeX3 Project)
   https://www.latex-project.org/latex3/

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	15
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

References:

1) Chris Chinchilla, Technical Writing for Software Developers: Enhance Communication, Improve Collaboration, and Leverage AI Tools for Software Development, Packt Publishing, 2024.
2) Robert A. Day and Barbara Gastel, How to Write and Publish a Scientific Paper, 9th Edition, Greenwood, 2024.
3) https://www.overleaf.com/learn/latex/LaTeX_video_tutorial_for_beginners_(video_1)
4) https://learning.edx.org/course/course-v1:IITBombayX+LaTeX101x+1T2021/home
5) https://www.udemy.com/course/learn-latex-the-complete-latex-course/?couponCode=HOLI24
6) https://www.overleaf.com/learn/latex/Choosing_a_LaTeX_Compiler

ELECTRONICS CIRCUIT DESIGN USING PROTEUS

Course Code	**24EEE655**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes:

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

24EEE655.1	Apply the fundamental concepts of electronics for creating schematics and layout of electronics design problems.
24EEE655.2	Simulate electronic circuits to study the behavior of components and circuits before building Physically.
24EEE655.3	Learn citations and how to build a bibliography and Mathematical Contents Make use of software interface for placing components on the board and routing traces to establish connections, mimicking the real-world PCB fabrication process.
24EEE655.4	Analyze the functionality of the code and its interaction with the hardware components without needing physical hardware.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE655.1	3	-	-	-	2	-	-	-	-	-	-	3	3
24EEE655.2	3	3	1	1	2	-	-	-	-	-	-	3	3
24EEE655.3	3	3	1	1	2	-	-	-	-	-	-	3	3
24EEE655.4	3	3	1	1	2	-	-	-	-	-	-	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Demo		
	• Basic Electronics Knowledge • Proteus Software Installation • Components and Libraries • Circuit Design Basics. • Circuit Simulation	2	24EEE655.1
	PART-A		
1	To understand the principles of LED operation and current limiting	2	24EEE655.1
2	To investigate the charging behavior of capacitors.	2	24EEE655.1
3	To design transistor as a Switch	2	24EEE655.1
4	To design and analyze an inverting amplifier	2	24EEE655.1 24EEE655.3
5	To create a square wave generator using 555 Timer in A stable Mode	2	24EEE655.1 24EEE655.3
6	To convert an AC signal to DC Using a Rectifier (Half wave)	2	24EEE655.1 24EEE655.3
	PART-B		
7	To obtain a stable 5V DC output using LM7805 Voltage Regulator	2	24EEE655.2
8	To investigate the basic logic gates	2	24EEE655.2
9	To Investigate serial to parallel conversion using Shift register	2	24EEE655.2
10	To design and analyze a crystal oscillator	2	24EEE655.3
11	To display frequency of an input signal using 7-segment Display	2	24EEE655.4
12	To convert an AC signal to DC Using a Rectifier (Full wave)	2	24EEE655.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. Draw the layout for 5V DC Power Supply circuit on Proteus.

https://www.studocu.com/row/document/air-university/electrical-circuit-analysis/1634537390389-lab5- pcb-designing-in-proteus/25746984

2. Design and Simulation of Hartley Oscillator. https://www.youtube.com/watch?v=akqoYmkaiSc
3. Flashing Led's Using 555 Ic Circuit, Simulation, And PCB Layout Design. https://www.youtube.com/watch?v=j2A35oHB3tM
4. Half Adder using Proteus. https://www.youtube.com/watch?v=CAMURFssBaQ

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	15
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	--
L2	Understand	--
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

References:

1) Proteus PCB Design Examples, George Shopov, - ARES Kindle: 2020, ASIN : B07XFG3R1Y.
2) Essential Circuit Analysis Using Proteus, Farzin Asadi, eBook ISBN 978-981-19-4353-9, 2023.
3) https://www.labcenter.com/

ADVANCED PROBLEM SOLVING METHODOLOGIES

Course Code	**24SDK66**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**-**
Hrs / Week	**2**	**Total Marks**	**50**
Credits	**0**	**Exam Hours**	**02**

Course outcomes:
Upon successful completion of this course, the student will be able to:

24SDK66.1	Infer the complex problems using the concepts of data structures and C programming
24SDK66.2	Apply object-oriented programming concepts in C++and Java to solve real time problem statements.
24SDK66.3	Solve real-world problem using python and C#
24SDK66.4	Develop the skills of handling data base queries and procedures

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24SDK66.1	3	3	-	-	2	-	-	-	-	-	-
24SDK66.2	2	3	3	-	3	-	-	-	-	-	-
24SDK66.3	2	2	3	2	3	-	-	-	-	-	-
24SDK66.4	2	3	3	-	3	-	-	-	-	-	-

MODULE-1	**Problem Solving On Data Structures and C**	**24SDK66.1**	**6 Hours**

Data Structures using C: Stack and queues, list, graph, tree, sorting and searching, Hash functions
Advanced C programming: Pointers, Recursion, Functions, Structure, Union, C Preprocessor

MODULE-2	**Problem Solving on Object Oriented Programming Using CPP**	**24SDK66.2**	**6 Hours**

Object Oriented Programming: Inheritance, Polymorphism, Exception handling, File Handling, Predefined function, Void function, Name spaces, Input and output streams.

MODULE-3	**Problem Solving on JAVA And XML**	**24SDK66.2**	**6 Hours**

Object oriented programming using Java: Inheritance, Polymorphism, Abstract class and Interface, Collections, Exception handling, Streams, Functional Interface.
XML: DTD, Schema, Server Path, DOM, XSLT, Name Space, AJAX.

MODULE-4	**Problem Solving Using C # And Python**	**24SDK66.3**	**6 Hours**

Python: Functions, iterators, Object oriented Programming, Exception Handling, Packages, Frame works- Django, Collections.
C#: Object oriented Programming, Delegate, Collections and generic, Name space.

MODULE-5	**Scenario Based Problems On DBMS**	**24SDK66.4**	**6 Hours**

ER Model, SQL- DDL, DML, TCL, DCL, Joins, subquery, PL/SQL-Index, Sequence, procedures and functions, normalization, B tree, B+ tree, Forms.

Note:

1. **Students shall solve the programming exercises and scenario-based problems available on the designated portal as part of the prescribed boot camp.**
2. **The CIE assessment and evaluation will be as per the guidelines framed by CDC.**

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution
		Tests
		50
L1	Remember	5
L2	Understand	10
L3	Apply	20
L4	Analyze	15
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Martin C Brown, "Python-The Complete Reference", Mc Graw Hill, 4th edition, 2020
2. Reema Tharega, "Data Structures using C", Oxford University Press, 2020
3. Ullakirch-Prinz, "A complete guide to program in C++", Jonas and Bartlett Learning, 2022
4. Kathy Sierra, "Headfirst Java", O'reilly Media, 2021
5. Andrew Stellman, "Headfirst C#", O'reilly Media, 2021

Web links and Video Lectures (e-Resources):

1. **https://www.learncpp.com/**
2. **https://www.programiz.com/dsa**
3. **https://code.visualstudio.com/Docs/languages/csharp**
4. **https://www.udemy.com/course/the-complete-java-course-from-basics-to-advanced/?couponCode=ST16MT70224**
5. **https://www.codecademy.com/learn/paths/c**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Analysis of industry relevant use cases
- Problem solving on scenario-based questions
- Placement portal practice sessions

CAPSTONE PROJECT			
Course Code	**24EEE67**	**CIE Marks**	**50**
L:T:P:S	**0:0:2:0**	**SEE Marks**	**50**
Hrs / Week	**04**	**Total Marks**	**100**
Credits	**02**	**Exam Hours**	**03**

Course outcomes:

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

24EEE67.1	Identify societal needs and organize them into multidisciplinary engineering areas through project problem analysis.
24EEE67.2	Conduct a literature review using technical resources to arrive at sustainable conclusions for the project.
24EEE67.3	Apply appropriate techniques and modern engineering tools to solve complex real-world problems in project work.
24EEE67.4	Evaluate different methodologies and select the most suitable approach based on specified criteria.
24EEE67.5	Interpret project progress and outcomes by preparing technical reports and delivering presentations.
24EEE67.6	Demonstrate effective individual and teamwork skills while carrying out project activities.

COs \POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
24EEE67.1	3	3	2	1	-	2	2	-	-	-	-	2	1
24EEE67.2	2	3	-	2	2	-	2	-	-	1	-	2	1
24EEE67.3	3	3	3	2	3	-	1	-	-	-	-	3	3
24EEE67.4	2	3	3	3	2	-	1	-	-	-	-	3	2
24EEE67.5	1	1	-	-	-	-	-	-	1	3	1	1	1
24EEE67.6	-	-	-	-	-	-	-	1	3	2	3	-	-

Capstone Project- Phase I is an experiential learning course that provides students with an opportunity to apply engineering knowledge and analytical skills towards solving real-world problems. The course enables students to identify and formulate a problem by considering societal, environmental, industrial, and technological needs. Students are expected to conduct a comprehensive literature survey, perform requirement analysis, evaluate the feasibility of proposed solutions, and design an appropriate methodology using modern engineering tools and technologies.

Based on the abilities of the student(s) and the recommendations of the guide, a single-disciplinary or multidisciplinary project may be assigned to an individual student or a group comprising not more than four students. During this phase, students shall define project objectives, develop system architecture, prepare a detailed implementation plan, and demonstrate preliminary outcomes such as simulation results, prototype design, or proof-of-concept models.

The project progress shall be reviewed periodically by a panel of experts throughout the semester. Continuous Internal Evaluation (CIE) marks shall be awarded based on problem identification, literature review, methodology formulation, feasibility analysis, progress achieved, project presentation skills, and performance during the question-and-answer sessions. Plagiarism in any form shall result in the award of an F grade and may lead to further disciplinary action as per institutional regulations.

At the end of Capstone Project-Phase I, students shall submit a detailed project proposal and progress report containing the problem statement, literature survey, objectives, methodology, system design, work completed, and implementation plan for Capstone Project Phase-II. The report shall be evaluated by duly appointed examiner(s).

Types of Capstone Projects: Capstone projects undertaken for one year may fall into one or more of the following categories:

a) Research-Oriented Projects:

- Focus on investigating new concepts, theories, or technologies.

• Aim to generate new knowledge or contribute to academic research.

b) Experimental/Analytical Projects

• Based on laboratory or field experiments to validate a hypothesis or study a phenomenon.
• Including detailed data collection, analysis, and interpretation.

c) Simulation/Modelling Projects

• Use computational tools to model, simulate, and predict system behaviour.
• Reduce the need for physical prototyping in the initial stages.

d) Interdisciplinary/Multidisciplinary Projects

• Combine knowledge and techniques from multiple engineering domains or other fields such as management, medicine, or environmental sciences. f) Entrepreneurial/Innovation Projects
• Focus on product or service innovation with potential for commercialization.
• Include aspects of market analysis, cost estimation, and business planning.

e) Industrial/Industry-Sponsored Projects

• Carried out in collaboration with an industry partner.
• Address real-world engineering problems faced by the organization.

CIE Assessment Pattern (50 Marks – Power point presentation, Report submission)

RBT Levels		Marks Distribution	
		REVIEW 1	REVIEW 2
		25	25
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	5	5

SEE Assessment Pattern (50 Marks – Write up, Power Point presentation)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

NATIONAL SERVICE SCHEME

Course Code	**24NSS50, 24NSS60**	**CIE Marks (each Semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4 = 200**
Credits	**00**	**Exam Hours**	**02**

Course outcomes:
At the end of the course, the student will be able to:

24NSS50/60.1	Understand the importance of his / her responsibilities towards society.
24NSS50/60.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
24NSS50/60.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.
24NSS50/60.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24NSS50/60.1	-	-	-	-	-	3	3	2	-	-	1
24NSS50/60.2	-	-	-	-	-	3	3	2	-	-	1
24NSS50/60.3	-	-	-	-	-	3	3	2	-	-	1
24NSS50/60.4	-	-	-	-	-	3	3	2	-	-	1

Semester/ Course Code	CONTENT	COs	HOURS
3RD 24NSS30	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing 2. Waste management–Public, Private and Govt organization, 5R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.	24NSS30.1, 24NSS30.2, 24NSS30.3, 24NSS30.4	30 HRS
4TH 24NSS40	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	24NSS40.1, 24NSS40.2, 24NSS40.3, 24NSS40.4	30 HRS
5TH 24NSS50	7. Developing Sustainable Water management system for rural areas and implementationapproaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill developmentprograms etc. 9. Spreading public awareness under rural outreach programs. (minimum 5 programs).	24NSS50.1, 24NSS50.2, 24NSS50.3, 24NSS50.4	30 HRS
6TH 24NSS60	10. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure.	24NSS60.1, 24NSS60.2, 24NSS60.3, 24NSS60.4	30 HRS

CIE Assessment Pattern (50 Marks – Activity based) –

CIE component for every semester	Marks
Presentation - 1 Selection of topic, PHASE - 1	10
Commencement of activity and its progress - PHASE - 2	10

Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
Total marks for the course in each semester	**50**

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

Suggested Learning Resources:

Reference Books:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

Pre-requisites to take this Course:

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
    - Lecture session by NSS Officer
    - Students Presentation on Topics
    - Presentation - 1, Selection of topic, PHASE – 1
    - Commencement of activity and its progress - PHASE – 2
    - Execution of Activity
    - Case study-based Assessment, Individual performance
    - Sector/ Team wise study and its consolidation
    - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic

1.	Organic farming, IndianAgriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govtorganization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contributionin social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools toachieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Govern ment Schemes officers	School selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

7.	Developing SustainableWater management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India.For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme,Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION AND SPORTS			
Course Code	**24PED50, 24PED60**	**CIE Marks (each semester)**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4= 200**
Credits	**00**	**Exam Hours**	**02**

Course outcomes:
At the end of the course, the student will be able to:

24PED50/60.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
24PED50/60.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
24PED50/60.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
24PED50/60.4	Understand the roles and responsibilities of organization and administration of sports and games

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
24PED50/60.1	-	-	-	-	-	2	-	3	3	-	-	2
24PED50/60.2	-	-	-	-	-	2	-	3	3	-	-	2
24PED50/60.3	-	-	-	-	-	2	-	3	3	-	-	2
24PED50/60.4	-	-	-	-	-	2	-	3	3	-	-	2

Semester	CONTENT	COs	HOURS
3RD 24PED30	**Module 1: Orientation** A. Lifestyle, B. Fitness C. Food & Nutrition D. Health & Wellness E. Pre-Fitness test.	24PED30.1, 24PED30.2	5 HRS
	Module 2: General Fitness & Components of Fitness A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash D. Agility – Shuttle Run E. Flexibility – Sit and Reach F. Cardiovascular Endurance – Harvard step Test	24PED30.2, 24PED30.3	15 HRS
	Module 3: Recreational Activities A. Postural deformities. B. Stress management. C. Aerobics. D. Traditional Games.	24PED30.3, 24PED30.4	10 HRS
4TH 24PED40	**Module 1: Ethics and Moral Values** A. Ethics in Sports B. Moral Values in Sports and Games	24PED40.1, 24PED40.2	5 HRS
	Module 2: Specific Games (Anyone to be selected by the student) A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.	24PED40.3	20 HRS

	E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. F. Athletics (Track / Field Events) – Any event as per availability of Ground.		
	Module 3: Role of Organization and administration	24PED40.4	5 HRS
5TH 24PED50	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: • Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Handball OR Ball Badminton** **Handball:** A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Ball badminton:** A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	24PED50.1, 24PED50.2, 24PED50.3, 24PED50.4	Total 30 Hrs/ Semester 2 Hrs/week
6TH 24PED60	**Athletics**: 1. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the	24PED60.1, 24PED60.2, 24PED60.3, 24PED60.4	Total 30 Hrs/ Semester 2 Hrs/week

	ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations. A. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice. 5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials		

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15
Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA			
Course Code	**24YOG50, 24YOG60**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**--**
Hrs / Week	**2**	**Total Marks**	**50 x 4 = 200**
Credits	**00**	**Exam Hours**	**02**

Course outcomes:
At the end of the course, the student will be able to:

24YOG50/60.1	Understanding the origin, history, aim and objectives of Yoga
24YOG50/60.2	Become familiar with an authentic foundation of Yogic practices
24YOG50/60.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat
24YOG50/60.4	Use the teachings of Patanjali in daily life.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
24YOG50/60.1	-	-	-	-	-	3	-	-	-	-	1
24YOG50/60.2	-	-	-	-	-	3	-	-	-	-	1
24YOG50/60.3	-	-	-	-	-	3	-	-	-	-	1
24YOG50/60.4	-	-	-	-	-	3	-	-	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
3rd 24YOG30	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 1. Suryanamaskar prayer and its meaning, Need, importance and b of Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	24YOG30.1, 24YOG30.2, 24YOG30.3, 24YOG30.4	Total 32 Hrs/ Semester 2 Hrs/week
4TH 24YOG40	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Brief introduction and importance of:** **Kapalabhati:** Revision of Kapalabhati -40strokes/min3rounds **Different types of Asanas**: 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana **Patanjali's Ashtanga Yoga**: Asana, Pranayama **Pranayama:** Chandra Bhedana, Nadishodhana, Surya Bhedana	24YOG40.1, 24YOG40.2, 24YOG40.3, 24YOG40.4	Total 32 Hrs/ Semester 2 Hrs/week

5TH 24YOG50	**Kapalabhati:** Revision of Kapalabhati - 60strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvanga **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	24YOG50.1, 24YOG50.2, 24YOG50.3, 24YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week
6TH 24YOG60	**Kapalabhati:** Revision of Kapalabhati – 80 strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 4. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	24YOG60.1, 24YOG60.2, 24YOG60.3, 24YOG60.4	Total 32 Hrs/ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks – Practical)

CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)

CIE	Marks
Avg of Test 1 and Test 2	25
Demonstration of Yogasana	25
Total	**50**

Suggested Learning Resources:

Reference Books:

4. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
5. Tiwari, O P: Asana Why and How
6. Ajitkumar: Yoga Pravesha (Kannada)
7. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
8. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
9. Nagendra H R: The art and science of Pranayama
10. Tiruka: Shatkriyegalu (Kannada)
11. Iyengar B K S: Yoga Pradipika (Kannada)
12. Iyengar B K S: Light on Yoga (English)

Web links and Video Lectures (e-Resources):

- https://youtu.be/KB-TYlgd1wE
- https://youtu.be/aa-TG0Wg1Ls

APPENDIX A

List of Assessment patterns

1. Group Discussions
2. Case studies
3. Practical Orientation on design thinking, Creative & Innovation
4. Participatory & Industry-Integrated Learning
5. Practical Activities/Problem Solving Exercises
6. Class Presentations
7. Analysis of Industry/Technical/Business Reports
8. Reports on Industrial Visits
9. Industrial/Social/Rural Projects
10. Participation in External Seminars/Workshops
11. Online/Offline Quizzes

APPENDIX B

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

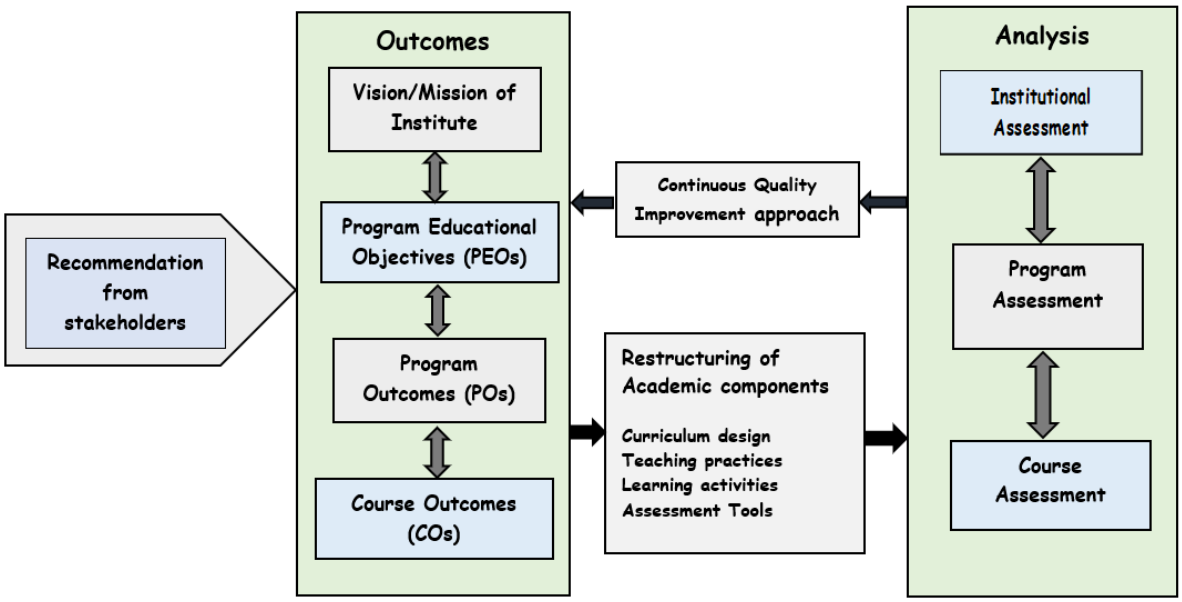
There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation.

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX C

The Graduate Attributes of NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved by straight forward application of knowledge, theories and techniques applicable to the engineering discipline. * That may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement. (like: cost, power requirement, durability, product life, etc.).,which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities

with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

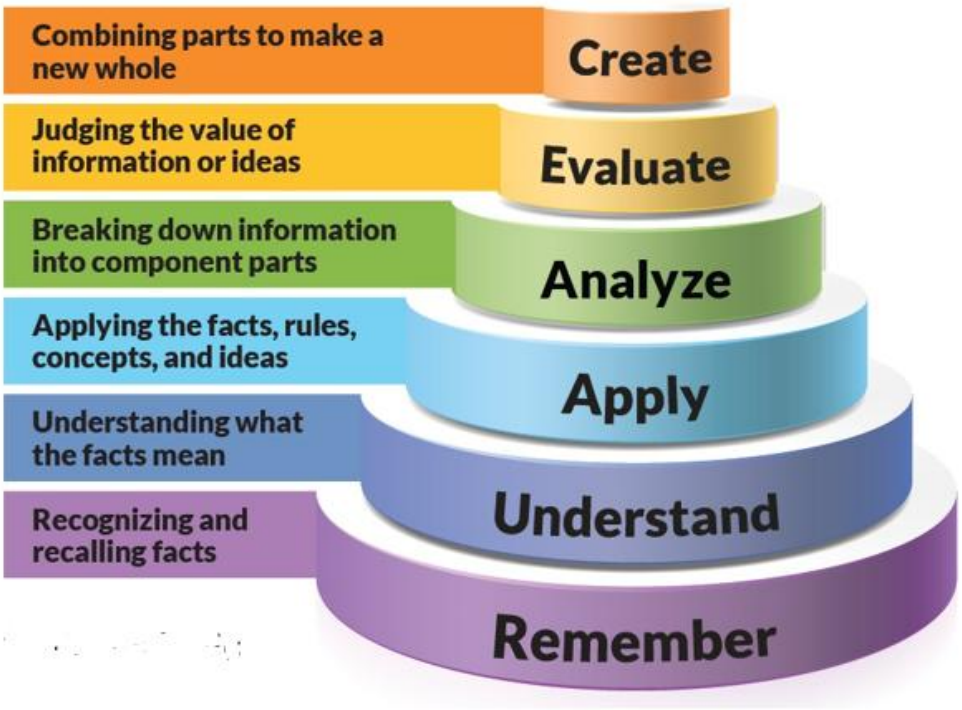
Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

APPENDIX D

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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