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**Department of Electrical and Electronics Engineering**  
**Academic Year 2023-24**

**5<sup>th</sup> and 6<sup>th</sup> Semester Scheme & Syllabus**

**BATCH: 2021-25**

**CREDITS: 160**

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# **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.

## 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

## PROGRAM OUTCOMES (POs)

S.No	Graduate Attributes	Program Outcomes (POs)
1	Engineering Knowledge	PO1: Able to understand the fundamentals of mathematics, science, Electrical and Electronics Engineering and apply them to the solution of complex engineering problems.
2	Problem Analysis	PO2: Ability to identify, formulate and analyse real time problems in Electrical and Electronics Engineering.
3	Design and Development of Solutions	PO3: Design solutions for complex engineering problems, that meet the specified needs and to interpret the data.
4	Investigation of Problem	PO4: Use research based knowledge and research methods to provide valid solutions for complex problems in Electrical and Electronics Engineering.
5	Modern Tool usage	PO5: Apply appropriate tools techniques for modeling, analyzing and solving Electrical and Electronics Engineering devices & systems.
6	Engineer and society	PO6: To give basic knowledge of social, economical, safety and cultural issues relevant to professional engineering.
7	Environment and sustainability	PO7: To impart knowledge related to the design and development of modern systems which are environmentally sensitive and to understand the importance of sustainable development.

8	Ethics	PO8: Apply ethical principles and professional responsibilities in engineering practice.
9	Individual & team work	PO9: Ability to visualize and function as an individual and as a member in a team of a multi-disciplinary environment.
10	Communication	PO10: Ability to communicate effectively complex engineering ideas to the engineering community & the society at large.
11	Lifelong learning	PO11: To impart education to learn and to engage in independent and life - long learning in the technological change.
12	Project management and finance	PO12: Ability to handle administrative responsibilities, manage projects & handle finance related issues in a multi-disciplinary environment.

**PEOs to POs mapping**

	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
<b>PEO 1</b>	3	3	3	3	3	2	2	2	2	2	2	2	3	3
<b>PEO 2</b>	3	3	3	3	3	2	2	2	2	2	2	2	3	3
<b>PEO 3</b>	2	2	2	2	2	3	3	3	3	2	2	2	2	2

## PROGRAM SPECIFIC OUTCOMES (PSOs)

**PSO 1:** Graduates will be able to solve real life problems of power system and power Electronics using MiPower, PSPICE and MATLAB software tools and hardware.

**PSO 2:** Graduates will be able to Develop & support systems based on Renewable and sustainable Energy sources.

**NEW HORIZON COLLEGE OF ENGINEERING**  
**B. E. in Electrical and Electronics Engineering**  
**Scheme of Teaching and Examinations for 2021- 2025 BATCH (2021 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	PCC	21EEE51	Power Electronics	EE	3	0	0	0	3	3	50	50	<b>100</b>
2	PCCL	21EEL51	Power Electronics Laboratory	EE	0	0	1	0	1	2	50	50	<b>100</b>
3	PCC	21EEE52	Industrial Automation	EE	3	0	0	0	3	3	50	50	<b>100</b>
4	PCCL	21EEL52	Industrial Automation Laboratory	EE	0	0	1	0	1	2	50	50	<b>100</b>
5	PCC	21EEE53	Transmission Distribution and Protection	EE	3	0	0	0	3	3	50	50	<b>100</b>
6	PEC	21EEE54X	Professional Elective Course-I	EE	3	0	0	0	3	3	50	50	<b>100</b>
7	AEC	21EEL55X	Ability Enhancement Course-V	EE	0	0	1	0	1	2	50	50	<b>100</b>
8	MP	21EEE56	Mini Project	EE	0	0	1	0	1	2	50	50	<b>100</b>
9	AEC	21EEK57	Research Methodology and IPR	EE	1	0	0	0	1	2	50	50	<b>100</b>
10	UHV	21EEK58	Innovation and Design Thinking	EE	1	0	0	0	1	1	50	50	<b>100</b>
<b>Total</b>									<b>18</b>	<b>23</b>	<b>500</b>	<b>500</b>	<b>1000</b>

NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator	<p>All students have to register for anyone of the courses namely National Service Scheme, Physical Education (PE) (Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of V semester. The activities shall be carried out from (for 4 semesters) between V semester to VIII semester.</p> <p>SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree.</p> <p>The events shall to be reflected in the calendar prepared for the NSS, PE and Yoga activities.</p>
	21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director	
	21YOG84	Yoga	Yoga Teacher	



**PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **NMC:** 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

Professional Elective Course-I			
21EEE541	Object Oriented programming using JAVA	21EEE544	Professional Ethics
21EEE542	Signals and Systems	21EEE545	Electromagnetic Field Theory
21EEE543	Advanced Control Systems		

Ability Enhancement Course-V (For EEE, all are Laboratory Courses 0-0-1-0)			
21EEL551	Simulation tools in Electrical Engineering	21EEL553	Advanced Arduino programming
21EEL552	Power System Protection	21EEL554	Introduction to MATLAB

**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 that are added supplement the latest trend and advanced technology in the selected stream of engineering.

**Mini-project work:** 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 2-4 if mini project work is single discipline (applicable to all Core Branches)
- (S) A group of 2 –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) **Inter disciplinary:** 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

**Credit Definition:**

1-hour Lecture (L) per week=1Credit

2-hours Tutorial (T) per week=1Credit

2-hours Practical / Drawing (P) per week=1Credit

2-hours 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 2021- 2025 BATCH (2021 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	HSMC	21EEE61	Operation Research and Management	EE	3	0	0	0	3	3	50	50	<b>100</b>
2	PCC	21EEE62	Advanced Industrial and Building Automation	EE	3	0	0	0	3	3	50	50	<b>100</b>
3	PCCL	21EEL62	Advanced Industrial and Building Automation Laboratory	EE	0	0	1	0	1	2	50	50	<b>100</b>
4	PCC	21EEE63	Power System Analysis	EE	3	0	0	0	3	3	50	50	<b>100</b>
5	PCCL	21EEL63	Power System Analysis Laboratory	EE	0	0	1	0	1	2	50	50	<b>100</b>
6	PEC	21EEE64X	Professional Elective Course-II	EE	3	0	0	0	3	3	50	50	<b>100</b>
7	UHV	21EEK65	Social Connect and Responsibility	EE	0	0	1	0	1	2	50	-	<b>50</b>
8	INT	21EEE66	Innovation/Entrepreneurship/Societal Internship	EE	0	0	3	0	3	0	50	50	<b>100</b>
9	MP	21EEE67	Mini project	EE	0	0	1	0	1	2	50	50	<b>100</b>
10	OEC	21NHOP6XX	Industrial Open Elective Course-I	Offering Dept.	3	0	0	0	3	3	50	50	<b>100</b>
<b>Total</b>									<b>22</b>	<b>23</b>	<b>500</b>	<b>450</b>	<b>950</b>

**HSMC:** Humanity and Social Science & Management Course, **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, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.

**Industrial Open Elective Course-I (OEC):** 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 that are added supplement the latest trend and advanced technology in the selected stream of engineering.

**21XXX61 (HSMC)**- 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 Management

**For Core Branches:** Engineering Economics and Management / Industrial Management / Construction Management

**Professional Elective Course-II**

21EEE641	Introduction to Cyber Security	21EEE644	High Voltage Engineering
21EEE642	Data Structures and Algorithms using Python	21EEE645	Special Electrical Machines
21EEE643	CMOS VLSI Design		

**Credit Definition:**

1-hour Lecture (L) per week=1Credit  
 2-hours Tutorial(T) per week=1Credit  
 2-hours Practical / Drawing (P) per week=1Credit  
 2-hours 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

## **Syllabus of Fifth Semester BE**

## POWER ELECTRONICS

<b>Course Code</b>	<b>21EEE51</b>										<b>CIE Marks</b>	<b>50</b>			
<b>L:T:P:S</b>	<b>3:0:0:0</b>										<b>SEE Marks</b>	<b>50</b>			
<b>Hours / Week</b>	<b>3</b>										<b>Total Marks</b>	<b>100</b>			
<b>Credits</b>	<b>03</b>										<b>Exam Hours</b>	<b>03</b>			
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
<b>21EEE51.1</b>	Analyze various power semiconductor devices														
<b>21EEE51.2</b>	Investigate the protection, gating and commutation circuits														
<b>21EEE51.3</b>	Examine different types of controlled rectifiers, choppers and inverters														
<b>21EEE51.4</b>	Choose suitable techniques to minimize the harmonics														
<b>21EEE51.5</b>	Analyze the performance of different power converters														
<b>21EEE51.6</b>	Design power converters for industrial applications														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>	
<b>21EEE51.1</b>	3	2	1	1	-	-	-	-	-	-	-	-	2	2	
<b>21EEE51.2</b>	3	3	2	2	1	-	-	-	-	-	-	-	2	2	
<b>21EEE51.3</b>	3	3	2	2	2	-	-	-	-	-	-	-	2	2	
<b>21EEE51.4</b>	3	3	2	2	2	-	-	-	-	-	-	-	2	2	
<b>21EEE51.5</b>	3	3	2	2	2	-	-	-	-	-	-	-	2	2	
<b>21EEE51.6</b>	3	3	2	2	3	-	-	-	-	-	-	-	2	2	
<b>MODULE-1</b>	<b>POWER SEMICONDUCTOR DEVICES</b>										<b>21EEE51.1,</b> <b>21EEE51.2</b>	<b>8 Hours</b>			
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														
<b>MODULE-2</b>	<b>AC-DC CONVERTER</b>										<b>21EEE51.3,</b> <b>21EEE51.5</b>	<b>8 Hours</b>			
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	Case Study to understand the operation of different converters with the change of power semiconductor devices.														
Text Book	Text Book 1: 6.1, 6.2, 6.3, 6.4, 6.6, 6.8														
<b>MODULE-3</b>	<b>DC-DC CONVERTER AND AC-AC CONVERTER</b>										<b>21EEE51.3,</b> <b>21EEE51.5</b>	<b>8 Hours</b>			
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	Case Study to understand the operation of different converters with the change 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														
<b>MODULE-4</b>	<b>DC-AC CONVERTER</b>										<b>21EEE51.3,</b> <b>21EEE51.4,</b> <b>21EEE51.5</b>	<b>8 Hours</b>			
Inverters-Single phase bridge inverters, Three phase bridge inverters-180° and 120° mode of conduction, PWM schemes, Harmonic distortion analysis.															
Text Book	Text Book 1: 8.1, 8.2, 8.4, 8.6, 8.7														

<b>MODULE-5</b>	<b>INDUSTRIAL APPLICATIONS</b>	<b>21EEE51.6</b>	<b>8 Hours</b>	
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			
<b>CIE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	3	2
<b>L2</b>	<b>Understand</b>	5	3	2
<b>L3</b>	<b>Apply</b>	5	3	2
<b>L4</b>	<b>Analyze</b>	5	3	2
<b>L5</b>	<b>Evaluate</b>	5	3	2
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	5		
<b>L2</b>	<b>Understand</b>	5		
<b>L3</b>	<b>Apply</b>	15		
<b>L4</b>	<b>Analyze</b>	15		
<b>L5</b>	<b>Evaluate</b>	10		
<b>L6</b>	<b>Create</b>	-		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1) Power Electronics by P. S. Bimbhra, Publisher: Khanna Publishers; 5th ed. 2014 edition.				
2) Power Electronics: Circuits, Devices and Applications by Mohammad H Rashid; Publisher: Pearson, 4th ed. 2014 edition.				
3) Power Electronics: Converters, Applications and Design by Ned Mohan; Publisher: Wiley, 3rd ed. 2014 edition.				
<b>Reference Books:</b>				
1) Power Electronics: Essentials and Applications by L. Umanand, Publisher: Wiley, 4th ed. 2010 edition.				
2) Simulation of Power Electronics Circuits with MATLAB/Simulink: Design, Analyze and Prototype Power Electronics by Farzin Asadi, Publisher: Apress, 2022 edition.				
<b>Web links and Video Lectures (e-Resources):</b>				
<ul style="list-style-type: none"> <li>• <a href="https://nptel.ac.in/courses/108101038">https://nptel.ac.in/courses/108101038</a></li> <li>• <a href="https://www.youtube.com/watch?v=jgh0TNfx0gQ">https://www.youtube.com/watch?v=jgh0TNfx0gQ</a></li> <li>• <a href="https://www.coursera.org/specializations/power-electronics?">https://www.coursera.org/specializations/power-electronics?</a></li> </ul>				
<b>Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning</b>				
<ul style="list-style-type: none"> <li>• Seminars</li> <li>• Demonstration of Real time applications using simulation</li> <li>• Video demonstration of latest trends in power electronics</li> </ul>				

<b>POWER ELECTRONICS LABORATORY</b>														
<b>Course Code</b>	<b>21EEL51</b>				<b>CIE Marks</b>				<b>50</b>					
<b>L:T:P:S</b>	<b>0:0:1:0</b>				<b>SEE Marks</b>				<b>50</b>					
<b>Hrs / Week</b>	<b>2</b>				<b>Total Marks</b>				<b>100</b>					
<b>Credits</b>	<b>01</b>				<b>Exam Hours</b>				<b>03</b>					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEL51.1</b>	Study the characteristics of various power semiconductor devices													
<b>21EEL51.2</b>	Investigate the protection, gating and commutation circuits													
<b>21EEL51.3</b>	Analyze the performance of power converters for various loads using simulink													
<b>21EEL51.4</b>	Design power converters for industrial applications													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
<b>21EEL51.1</b>	3	1	1	1	1	-	-	-	1	-	-	-	2	2
<b>21EEL51.2</b>	3	2	2	2	2	-	-	-	1	-	-	-	2	2
<b>21EEL51.3</b>	3	3	2	2	2	-	-	-	1	-	-	-	2	2
<b>21EEL51.4</b>	3	2	2	2	2	-	-	-	1	-	-	-	2	2
<b>Exp. No. / Pgm. No.</b>	<b>List of Experiments / Programs</b>											<b>Hours</b>	<b>COs</b>	
<b>Prerequisite Experiments / Programs / Demo</b>														
	<ul style="list-style-type: none"> <li><b>Introduction to Power Semiconductor Devices</b></li> </ul>											2	NA	
<b>PART-A</b>														
1	Static characteristics of SCR											2	21EEL51.1	
2	Static characteristics of MOSFET and IGBT											2	21EEL51.1	
3	SCR turn-on circuit using synchronized UJT relaxation oscillator											2	21EEL51.2	
4	SCR digital triggering circuit for a single-phase controlled rectifier and A.C. voltage controller											2	21EEL51.2	
5	Single-phase full-wave rectifier with R and RL loads											2	21EEL51.4	
6	A.C. voltage controller using TRIAC and DIAC combination connected to R load											2	21EEL51.4	
<b>PART-B</b>														
7	Speed control of DC motor using single phase semi converter											2	21EEL51.4	
8	Speed control of a separately excited D.C. motor using and IGBT or MOSFET chopper											2	21EEL51.4	
9	MOSFET or IGBT based single-phase full-bridge inverter connected to R load											2	21EEL51.4	
10	Speed control of universal motor using A.C. voltage controller											2	21EEL51.4	
11	Speed control of stepper motor											2	21EEL51.4	
12	Simulation of converter circuits											2	21EEL51.3	
<b>PART-C</b>														
<b>Beyond Syllabus Virtual Lab Content</b> <b>(To be done during Lab but not to be included for CIE or SEE)</b> <a href="https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html">https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html</a> Virtual Labs, AnMoE. Govt. of India Initiative														



**CIE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	5	05
L2	Understand	5	05
L3	Apply	15	10
L4	Analyze	5	10
L5	Evaluate	-	-
L6	Create	-	-

**SEE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	05
L2	Understand	05
L3	Apply	20
L4	Analyze	20
L5	Evaluate	-
L6	Create	-

**Suggested Learning Resources:****Reference Books:**

- 1) P. S. Bimbhra, "Power Electronics", Publisher: Khanna Publishers, 5th ed. 2014 edition.
- 2) FarzinAsadi, "Simulation of Power Electronics Circuits with MATLAB/Simulink: Design, Analyze and Prototyped Power Electronics", Publisher: Apress, 2022 edition.

<b>INDUSTRIAL AUTOMATION</b>														
<b>Course Code</b>	21EEE52								<b>CIE Marks</b>				50	
<b>L:T:P:S</b>	3:0:0:0								<b>SEE Marks</b>				50	
<b>Hours / Week</b>	3								<b>Total Marks</b>				100	
<b>Credits</b>	03								<b>Exam Hours</b>				03	
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE52.1</b>	Understand the need and basics of automation													
<b>21EEE52.2</b>	Analyze the architecture of PLC.													
<b>21EEE52.3</b>	Develop a suitable logic for various real-time applications using specific programming language for PLC.													
<b>21EEE52.4</b>	Investigate the types of protocols for PLC													
<b>21EEE52.5</b>	Build blocks and mimic screen using HMI and SCADA													
<b>21EEE52.6</b>	Apply the knowledge of industry 4.0 in real time applications													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
<b>21EEE52.1</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEE52.2</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEE52.3</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEE52.4</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEE52.5</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEE52.6</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>MODULE-1</b>	<b>INTRODUCTION TO AUTOMATION</b>								<b>21EEE52.1</b>				<b>8 Hours</b>	
Automation overview-types of automation, automation tools and technologies-benefits of automation-levels of automation with examples-different systems for automation (PLC, SCADA, HMI, DCS, DRIVES), challenges and considerations in automation-future trends in automation- real-world applications														
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16													
<b>MODULE-2</b>	<b>PLC AND PROTOCOLS</b>								<b>21EEE52.2, 21EEE52.3</b>				<b>8 Hours</b>	
PLC Introduction - Definition - Block diagram of PLC – Principle of operation – Modes of operating – PLC Scan - Hardwire control system compared with PLC system - Advantages and Disadvantages of PLCs – Criteria for selection of suitable PLC – Memory organization – Input Types – Discrete input – Analog input - Elements of Power supply unit - PLC Types (Fixed I/O and Modular I/O) - List of various PLCs available – Applications of PLC Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/ RTU), Introduction to third party interface, the concept of OPC (Object linking and embedding for Process Control)														
Case study	List of various PLCs													
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15													
<b>MODULE-3</b>	<b>PROGRAMMING OF PLC</b>								<b>21EEE52.4</b>				<b>8 Hours</b>	
PLC Ladder Language-PLC Basic Instructions-Programming Logic-Gate Functions, PLC Timer Instructions, PLC Counter Instructions-Math Instructions-Compare-Jump& MCR Instructions-Subroutine-Functions-Logic & Bit Shift Instructions- Data Handling Instructions-Sequencer Instructions-PID-Functional Block Diagram (FBD)-Instruction List, Structured text-Sequential Function Chart (SFC)														
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10													
<b>MODULE-4</b>	<b>HMI &amp; SCADA</b>								<b>21EEE52.5</b>				<b>8 Hours</b>	
Different Types of Operator Interfaces - Textual, Graphical-Wiring of HMI-Data Handling With HMI-Configuration and Interfacing to PLC and PC-Communication Standards. SCADA -Role of SCADA in Industrial Automation-SCADA System Configuration, RTU, Communication Protocols.-Script Programming.-Real Time and Historical Trend. Configuring Alarms-Real Time Project Development with PLC Interfacing.														

Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
<b>MODULE-5</b>	<b>INDUSTRY 4.0</b>	<b>21EEE52.6</b>	<b>8 Hours</b>

Fourth Industrial Revolution-Industry4.0 design principles-Technology pillars for Industry 4.0-Cyber Physical Systems, IoT Technologies-cloud computing, Artificial Intelligence-Service oriented architecture-capability and competency-AR/VR technologies-Big Data.

Text Book Text Book 2: 12.1 to 12.10

#### CIE Assessment Pattern (50 Marks - Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	2	-
L3	Apply	5	7	5
L4	Analyze	5	3	5
L5	Evaluate	5	3	-
L6	Create	-	-	-

#### 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) Programming Industrial Control Systems Using IEC 1131-3 (I E E CONTROL ENGINEERING SERIES) Revised Edition, by Robert W. Lewis (Author), 30 June 1998.
- 2) Programmable Logic Controllers and Industrial Automation: An Introduction 2nd Edition, by Madhuchandrandra Mitra and Samarjt Sengupta.12 July 2017

##### Reference Books:

- 1) Industrial Process Automation Systems 1st Edition, by B.R. Mehta Y. Jaganmohan Reddy, 26 November 2014
- 2) Overview of Industrial Process Automation Paperback, by K.L.S. Sharma, 27 October 2016
- 3) Industrial Instrumentation Paperback, by K Krishnaswamy, S. Vijyachitra, 1 January 2020.
- 4) Programmable Logic Controllers, By Frank D. Petruzella,2016,McGraw-Hill Science Engineering; 4th edition, ISBN-10 : 0073303429

#### Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/108105063>
- <http://plc-coep.vlabs.ac.in/>
- <https://www.youtube.com/watch?v=uOtdWHMKhnw>
- [https://www.youtube.com/watch?v=x3MUGVKWXdw&list=PLWF9TXck7O\\_xtginyRk5DMGHN0c\\_HKAcur&index=1](https://www.youtube.com/watch?v=x3MUGVKWXdw&list=PLWF9TXck7O_xtginyRk5DMGHN0c_HKAcur&index=1)

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

- Seminars and Debates
- Development of small real time projects
- Visit to any automation industry
- Demonstration of Real time applications using automation
- Video demonstration of latest trends in industries
- Organizing Group wise discussions on recent innovations and challenges in automation

<b>INDUSTRIAL AUTOMATION LABORATORY</b>														
<b>Course Code</b>	21EEL52				<b>CIE Marks</b>				50					
<b>L:T:P:S</b>	0:0:1:0				<b>SEE Marks</b>				50					
<b>Hrs / Week</b>	2				<b>Total Marks</b>				100					
<b>Credits</b>	01				<b>Exam Hours</b>				03					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEL52.1</b>	Solve the problem by ladder logic diagrams in the software.													
<b>21EEL52.2</b>	Design a PLC based solution to real-world problems.													
<b>21EEL52.3</b>	Apply the SFC based solution for various automation applications.													
<b>21EEL52.4</b>	Design of electrical control circuits using HMI													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
<b>21EEL52.1</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEL52.2</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEL52.3</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEL52.4</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>Exp. No. / Pgm. No.</b>	<b>List of Experiments / Programs</b>											<b>Hours</b>	<b>COs</b>	
<b>Prerequisite Experiments / Programs / Demo</b>														
	<ul style="list-style-type: none"> <li>Digital logic concepts</li> <li>Control of Electrical Machines</li> </ul>											2	NA	
<b>PART-A</b>														
1	Design a ladder logic diagram for basic gates and execute in hardware and simulation modes.											2	21EEL52.1	
2	Design ladder for Sequential operation of ON/OFF of a set of lights.											2	21EEL52.1	
3	Execute Latching and Unlatching of a Motor using PLC.											2	21EEL52.1	
4	Design an application to count using operate and value FBD.											2	21EEL52.1	
5	Design ladder logic for automatic indication of water tank level water level.											2	21EEL52.2	
6	Design a wiring Tunnel wiring using ladder logic diagram and execute in hardware.											2	21EEL52.2	
<b>PART-B</b>														
7	Design a circuit to count the number of person entering the conference room using counters.											2	21EEL52.2	
8	Control a motor direction (Forward and reverse operation) using timer											2	21EEL52.2	
9	Using SFC control the drill motor automatically											2	21EEL52.3	
10	Using SFC control the sequential operation of the motor											2	21EEL52.3	
11	Draw and execute the operation lamp in the mimic screen											2	21EEL52.4	
12	Draw and execute the forward reverse operation in the mimic screen											2	21EEL52.4	
<b>PART-C</b>														
<b>Beyond Syllabus Virtual Lab Content</b> <b>(To be done during Lab but not to be included for CIE or SEE)</b> <a href="https://plc-coep.vlabs.ac.in/">https://plc-coep.vlabs.ac.in/</a>														

**CIE Assessment Pattern (50 Marks - Lab)**

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

**SEE Assessment Pattern (50 Marks - Lab)**

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

**Suggested Learning Resources:****Reference Books:**

- 1) Programming Industrial Control Systems Using IEC 1131-3 (IEE CONTROL ENGINEERING SERIES) Revised Edition, by Robert W. Lewis
- 2) Programmable Logic Controllers and Industrial Automation: An Introduction 2nd Edition, by Madhuchhanda Mitra and Samarjit Sengupta.
- 3) Industrial Controls and Manufacturing (Engineering) 1st Edition by Edward W. Kamen

<b>TRANSMISSION, DISTRIBUTION AND PROTECTION</b>														
<b>Course Code</b>	<b>21EEE53</b>							<b>CIE Marks</b>	<b>50</b>					
<b>L:T:P:S</b>	<b>3:0:0:0</b>							<b>SEE Marks</b>	<b>50</b>					
<b>Hours / Week</b>	<b>3</b>							<b>Total Marks</b>	<b>100</b>					
<b>Credits</b>	<b>03</b>							<b>Exam Hours</b>	<b>03</b>					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE53.1</b>	Understand the basic concepts of electrical power system and various transmission line parameters													
<b>21EEE53.2</b>	Identify various types of insulators, their significance and choose an appropriate insulator for a given system													
<b>21EEE53.3</b>	Derive expressions for the computation of transmission line parameters and to determine voltage regulation and efficiency													
<b>21EEE53.4</b>	Develop mathematical models of transmission lines with different configurations and performance assessment													
<b>21EEE53.5</b>	Categorize different types of distribution systems and examine its quality and reliability.													
<b>21EEE53.6</b>	Use various types of protection devices													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE53.1</b>	3	2	2	-	-	-	-	-	-	-	-	-	1	1
<b>21EEE53.2</b>	3	3	2	1	-	-	-	-	-	-	-	-	1	1
<b>21EEE53.3</b>	3	3	2	1	-	-	-	-	-	-	-	-	1	1
<b>21EEE53.4</b>	3	3	2	1	-	-	-	-	-	-	-	-	1	1
<b>21EEE53.5</b>	3	3	2	1	-	-	-	-	-	-	-	-	1	1
<b>21EEE53.6</b>	3	-	-	-	-	-	-	-	-	-	-	-	1	1
<b>MODULE-1 Introduction to Power System and Overhead Transmission Lines</b>														
<b>21EEE53.1</b>	<b>8 Hours</b>													
Structure of electric power system: generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC Interconnection. Feeders, distributors and service mains 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														
<b>Text Book</b>	Text Book 1: 7.1, 7.2, 7.4, 7.5, 7.6, 7.9, 7.12 Text Book 2: 4.15, 4.18													
<b>MODULE-2 Insulators and Corona</b>	<b>21EEE53.1, 21EEE53.2</b>											<b>8 Hours</b>		
Introduction, Materials used, Types, Potential Distribution over suspension insulators, String efficiency, Methods to improve string efficiency, grading rings, Arching horns, Testing of Insulators, Problems. Introduction, Phenomenon of corona, Disruptive & Critical voltages, Power loss due corona, Advantages & Disadvantages of corona, Problems														
<b>Case study</b>	Calculation of string efficiency and disruptive and critical voltages													
<b>Text Book</b>	Text Book 1: 7.15, 7.16, 7.17, 7.19, 7.20 Text Book 2: 4.18													
<b>MODULE-3 Line Parameters and Performance of transmission lines</b>	<b>21EEE53.3, 21EEE53.4</b>											<b>8 Hours</b>		
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, Problems. Introduction, Short transmission lines, Medium transmission lines- Nominal T & $\Pi$ method, End condenser method, Long transmission lines, ABCD constants of transmission lines, Ferranti Effect, Line regulation, Problems.														
<b>Text Book</b>	Text Book 1: 3.2, 3.3, 3.4, 3.5, 3.6, 3.9 Text Book 2: 1.4, 1.7													
<b>MODULE-4 Distribution and Underground Cables</b>	<b>21EEE53.5</b>											<b>8 Hours</b>		

Primary and secondary distribution, Design considerations in distribution system, Distribution system losses, Factors effecting distribution system losses, Methods for the reduction of line losses, Classification of distribution system, Radial distribution system, DC distribution, Uniformly loaded distribution. Ring Main distribution,  
Introduction, types, materials used for underground cables, Insulation resistance, thermal rating of cables, charging current, Grading of cables, Capacitance grading & Inters heath grading, Testing of cables

Case study | Analysis of materials used underground cables

Text Book | Text Book 1: 3.11,3.13,3.16 Text Book 2: 1.12, 1.14

**MODULE-5** | **Protection of power system** | **21EEE53.6** | **8 Hours**

Fuse law- cut-off characteristics- Time current characteristics- fuse material- HRC fuse - Liquid fuse- Application of fuse, Types of Circuit Breakers: Air blast CB - Oil CB - SF6 CB - Vacuum CB, Basic requirement of protective relaying, Zones of protection, Over Current relay- IDMT relays, PSM, TSM, problems, negative sequence relays.

Protection of alternator, Protection of transformers, Protection of transmission lines, Protection against over voltages: Causes of over voltages - Surge diverters - Insulation co-ordination

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)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	3
L2	Understand	5	2	4
L3	Apply	5	3	3
L4	Analyze	5	5	-
L5	Evaluate	5	5	-
L6	Create	-	-	-

#### 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) Soni Gupta & Bhatanagar, "A Course of Electrical Power", Dhanpat Rai & Sons (New Delhi), 2014
- 2) Electrical Power Systems, C.L. Wadhwa, 4th edition, 2009, Wiley Eastern Ltd, ISBN 0-470-21808-8

##### Reference Books:

- 1) Elements of power System Analysis, W.D. Stevenson,, 4th Edition, 1982, TMH, ISBN: 9780070665842
- 2) Electric Power Generation Transmission and Distribution, S.M. Singh, 3rd Edition, 2010, Prentice Hall of India Publishers, ISBN: -978-81-203-3560-8.
- 3) Electrical Power Transmission and Distribution, J.B. Gupta,, 2010, S.K. Kataria & Sons Publisher, 2010, 4th Edition, ISBN 978-0470-40863-6
- 4) Electrical Power, S.L. Uppal, Khanna Publication
- 5) Electrical Power Systems, Ashfaq Hussain, CBS Publication
- 6) Electric Power Distribution, A.S. Pabla, McGraw-Hill, 6th Edition, 2012
- 7) Principles of Power System, V.K. Mehta, Rohit Mehta, S. Chand, 1st Edition 2013

**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



## 21EEE54X-Professional Elective Course-I

<b>OBJECT ORIENTED PROGRAMMING USING JAVA</b>															
<b>Course Code</b>	21EEE541					<b>CIE Marks</b>					50				
<b>L:T:P:S</b>	3:0:0:0					<b>SEE Marks</b>					50				
<b>Hrs / Week</b>	3					<b>Total Marks</b>					100				
<b>Credits</b>	03					<b>Exam Hours</b>					03				
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
<b>21EEE541.1</b>	Apply the concepts of OOP to write special functions and I/O programs														
<b>21EEE541.2</b>	Use governing principles of Java for writing advanced programs and troubleshooting mechanisms														
<b>21EEE541.3</b>	Analyze the Java control structures, I/O operations and file operations														
<b>21EEE541.4</b>	Analyze the Inheritance, Interface and Package to optimize Java program														
<b>21EEE541.5</b>	Evaluate the exception handling mechanisms and its implementations														
<b>21EEE541.6</b>	Develop Java frameworks using Java Swing and network connectivity using JDBC														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	
<b>21EEE541.1</b>	3	2	2	-	-	-	-	-	-	-	-	-	-	1	
<b>21EEE541.2</b>	3	2	2	-	-	-	-	-	-	-	-	-	-	1	
<b>21EEE541.3</b>	2	3	2	-	-	-	-	-	-	-	-	-	-	1	
<b>21EEE541.4</b>	2	3	2	-	-	-	-	-	-	-	-	-	-	1	
<b>21EEE541.5</b>	1	1	1	2	-	-	-	-	-	-	-	-	-	1	
<b>21EEE541.6</b>	2	2	3	-	-	-	-	-	-	-	-	-	-	1	
<b>MODULE-1 Introduction to Java, Objects and Classes:</b>															
										<b>21EEE541.1, 21EEE541.3</b>			<b>8 Hours</b>		
Basics and Overview of Java programming, - "Hello, World" Program, Compiling and Running a Java Program, Data types, Variables, Operators, Control structures including Selection, Looping, Working with Objects, Implementing Classes, Object Construction, Static Variables and Methods, Overloading, Math class, Arrays in java.															
Case study		Java program to demonstrate addition of two matrix													
Text Book		Text Book 1: 3,4,5													
<b>MODULE-2 I/O Basics &amp;Files:</b>															
										<b>21EEE541.1, 21EEE541.3</b>			<b>8 Hours</b>		
Reading input, Writing output - Scanner class, Buffered Reader class, Reading and Writing files. Constructors: Visibility modifiers, Methods and Objects, Inbuilt classes like String, Character, String Buffer, 'this' reference, nested classes.															
Case study		Program to demonstrate constructor overloading concept													
Text Book		Text Book 1: 2.2, 2.3, 2.4 to 2.15													
<b>MODULE-3 Inheritance, Interface and Package:</b>															
										<b>21EEE541.2, 21EEE541.4</b>			<b>8 Hours</b>		
Inheritance and types, Base and Derived classes, Overriding, Polymorphism, Dynamic Binding, Casting objects, Instance of operator, super(), final-keyword and method, finalize, Abstract class, Interface, Package, Object class.															
Text Book		Text Book 2:2.5, 3.1, 3.3, 4.1													
<b>MODULE-4 Exception Handling and Multithreading:</b>															
										<b>21EEE541.2, 21EEE541.5</b>			<b>8 Hours</b>		
Exception Types, Uncaught Exceptions, Using try and catch block, Multiple catch clauses, Nested try statements, throw, throws, finally, Java's Built-in Exceptions and User defined Exceptions. Threads: Java Thread Model, Main Thread, Thread Life Cycle- Creating a Thread, Running, Suspending, Resuming and Stopping Threads, Creating Multiple Threads, Thread Priorities, Synchronization, Inter-thread Communication.															
Text Book		Text Book 2: 5.1, 5.2, 5.3													
<b>MODULE-5 Java Swing and JDBC:</b>															
										<b>21EEE541.2, 21EEE541.6</b>			<b>8 Hours</b>		

**Java Swing :** JFrame, JButton, JLabel, JTextField, JTextArea, JPasswordField, JRadioButton, JComboBox, JTable, Jlist, JOptionPane, JScrollBar, JMenuBar, JCheckBox, JRadioButon, JOptionPane, JMenu, JProgressBar, JSlider, JSpinner  
**JDBC:** MySQL basics, Java Database Connectivity, Characteristics, Types of JDBC Drivers, JDBC Architectures, Connecting to Database, Examples

Text Book      Text Book 3: 10,11

**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	25
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

**Suggested Learning Resources:**

**Text Books:**

- 1)Herbert Schildt, Java™:The Complete Reference, McGraw-Hill, 12th edition, November 2021, ISBN: 978-1-260-46341-5
- 2)Cay S. Horstmann, Core Java® SE 9 for the Impatient, Addison Wesley, Second Edition, 2018, ISBN: 978-013-4694726
- 3)Debasis Samantha, Object oriented Programming with Java, [cse.iitkgp.ac.in/~dsamanta/java/index.htm](http://cse.iitkgp.ac.in/~dsamanta/java/index.htm)

**Reference Books:**

- 1)SAMS teach yourself Java–2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education. ISBN: 978-0672324550
- 2)Ken Kousen, Modern Java Recipes, O'Reilly Media, Inc., 2017, ISBN: 9781491973172

**Web links and Video Lectures (e-Resources):**

- [https://onlinecourses.nptel.ac.in/noc19\\_cs84/preview](https://onlinecourses.nptel.ac.in/noc19_cs84/preview)
- [https://youtube.com/playlist?list=PLD\\_UHTlXPZlOel4rygnbL1wke53kFZuJch](https://youtube.com/playlist?list=PLD_UHTlXPZlOel4rygnbL1wke53kFZuJch)  
<https://www.youtube.com/watch?v=eIrMbaQSU34>  
<https://java-programming.mooc.fi/part-1>

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

- Experiential learning approach through lab sessions
- Video demonstration of coding using JAVA
- Problem solving approach

## SIGNALS AND SYSTEMS

<b>Course Code</b>	<b>21EEE542</b>		<b>CIE Marks</b>	<b>50</b>										
<b>L:T:P:S</b>	<b>3:0:0:0</b>		<b>SEE Marks</b>	<b>50</b>										
<b>Hours / Week</b>	<b>3</b>		<b>Total Marks</b>	<b>100</b>										
<b>Credits</b>	<b>03</b>		<b>Exam Hours</b>	<b>03</b>										
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE542.1</b>	Classify the continuous and discrete time signals and systems													
<b>21EEE542.2</b>	Examine the properties of LTI systems and evaluate the response													
<b>21EEE542.3</b>	Apply Fourier series concepts for continuous time signals													
<b>21EEE542.4</b>	Analyze continuous and discrete systems using Fourier Transform.													
<b>21EEE542.5</b>	Evaluate the time response using Z Transform.													
<b>21EEE542.6</b>	Develop Discrete Time systems for real time applications													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE542.1</b>	3	3	2	3	3	-	-	-	-	-	-	-	1	-
<b>21EEE542.2</b>	3	3	2	3	3	-	-	-	-	-	-	-	1	-
<b>21EEE542.3</b>	3	3	2	3	3	-	-	-	-	-	-	-	1	-
<b>21EEE542.4</b>	3	3	2	3	3	-	-	-	-	-	-	-	1	-
<b>21EEE542.5</b>	3	3	2	3	3	-	-	-	-	-	-	-	1	-
<b>21EEE542.6</b>	3	3	2	3	3	-	-	-	-	-	-	-	1	-
<b>MODULE-1</b>	<b>SIGNALS AND SYSTEMS</b>			<b>21EEE542.1</b>	<b>8 Hours</b>									
Signals- Continuous / Discrete - Periodic / Aperiodic - Even /Odd - Energy and Power signals. Systems- Continuous /Discrete - Linear / Non-Linear – Time Variant / Invariant, Causal / Non-Causal – Stable / Unstable - Static / Dynamic systems. Types of test signals.														
Text Book	1.1, 2.1													
<b>MODULE-2</b>	<b>TIME-DOMAIN REPRESENTATIONS FOR LTI SYSTEMS</b>			<b>21EEE542.1,</b> <b>21EEE542.2</b>	<b>8 Hours</b>									
Convolution – Properties – Convolution Sum and Convolution Integral for infinite duration sequences - Solutions of differential and difference equations – Block diagram representation – Direct form I and Direct form II.														
Application	Numerical on block diagram representation of LTI systems													
Text Book	1.2, 1.3, 2.2													
<b>MODULE-3</b>	<b>FOURIER SERIES</b>			<b>21EEE542.3</b>	<b>8 Hours</b>									
Representation - Properties - Dirichlet conditions – Trigonometric and Exponential Fourier series -Complex Fourier spectrum														
Text Book	1.3, 2.3													
<b>MODULE-4</b>	<b>FOURIER TRANSFORM</b>			<b>21EEE542.4</b>	<b>8 Hours</b>									
Deduction from Fourier series - Fourier transform of arbitrary and standard signals -Properties -Fourier transforms involving impulse function and Signum function.														
Application	Numerical on stability of the system													
Text Book	1.3, 1.4, 2.3													
<b>MODULE-5</b>	<b>Z TRANSFORM AND REALISATION OF SYSTEMS</b>			<b>21EEE542.5,</b> <b>21EEE542.6</b>	<b>8 Hours</b>									
The Z Transform – Properties of Region of Convergence - Properties of Z Transform – Inverse Z transform. Stability – Causality.														
Text Book	1.7, 2.5													

**CIE Assessment Pattern (50 Marks - Theory)**

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

**SEE Assessment Pattern (50 Marks - Theory)**

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

**Suggested Learning Resources:****Text Books:**

- 1) Signals and Systems, Simon Haykin and Barry Van Veen, 2nd edition, 2007, John Wiley & sons.
- 2) Signals and Systems, Udaykumar S, 6th edition, 2012, Prismbook House.

**Reference Books:**

- 1) Signals and Systems, Allen V Oppenheim, Allen S. Willsiky, S. Hamid Nawab, 2015, PHI.
- 2) Principles of Linear Systems and Signals, B.P.Lathi, 2nd edition, 2009, Oxford University Press.

**Web links and Video Lectures (e-Resources):**

- <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/>
- <https://www.youtube.com/playlist?list=PLC6210462711083C4>

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

- Organizing Group wise discussions
- Seminars
- E - Resources for the virtual learning environment
- Occasional Flipped classroom exercise

<b>ADVANCED CONTROL SYSTEMS</b>														
<b>Course Code</b>	<b>21EEE543</b>							<b>CIE Marks</b>	<b>50</b>					
<b>L:T:P:S</b>	<b>3:0:0:0</b>							<b>SEE Marks</b>	<b>50</b>					
<b>Hours / Week</b>	<b>3</b>							<b>Total Marks</b>	<b>100</b>					
<b>Credits</b>	<b>03</b>							<b>Exam Hours</b>	<b>03</b>					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE543.1</b>	Apply appropriate techniques to obtain the state space model of a system													
<b>21EEE543.2</b>	Analyze time response of states and outputs of LTIV systems													
<b>21EEE543.3</b>	Evaluate the controllability and observability from the state models													
<b>21EEE543.4</b>	Design a state feedback controller that meets the desired specifications													
<b>21EEE543.5</b>	Design full order and reduced order state observers for state measurement													
<b>21EEE543.6</b>	Analyze and evaluate the behavior and stability of nonlinear systems													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE543.1</b>	3	3	2	2	-	-	-	-	-	-	-	-	1	-
<b>21EEE543.2</b>	3	3	2	2	-	-	-	-	-	-	-	-	1	-
<b>21EEE543.3</b>	3	3	3	3	-	-	-	-	-	-	-	-	1	-
<b>21EEE543.4</b>	3	3	3	3	-	-	-	-	-	-	-	-	1	-
<b>21EEE543.5</b>	3	3	3	3	-	-	-	-	-	-	-	-	1	-
<b>21EEE543.6</b>	3	3	2	2	-	-	-	-	-	-	-	-	1	-
<b>MODULE-1 STATE SPACE REPRESENTATION</b>														
<b>21EEE543.1</b>	<b>8 Hours</b>													
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.														
Case Study	Develop the state space model of a physical systems													
Text Book	Text Book 1: 5.1 to 5.7													
<b>MODULE-2 TIME RESPONSE</b>														
<b>21EEE543.2</b>	<b>8 Hours</b>													
Existence and uniqueness of solutions to Continuous-time state equations – Solution of Linear Time Invariant State equations – Evaluation of matrix exponential														
Text Book	Text Book 2: 9.1 to 9.4													
<b>MODULE-3 CONTROLLABILITY AND OBSERVABILITY</b>														
<b>21EEE543.3</b>	<b>8 Hours</b>													
Controllability - Observability – Canonical forms – Stabilizability and Detectability – Output Controllability – Reducibility														
Self-study	Examine the controllability and observability of a given system													
Text Book	Text Book 1: 6.1 to 6.8													
<b>MODULE-4 STATE FEEDBACK</b>														
<b>21EEE543.4, 21EEE543.5</b>	<b>8 Hours</b>													
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														
Text Book	Text Book 1: 7.1,7.2,7.3,7.4,7.5													
<b>MODULE-5 ANALYSIS OF NON-LINEARITIES</b>														
<b>21EEE543.6</b>	<b>8 Hours</b>													
Types of non-linearity – Typical examples – Equivalent linearization – Describing function analysis of non-linear systems – limit cycles – Stability of oscillations														
Text Book	Text Book 1: 10.1 to 10.5													

<b>CIE Assessment Pattern (50 Marks - Theory)</b>			
<b>RBT Levels</b>		<b>Marks Distribution NPTEL</b>	
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>
		25	25
<b>L1</b>	<b>Remember</b>	-	-
<b>L2</b>	<b>Understand</b>	5	10
<b>L3</b>	<b>Apply</b>	10	10
<b>L4</b>	<b>Analyze</b>	10	5
<b>L5</b>	<b>Evaluate</b>	-	-
<b>L6</b>	<b>Create</b>	-	-

<b>SEE Assessment Pattern (50 Marks - Theory)</b>		
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>
<b>L1</b>	<b>Remember</b>	-
<b>L2</b>	<b>Understand</b>	10
<b>L3</b>	<b>Apply</b>	20
<b>L4</b>	<b>Analyze</b>	20
<b>L5</b>	<b>Evaluate</b>	-
<b>L6</b>	<b>Create</b>	-

**Suggested Learning Resources:**

**Text Books:**

- 1) Digital control and state variable methods: Conventional and Intelligent Control Systems, M Gopal, McGraw Hill Education, Fourth Edition 2012
- 2) Modern Control Engineering, K. Ogata, Fifth edition, PHI, 2012.

**Reference Books:**

- 1) Control Systems, Principles and Design, M. Gopal, Fourth Edition, Tata McGraw Hill, 2015
- 2) Control System Engineering, Norman S. Nise, Sixth Edition, Wiley India, 2011
- 3) Pan, L., Pang, S., Song, T. and Gong, F. eds., 2021. Bio-Inspired Computing: Theories and Applications: 15th International Conference, BIC-TA 2020, Qingdao, China, October 23-25, 2020, Revised Selected Papers (Vol. 1363). Springer Nature.
- 4) Wann, D., 1994. Bio Logic: Designing with nature to protect the environment.

**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.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**

- Digital simulation of mathematical modelling of physical systems
- Video demonstration of modeling a non-linear system
- For active participation of students, instruct the students to prepare Presentation and Handouts

## PROFESSIONAL ETHICS

<b>Course Code</b>	<b>21EEE544</b>										<b>CIE Marks</b>		<b>50</b>	
<b>L:T:P:S</b>	<b>3:0:0:0</b>										<b>SEE Marks</b>		<b>50</b>	
<b>Hours / Week</b>	<b>3</b>										<b>Total Marks</b>		<b>100</b>	
<b>Credits</b>	<b>03</b>										<b>Exam Hours</b>		<b>03</b>	
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE544.1</b>	Understand the foundational concepts of ethics and its relevance to engineering													
<b>21EEE544.2</b>	Create awareness on Engineering Ethics and to discuss the ethical issues related to engineering through various ethical theories													
<b>21EEE544.3</b>	Apply ethics and codes of ethics in engineering profession													
<b>21EEE544.4</b>	Create awareness on Safety, Responsibility and Rights													
<b>21EEE544.5</b>	Build proper practices for global corporate world													
<b>21EEE544.6</b>	Demonstrate the necessity of ethics in corporate, industry and society													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
<b>21EEE544.1</b>	-	-	-	-	-	3	-	3	1	1	-	2	-	-
<b>21EEE544.2</b>	-	-	-	-	-	3	-	3	1	1	-	2	-	-
<b>21EEE544.3</b>	-	-	-	-	-	3	-	3	1	1	-	2	-	-
<b>21EEE544.4</b>	-	-	-	-	-	3	-	3	1	1	-	2	-	-
<b>21EEE544.5</b>	-	-	-	-	-	3	-	3	1	1	-	2	-	-
<b>21EEE544.6</b>	-	-	-	-	-	3	-	3	1	1	-	2	-	-
<b>MODULE-1 HUMAN VALUES 21EEE544.1 8 Hours</b>														
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Stress and Emotional management.														
Self-study	Screening of NPTEL video lecture on stress and its management													
Text Book	Text Book 2: 1.1 to 1.23													
<b>MODULE-2 ENGINEERING ETHICS 21EEE544.2 8 Hours</b>														
Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.														
Self-study	Role of religion in establishing ethical values													
Text Book	Text Book 2: 2.1 to 2.29													
<b>MODULE-3 ENGINEERING AS SOCIAL EXPERIMENTATION 21EEE544.3 8 Hours</b>														
Work Place Rights & Responsibilities, Ethics in changing domains of Research, Engineers and Managers; Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics– A Balanced Outlook on Law.														
Case Study	Challenger space craft disaster													
Text Book	Text Book 2: 3.1 to 3.9													
<b>MODULE-4 SAFETY, RESPONSIBILITIES AND RIGHTS 21EEE544.4 8 Hours</b>														
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk- Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.														
Case Study	Bhopal gas tragedy													
Text Book	Text Book 2: 4.1 to 5.11													
<b>MODULE-5 GLOBAL ISSUES 21EEE544.5, 21EEE544.6 8 Hours</b>														
Multinational Corporations – Environmental Ethics – Global warming - Computer Ethics Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility.														
Self-study / Case Study	Survey on Corporate social responsibility of a Multinational organization in India.													

Text Book	Text Book 2: 6.1 to 6.8																																
<b>CIE Assessment Pattern (50 Marks - Theory)</b>																																	
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L5	Evaluate	--																															
L6	Create	--																															
<p><b>Suggested Learning Resources:</b></p> <p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.</li> <li>2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.</li> <li>2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009</li> <li>3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003</li> <li>4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001</li> <li>5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" McGraw Hill education, India Pvt. Ltd., New Delhi 2013.</li> <li>6. World Community Service Centre, „ Value Education“, Vethathiri publications, Erode, 2011</li> <li>7. Ethics for the Real World: Creating a Personal Code to Guide Decisions in Work and Life" by Ronald A. Howard and Clinton D. Korver</li> <li>8. Ethical Leadership and Decision Making in Education: Applying Theoretical Perspectives to Complex Dilemmas" by Joan Poliner Shapiro and Jacqueline A. Stefkovich</li> </ol>																																	
<p><b>Web links and Video Lectures (e-Resources):</b></p> <ul style="list-style-type: none"> <li>• <a href="https://youtu.be/PxVFvDh4tPg">https://youtu.be/PxVFvDh4tPg</a></li> <li>• <a href="https://youtu.be/A_b3Vv-YWgl">https://youtu.be/A_b3Vv-YWgl</a></li> <li>• <a href="https://youtu.be/pE5E3YkEyYY">https://youtu.be/pE5E3YkEyYY</a></li> <li>• <a href="https://youtu.be/QRfyOTpApNc">https://youtu.be/QRfyOTpApNc</a></li> <li>• <a href="https://youtu.be/EVWcuFXeSgk">https://youtu.be/EVWcuFXeSgk</a></li> </ul>																																	
<p><b>Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Pedagogy for Course Delivery:</b></p> <ul style="list-style-type: none"> <li>• Contents related activities (Activity-based discussions)</li> <li>• For active participation of students, instruct the students to prepare Flowcharts and Handouts</li> <li>• Organizing Group wise discussions on issues</li> <li>• Seminars</li> </ul>																																	



<b>ELECTROMAGNETIC FIELD THEORY</b>															
<b>Course Code</b>	<b>21EEE545</b>										<b>CIE Marks</b>	<b>50</b>			
<b>L:T:P:S</b>	<b>3:0:0:0</b>										<b>SEE Marks</b>	<b>50</b>			
<b>Hours / Week</b>	<b>3</b>										<b>Total Marks</b>	<b>100</b>			
<b>Credits</b>	<b>03</b>										<b>Exam Hours</b>	<b>03</b>			
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
<b>21EEE545.1</b>	Understand the basic concepts of electrostatics and magneto statics														
<b>21EEE545.2</b>	Interpret the potential field of a point charge, Potential gradient, Energy density in the electrostatic field and conductor's properties and boundary conditions.														
<b>21EEE545.3</b>	Describe the Poisson's and Laplace Equations, Biot - Savart's law, Ampere's circuital law and Stokes theorem.														
<b>21EEE545.4</b>	Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density														
<b>21EEE545.5</b>	Illustrate the Faraday's law, Displacement current, Maxwell's equations														
<b>21EEE545.6</b>	Understand the basic concepts of electromagnetic waves and characterizing parameters														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>	
<b>21EEE545.1</b>	3	3	3	3	-	-	-	-	-	-	-	-	-	-	
<b>21EEE545.2</b>	3	3	3	3	-	-	-	-	-	-	-	-	-	-	
<b>21EEE545.3</b>	3	3	3	3	-	-	-	-	-	-	-	-	-	-	
<b>21EEE545.4</b>	3	3	3	3	-	-	-	-	-	-	-	-	-	-	
<b>21EEE545.5</b>	3	3	3	3	-	-	-	-	-	-	-	-	-	-	
<b>21EEE545.6</b>	3	3	3	3	-	-	-	-	-	-	-	-	-	-	
<b>MODULE-1</b>															
<b>Vector Analysis and Electrostatics</b>											<b>21EEE545.1</b>	<b>8 Hours</b>			
Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector Components and unit vectors. Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems. Numerical. Coulomb's law, Electric field intensity and its evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions. Electric flux density, Gauss law and its applications. Maxwell's first equation (Electrostatics). Divergence theorem. Numerical.															
Application	Numerical on vector analysis														
Text Book	Text Book 1: Chapter 1, 2, 3 Text book 2: Chapter 4,5,6(part -2)														
<b>MODULE-2</b>															
<b>Energy and Potential and Conductor and Dielectrics</b>											<b>21EEE545.2</b>	<b>8 Hours</b>			
Energy expended in moving a point charge in an electric field. The line integral. Definition of potential difference and potential. The potential field of a point charge and of a system of charges. Potential gradient. The dipole. Energy density in the electrostatic field. Numerical. Current and current density. Continuity of current. Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates. Numerical.															
Text Book	Text Book 1: Chapter 4, 5														
<b>MODULE-3</b>															
<b>Poisson's and Laplace Equations and Steady magnetic fields</b>											<b>21EEE545.3</b>	<b>8 Hours</b>			
Derivations and problems, Uniqueness theorem. Biot - Savart's law, Ampere's circuital law. The Curl. Stokes theorem. Magnetic flux and flux density. Scalar and vector magnetic potentials. Numerical.															
Application	Numerical on various magnetic theorem and laws														
Text Book	Text Book 1: Chapter 7, 8														

<b>MODULE-4</b>	<b>Magnetic forces and Magnetic Materials and Magnetism</b>	<b>21EEE545.4</b>	<b>8 Hours</b>
Force on a moving charge and differential current element. Force between differential current elements. Force and torque on a closed circuit. Numerical. Nature of magnetic materials, magnetization and permeability. Magnetic boundary conditions. Magnetic circuit, inductance and mutual inductance. Numerical.			
Text Book	Text Book 1: Chapter 9		
<b>MODULE-5</b>	<b>Time Varying Fields and Maxwell's Equations and Uniform plane wave</b>	<b>21EEE545.5, 21EEE545.6</b>	<b>8 Hours</b>
Faraday's law, Displacement current. Maxwell's equations in point form and integral form. Numerical. Electromagnetic radiation: near field—non-radiative and radiative, far field. Wave propagation in free space and in dielectrics. Pointing vector and power considerations. Propagation in good conductors, skin effect. Numerical.			
Text Book	Text Book 1: Chapter 10, 11 Text book 2: Chapter 9,10(part -4)		
<b>CIE Assessment Pattern (50 Marks - Theory)</b>			
<b>RBT Levels</b>		<b>Marks Distribution NPTEL</b>	
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>
		<b>25</b>	<b>25</b>
<b>L1</b>	<b>Remember</b>	5	-
<b>L2</b>	<b>Understand</b>	5	-
<b>L3</b>	<b>Apply</b>	5	10
<b>L4</b>	<b>Analyze</b>	5	10
<b>L5</b>	<b>Evaluate</b>	5	5
<b>L6</b>	<b>Create</b>	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>			
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>	
<b>L1</b>	<b>Remember</b>	10	
<b>L2</b>	<b>Understand</b>	10	
<b>L3</b>	<b>Apply</b>	10	
<b>L4</b>	<b>Analyze</b>	10	
<b>L5</b>	<b>Evaluate</b>	10	
<b>L6</b>	<b>Create</b>	--	
<b>Suggested Learning Resources:</b>			
<b>Text Books:</b>			
1. Engineering Electromagnetics William H Hayt et al McGraw Hill 8th Edition, 2014			
2. Principles of Electromagnetics Matthew N. O. Sadiku Oxford 6th Edition, 2015			
<b>Reference books:</b>			
1. Fundamentals of Engineering Electromagnetics David K. Cheng Pearson 2014			
2. Electromagnetism -Theory (Volume -1) -Applications (Volume-2) Ashutosh Pramanik PHI Learning 2014			
3. Electromagnetic Field Theory Fundamentals Bhag Guru et al Cambridge 2005			
4. Electromagnetic Field Theory Rohit Khurana Vikas Publishing 1st Edition, 2014			
<b>Web links and Video Lectures (e-Resources):</b>			
• <a href="https://archive.nptel.ac.in/courses/108/104/108104087/">https://archive.nptel.ac.in/courses/108/104/108104087/</a>			
• <a href="https://archive.nptel.ac.in/courses/108/106/108106073/">https://archive.nptel.ac.in/courses/108/106/108106073/</a>			
• <a href="https://nptel.ac.in/courses/115101005">https://nptel.ac.in/courses/115101005</a>			
• <a href="https://www.youtube.com/watch?v=Elv3WpL32UE">https://www.youtube.com/watch?v=Elv3WpL32UE</a>			
<b>Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning</b>			
• Video demonstration			
• Contents related activities (Activity-based discussions)			
• For active participation of students, instruct the students to prepare Flowcharts and Handouts			
• Organizing Group wise discussions on issues /Critical Thinking			
• Seminars			

## 21EEL55X-Ability Enhancement Course-V

SIMULATION TOOLS FOR ELECTRICAL ENGINEERING														
<b>Course Code</b>	21EEL551				<b>CIE Marks</b>				50					
<b>L:T:P:S</b>	0:0:1:0				<b>SEE Marks</b>				50					
<b>Hrs / Week</b>	2				<b>Total Marks</b>				100					
<b>Credits</b>	01				<b>Exam Hours</b>				03					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEL551.1</b>	Apply the knowledge to simulate DC and AC circuits													
<b>21EEL551.2</b>	Analyze and simulate the control signals for the requirement													
<b>21EEL551.3</b>	Design the operational amplifier for the integrated circuits													
<b>21EEL551.4</b>	Acquire knowledge on the power electronic converters													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>	<b>P06</b>	<b>P07</b>	<b>P08</b>	<b>P09</b>	<b>P010</b>	<b>P011</b>	<b>P012</b>	<b>PS01</b>	<b>PS02</b>
<b>21EEL551.1</b>	3	3	2	2	2	-	-	-	1	-	-	-	3	3
<b>21EEL551.2</b>	3	3	2	2	3	-	-	-	1	-	-	-	3	3
<b>21EEL551.3</b>	3	3	3	3	3	-	-	-	1	-	-	-	3	3
<b>21EEL551.4</b>	3	3	3	3	3	-	-	-	1	-	-	-	3	3
<b>Exp. No. / Pgm. No.</b>														
<b>List of Experiments / Programs</b>														
<b>Hours</b>														
<b>COs</b>														
<b>Prerequisite Experiments / Programs / Demo</b>														
	<ul style="list-style-type: none"> <li>Basic idea about Electrical Circuit and transient response</li> <li>Basic idea about electronic circuits and its operation</li> <li>Familiarization of Power Electronics Components, 3 phase system</li> </ul>											2	NA	
<b>PART-A</b>														
1	Simulation of DC circuits											2	21EEL551.1	
2	Simulation of transient response of RLC Circuit to step, pulse and sinusoidal signals											2	21EEL551.1	
3	Design and simulation of Lag, Lead and Lag-Lead Compensators											2	21EEL551.2	
4	Analysis of 3 phases circuit representing the generator transmission line and load.											2	21EEL551.1	
5	Simulation of integrator and differentiator circuits using Op-AMP											2	21EEL551.3	
6	Simulation of Comparator circuit using OP-AMP											2	21EEL551.3	
<b>PART-B</b>														
7	Simulation of Schmitt trigger circuit using OP-AMP											2	21EEL551.3	
8	Simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RL load											2	21EEL551.4	
9	Simulation of single-phase inverter using PWM control											2	21EEL551.4	
10	Simulation of power electronic converters											2	21EEL551.4	
11	Simulation of DC separately excited motor using transfer function.											2	21EEL551.4	
12	Simulation of Chopper fed DC motor drives											2	21EEL551.4	
<b>PART-C</b>														
<b>Beyond Syllabus Virtual Lab Content</b> <b>(To be done during Lab but not to be included for CIE or SEE)</b> Implementation of DOL starter <a href="https://plc-coep.vlabs.ac.in/exp/dol-starter/">https://plc-coep.vlabs.ac.in/exp/dol-starter/</a>														

**CIE Assessment Pattern (50 Marks - Lab)**

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

**SEE Assessment Pattern (50 Marks - Lab)**

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

**Suggested Learning Resources:****Reference Books:**

1. Integrated Electronics, Jacob Millman & Christos C. Halkias, Tata-McGrawHill, 2<sup>nd</sup> Edition, 2010. ISBN: 9780070151420
2. Fundamentals of Analog Circuits, Thomas L. Floyd, Pearson, 2<sup>nd</sup> edition, 2012, ISBN: 0130606197
3. Electronic Devices and Circuits, S. Salivahanan, N. Suresh, McGrawHill, 3<sup>rd</sup> edition, 2013 ISBN: 978-0070660847
4. Op Amps, Design, Applications and Trouble Shooting, Elsevier, 2<sup>nd</sup> Edition, 2015. ISBN: 9780750697026.
5. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
6. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998
7. Mohammed H. Rashid "Power Electronics" Pearson Education Third Edition - First Indian reprint 2004.

<b>POWER SYSTEM PROTECTION</b>														
<b>Course Code</b>	22EEL552					<b>CIE Marks</b>					50			
<b>L:T:P:S</b>	0:0:1:0					<b>SEE Marks</b>					50			
<b>Hrs / Week</b>	2					<b>Total Marks</b>					100			
<b>Credits</b>	01					<b>Exam Hours</b>					03			
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>22EEL552.1</b>	Apply the concept of electromechanical relays for understanding the characteristics of relays													
<b>22EEL552.2</b>	Develop microcontroller based protective relays													
<b>22EEL552.3</b>	Analyze the performance of directional relay and differential relay.													
<b>22EEL552.4</b>	Analyze the protection of Synchronous generator, motor and transmission lines													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
<b>22EEL552.1</b>	3	3	3	3	2	-	-	-	-	-	-	-	3	2
<b>22EEL552.2</b>	3	3	3	3	2	-	-	-	-	-	-	-	3	2
<b>22EEL552.3</b>	3	3	3	3	2	-	-	-	-	-	-	-	3	2
<b>22EEL552.4</b>	3	3	3	3	2	-	-	-	-	-	-	-	3	2
<b>Exp. No. / Pgm. No.</b>	<b>List of Experiments / Programs</b>											<b>Hours</b>	<b>COs</b>	
<b>Prerequisite Experiments / Programs / Demo</b>														
	<ul style="list-style-type: none"> <li>Basic knowledge in programming</li> <li>Familiarization of Electrical Components.</li> </ul>											2	NA	
<b>PART-A</b>														
1	Performance of IDMT characteristics for microprocessor based over current relay											2	22EEL552.2	
2	Performance of IDMT characteristics for microprocessor based under voltage relay											2	22EEL552.2	
3	Protection of relay using negative sequence relay.											2	22EEL552.3	
4	Protection Relays For High And Low Voltage Networks: Differential Relay.											2	22EEL552.3	
5	Protection of Synchronous Generator using Protective Relays.											2	22EEL552.4	
<b>PART-B</b>														
6	Protection of Transmission lines using Electromechanical Relays.											2	22EEL552.4	
7	Protection of Transmission lines using Digital Relays											2	22EEL552.1	
8	Protection using microcontroller based earth fault relay											2	22EEL552.3	
9	Study of fuse and MCB characteristics											2	22EEL552.1	
10	Motor protection using relays											2	22EEL552.4	
<b>PART-C</b>														
<b>Beyond Syllabus Virtual Lab Content</b> <b>(To be done during Lab but not to be included for CIE or SEE)</b> 1. <a href="https://www.youtube.com/watch?v=d4yIEMMja1s">https://www.youtube.com/watch?v=d4yIEMMja1s</a> 2. <a href="https://www.youtube.com/watch?v=-TQYyVSZYis">https://www.youtube.com/watch?v=-TQYyVSZYis</a>														

**CIE Assessment Pattern (50 Marks - Lab)**

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

**Suggested Learning Resources:****Reference Books:**

1. Power system protection and switch gear, B. Ravindranath. M.Chander, New Age International limited, Second edition, 2018.
2. Power system protection and switch gear, Badriram, D N Vishwakarma, Tata McGraw Hill Education Private Limited,2011.
3. Switch gear protection and power systems, Sunil S.Rao,Khanna publishers, 13th edition,2008

## ADVANCED ARDUINO PROGRAMMING

<b>Course Code</b>	21EEL553		<b>CIE Marks</b>	50										
<b>L:T:P:S</b>	0:0:1:0		<b>SEE Marks</b>	50										
<b>Hrs / Week</b>	2		<b>Total Marks</b>	100										
<b>Credits</b>	01		<b>Exam Hours</b>	03										
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEL553.1</b>	Apply the knowledge on Arduino programming to perform different tasks.													
<b>21EEL553.2</b>	Analyze the importance of microcontroller in the functioning of embedded systems													
<b>21EEL553.3</b>	Interface the Arduino with cloud, interact with online services, and control devices remotely													
<b>21EEL553.4</b>	Develop different types of actuators, servo motors, DC motors, and stepper motors with control system applications													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEL553.1</b>	3	3	3	3	2	-	-	-	-	-	-	2	1	1
<b>21EEL553.2</b>	3	3	3	3	2	-	-	-	-	-	-	2	1	1
<b>21EEL553.3</b>	3	3	3	3	2	-	-	-	-	-	-	2	1	1
<b>21EEL553.4</b>	3	3	3	3	2	-	-	-	-	-	-	2	1	1
<b>Exp. No. / Pgm. No.</b>	<b>List of Experiments / Programs</b>			<b>Hours</b>	<b>COs</b>									
<b>Prerequisite Experiments / Programs / Demo</b>														
	<ul style="list-style-type: none"> <li>Knowing basic programming concepts such as variables, data types, loops, and conditionals helps with learning Arduino programming.</li> <li>Basic math skills, including arithmetic and algebra, aid in tasks like calculating resistor values and working with sensor data.</li> <li>Developing logical thinking and problem-solving skills will aid in troubleshooting and writing efficient code.</li> </ul>			2	NA									
<b>PART-A</b>														
1	Digital input and digital output on Arduino Mega board and using LED and Buzzer.			2	21EEL553.1									
2	Analog input and analog output on Arduino Mega board using PWM. Different outputs on LED.			2	21EEL553.1									
3	Serial Communication between Arduino board and PC:- character send and received, Read and display voltage.			2	21EEL553.2									
4	DC Motor to control motor speed and direction of rotation.			2	21EEL553.2									
5	Rotate the servo motor to a specific angle using PWM signals.			2	21EEL553.2									
6	Rotate a stepper motor in precise steps and directions.			2	21EEL553.3									
<b>PART-B</b>														
7	Using Arduino board, build a circuit to blink LED.			2	21EEL553.3									
8	Temperature and Humidity Sensor: Interface with a DHT11 or DHT22 sensor to display real-time temperature and humidity readings.			2	21EEL553.3									
9	Ultrasonic Distance Sensor: Measure distance and display the results.			2	21EEL553.4									
10	Internet of Things (IoT): Send sensor data to cloud platforms like ThingSpeak or Blynk for remote monitoring.			2	21EEL553.4									
11	LCD Display: Connect and control a character LCD to display text or sensor readings.			2	21EEL553.4									
12	Potentiometer: Read values from a potentiometer and use them to control LED brightness or servo motor position.			2	21EEL553.4									

**PART-C**

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

1. <https://youtu.be/vI0nd8wCqRY?si=72h342D2iGPCQ1S9>
2. <https://youtu.be/BLrHTHUjPuw?si=mttnwUuofHocxGh2>

**CIE Assessment Pattern (50 Marks - Lab)**

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

**SEE Assessment Pattern (50 Marks - Lab)**

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

**Suggested Learning Resources:**

**Reference Books:**

1) Simon Monk, "Programming Arduino: Getting Started with Sketches", McGraw-Hill Education, Second Edition, 2016, ISBN-10: 1259641635; ISBN-13: 978-1259641633.

2) John Nussey, Arduino For Dummies, 1st Edition, Publisher: John Wiley & Sons; ISBN-10: 1118446372; ISBN-13: 978-1118446379.



## INTRODUCTION TO MATLAB

<b>Course Code</b>	21EEL554	<b>CIE Marks</b>	50
<b>L:T:P:S</b>	0:0:1:0	<b>SEE Marks</b>	50
<b>Hrs / Week</b>	2	<b>Total Marks</b>	100
<b>Credits</b>	01	<b>Exam Hours</b>	03

### Course outcomes:

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

<b>21EEL554.1</b>	Perform basic mathematical operations using the software.
<b>21EEL554.2</b>	Make use of computational tools.
<b>21EEL554.3</b>	Analyze an engineering system/Problem through graphical representation and numerical analysis
<b>21EEL554.4</b>	Develop the electrical and electronics circuits for the given applications

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>21EEL554.1</b>	2	2	2	2	3	-	-	-	-	-	-	1	3	2
<b>21EEL554.2</b>	2	3	2	2	3	-	-	-	-	-	-	1	3	2
<b>21EEL554.3</b>	2	3	2	2	3	-	-	-	-	-	-	1	3	2
<b>21EEL554.4</b>	3	3	2	2	3	-	-	-	-	-	-	1	3	2

<b>Exp. No. / Pgm. No.</b>	<b>List of Experiments / Programs</b>	<b>Hours</b>	<b>COs</b>
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### Prerequisite Experiments / Programs / Demo

	<ul style="list-style-type: none"> <li>Basic Computational knowledge</li> <li>Basic knowledge on the application circuits</li> </ul>	2	NA
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### PART-A

1	To write a MATLAB program to perform some basic operation on matrices such as addition, subtraction, multiplication.	2	21EEL554.1
2	To write a MATLAB Program to generate various signals and sequences, such as unit impulse, unit step, unit ramp, sinusoidal, square, sawtooth, triangular, sine signals.	2	21EEL554.2
3	Practicing MATLAB environment with simple exercises to familiarize Command Window, History, Workspace, Current Directory, Figure window, Edit window, Shortcuts, Help files.	2	21EEL554.2
4	To write program using Matrix Constructors and Operator, Matrix Bitwise operator, Relational Operators and Logical Operator	2	21EEL554.2
5	To write a program to create 2-D and 3-D plots in MATLAB using the plot function to visualize data	2	21EEL554.3
6	To write and execute programs using control loop statement.	2	21EEL554.2

### PART-B

7	Analyze a given electrical network by applying Network Theorems using MATLAB.	2	21EEL554.4
8	Analyze basic electronics circuits using MATLAB/SCILAB.	2	21EEL554.4
9	Design and analysis of measurement of Real Power, Reactive Power and Power Factor in Three Phase Circuits using MATLAB/SCILAB.	2	21EEL554.3
10	Determination of ABCD parameter of transmission network.	2	21EEL554.4
11	To write a MATLAB program to find the impulse response and step response of a system from its difference equation.	2	21EEL554.4
12	Speed control of DC motor using MATLAB.	2	21EEL554.4

### PART-C

#### Beyond Syllabus Virtual Lab Content

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

1. <https://asnm-iitkgp.vlabs.ac.in/>

2. <https://matlabacademy.mathworks.com/details/matlab-fundamentals/mlbe>

**CIE Assessment Pattern (50 Marks - Lab)**

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

**SEE Assessment Pattern (50 Marks - Lab)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	10
L4	Analyze	20
L5	Evaluate	15
L6	Create	-

**Suggested Learning Resources:****Reference Books:**

1. Amos Gilat -MATLAB: An Introduction with applications – Wiley India Pvt. Ltd, 4th Ed., 2012, ISBN- 8126537205
2. RudraPratap - Getting started with MATLAB – Oxford University Press, 2010, ISBN- 0198069197
3. <https://www.udemy.com/MATLAB/Online-Course>
4. <https://nptel.ac.in/courses/103/106/103106118>
5. <https://www.matlabtutorials.com/mathforum/>

## MINI PROJECT

<b>Course Code</b>	<b>21EEE56</b>		<b>CIE Marks</b>	<b>50</b>										
<b>L:T:P:S</b>	<b>0:0:1:0</b>		<b>SEE Marks</b>	<b>50</b>										
<b>Hrs / Week</b>	<b>02</b>		<b>Total Marks</b>	<b>100</b>										
<b>Credits</b>	<b>01</b>		<b>Exam Hours</b>	<b>03</b>										
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE56.1</b>	Apply the knowledge learned via several courses to practical issues.													
<b>21EEE56.2</b>	Evaluate small hardware systems by using modern tools and technologies.													
<b>21EEE56.3</b>	Able to work in teams and manage the conduct of the research study.													
<b>21EEE56.4</b>	Communicate and comprehend the work through articles.													
<b>21EEE56.5</b>	Articulate the project related activities and findings													
<b>21EEE56.6</b>	Extend or use the idea in mini project for Major project													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE56.1</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE56.2</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE56.3</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE56.4</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE56.5</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE56.6</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<p>Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. The student shall be capable to recognize a problem in the area of Electrical and Electronics Engineering and solve it using latest technologies in a mini-project. Based on the ability/abilities of the student/s and recommendations of the guide, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students. The mini-project work will be reviewed by a panel of experts throughout the semester. The CIE marks awarded for the Mini-project work shall be based on the work accomplishment, project presentation skill, and question and answer session. The Plagiarized projects will automatically result an F grade and the student will be liable for further disciplinary action. At the completion of a mini project the student will submit a project report, which will be evaluated by duly appointed examiner(s).</p>														
<b>CONTENTS</b>						<b>CO's</b>		<b>Hours</b>						
Perform a literature search to review current knowledge and developments in the chosen technical area. Review and finalization of the Approach to the Problem relating to the chosen topic/title. Preparation of work schedule with a team.						21EEE56.1, 21EEE56.3		5						
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as required for the chosen field						21EEE56.1, 21EEE56.2		5						
Development of product/process, testing, results, conclusions and future directions.						21EEE56.1, 21EEE56.2, 21EEE56.5, 21EEE56.6		5						
Present the work in a forum involving poster presentations and demonstrations of operational hardware and software.						21EEE56.4		5						
Preparation of a project report in the standard format for being evaluated by the guide and the department with plagiarism certificate.						21EEE56.3, 21EEE56.4		5						

**CIE Assessment Pattern (50 Marks - Theory) -**

RBT Levels		Marks Distribution	
		Review 1 (25 Marks)	Review 2 (25 Marks)
		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 - Theory)**

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

## RESEARCH METHODOLOGY AND IPR

<b>Course Code</b>	21EEK57	<b>CIE Marks</b>	50											
<b>L:T:P:S</b>	1:0:0:0	<b>SEE Marks</b>	50											
<b>Hrs / Week</b>	02	<b>Total Marks</b>	100											
<b>Credits</b>	01	<b>Exam Hours</b>	02											
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEK57.1</b>	Characterize the significance and suitability of research in engineering applications													
<b>21EEK57.2</b>	Demonstrate the various processing techniques of research													
<b>21EEK57.3</b>	Evaluate the research in the development of engineering materials, process and tools													
<b>21EEK57.4</b>	Analyze criteria to fit own intellectual work in particular form of IPR													
<b>21EEK57.5</b>	Apply statutory provisions to protect particular form of research													
<b>21EEK57.6</b>	Develop the art of scholarly writing and evaluate its quality													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEK57.1</b>	3	3	3	-	-	-	-	-	3	3	2	3	-	-
<b>21EEK57.2</b>	3	3	3	1	2	-	-	-	3	3	2	3	-	-
<b>21EEK57.3</b>	3	3	3	1	2	-	-	2	3	3	2	3	-	-
<b>21EEK57.4</b>	3	3	-	-	-	-	-	2	3	3	2	3	-	-
<b>21EEK57.5</b>	3	-	-	-	-	-	-	2	3	3	2	3	-	-
<b>21EEK57.6</b>	3	3	3	1	2	-	-	1	3	3	2	3	-	-
<b>MODULE-1</b>	<b>RESEARCH FORMULATION AND DESIGN</b>							<b>21EEK57.1, 21EEK57.2</b>			<b>3 Hours</b>			
Definition and objective of research, types of research, steps in research process, research design, concept and types of research design, defining and formulating the research problems, importance of literature review- primary and secondary sources, reviews, monographs, patent, research database, web sources, identifying gap areas from the literature and research data base, surveying synthesis, Interpretation.														
Text Book	Text Book 1: Ch. 1, 2& 6													
<b>MODULE-2</b>	<b>SAMPLING &amp; DATA INTERPRETATION</b>							<b>21EEK57.2, 21EEK57.3</b>			<b>3 Hours</b>			
Mathematical tools for analysis, statistical analysis of data, regression analysis, correlation, concept of best fit and exact fit, theory, examples from linear regression with one and more unknowns.														
Case Study	To find the solution for the given research problem using different types of research methods													
Text Book	Text Book 1: Ch. 4& 7													
<b>MODULE-3</b>	<b>PATENT RIGHTS AND IPR</b>							<b>21EEK57.3, 21EEK57.4</b>			<b>3 Hours</b>			
Patents and its basics, process of filing patent at national and international level, Introduction and significance of intellectual property rights, commercialization, royalty, copyright, trade related aspects of IPR, Administration of patent system in India, licensing and transfer of technology, case studies.														
Text Book	Text Book 2: Ch. 1 & 2/ IPR India website													
<b>MODULE-4</b>	<b>RESEARCH AND PUBLICATION ETHICS</b>							<b>21EEK57.4, 21EEK57.5</b>			<b>3 Hours</b>			
Research and Integrity, Scientific mis conduct: Falsification, Fabrication and Plagiarism (FFP), Conflict of research, Predatory publishers and Journals, Open access publication, citation and acknowledgement, reproducibility and accountability, software tools for similarity check														

Text Book	Text Book 1: Ch. 14 & 15			
<b>MODULE-5</b>	<b>REPORT WRITING</b>	<b>21EEK57.5, 21EEK57.6</b>	<b>3 Hours</b>	
Structure and components of research report, types of report, layout of research report, mechanism of writing a research report, referencing in academic writing, Abstracting, Bibliography				
Case Study	Challenges in Electrical and Electronics Engineering research			
Text Book	Text Book 1: Ch. 14			
<b>CIE Assessment Pattern (50 Marks - Theory) -</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	5	-	-
<b>L2</b>	<b>Understand</b>	5	-	-
<b>L3</b>	<b>Apply</b>	5	5	5
<b>L4</b>	<b>Analyze</b>	5	5	5
<b>L5</b>	<b>Evaluate</b>	5	5	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks - Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	10		
<b>L2</b>	<b>Understand</b>	10		
<b>L3</b>	<b>Apply</b>	10		
<b>L4</b>	<b>Analyze</b>	10		
<b>L5</b>	<b>Evaluate</b>	10		
<b>L6</b>	<b>Create</b>	--		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1) Kothari, C.R., "Research Methodology: Methods and Techniques". New Age International, 2018, ISBN-13: 978-8122436235				
2) Ramakrishna Chintakunta, A Text book of Intellectual Property rights, Blue Hill Publication, ASIN: B09T6YDB5N, 2022				
<b>Reference Books:</b>				
1) Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K, An introduction to Research Methodology, RBSA Publishers. 2015, ISBN-13:978-8176111652				
2) Ranjith Kumar, Research methodology, Saga publications, 4 <sup>th</sup> edition, 2014, ISBN-13- 978-9351501336 Anderson, T. W., "An Introduction to Multivariate Statistical Analysis", Wiley Eastern Pvt., Ltd., New Delhi, 2011, ISBN-13: 978-8126524488				
3) Montgomery, Douglas C. & Runger, George C. (2016) 6/e, Applied Statistics & probability for Engineers (Wiley India) ISBN-13: 978-1118539712				
4) Montgomery, Douglas C. (2012) 8th edition, Design and Analysis of Experiments (Wiley India) ISBN: 978-1-118-14692-7				
5) Sinha, S.C. and Dhiman, A.K., 2012. Research Methodology, EssEss Publications. 2 volumes. ISBN : 81-7000-324-5, 81-7000-334-2				
<b>Web links and Video Lectures (e-Resources):</b>				
<ul style="list-style-type: none"> <li>• <a href="https://www.youtube.com/watch?v=_Mb_cNqfsdc">https://www.youtube.com/watch?v=_Mb_cNqfsdc</a></li> <li>• <a href="https://www.youtube.com/watch?v=GSeeyJVD0JU">https://www.youtube.com/watch?v=GSeeyJVD0JU</a></li> <li>• <a href="https://www.youtube.com/watch?v=nv7MOoHMM2k">https://www.youtube.com/watch?v=nv7MOoHMM2k</a></li> </ul>				
<b>Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning</b>				
<ul style="list-style-type: none"> <li>• Video sessions</li> <li>• Organizing Group wise discussions</li> <li>• Seminars</li> </ul>				

<b>INNOVATION AND DESIGN THINKING</b>															
<b>Course Code</b>	<b>21EEK58</b>										<b>CIE Marks</b>	<b>50</b>			
<b>L:T:P:S</b>	<b>1:0:0:0</b>										<b>SEE Marks</b>	<b>50</b>			
<b>Hrs / Week</b>	<b>01</b>										<b>Total Marks</b>	<b>100</b>			
<b>Credits</b>	<b>01</b>										<b>Exam Hours</b>	<b>01</b>			
<b>Course outcomes:</b>															
At the end of the course, the student will be able to:															
<b>21EEK58.1</b>	Articulate a comprehensive understanding of the concept of Design Thinking														
<b>21EEK58.2</b>	Apply Design Thinking methodologies to solve complex and ambiguous problems effectively														
<b>21EEK58.3</b>	Utilize design thinking tools for creative solutions														
<b>21EEK58.4</b>	Implement design thinking in IT that showcase the ability to drive meaningful innovation														
<b>21EEK58.5</b>	Develop strategic innovation for Business Model Design														
<b>21EEK58.6</b>	Create the Minimum Viable Product to solve societal needs using Design Thinking														
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>	
<b>21EEK58.1</b>	3	-	-	-	-	-	-	-	3	3	-	3	-	-	
<b>21EEK58.2</b>	3	3	2	-	-	-	-	-	3	3	-	3	-	-	
<b>21EEK58.3</b>	3	3	2	-	2	-	-	-	3	3	-	3	-	-	
<b>21EEK58.4</b>	3	3	2	2	2	-	-	-	3	3	-	3	-	-	
<b>21EEK58.5</b>	3	3	2	2	-	-	-	-	3	3	-	3	-	-	
<b>21EEK58.6</b>	3	3	2	2	2	1	1	1	3	3	1	3	-	-	
<b>MODULE-1</b>	<b>UNDERSTANDING DESIGN THINKING</b>										<b>21EEK58.1</b> <b>21EEK58.2</b>	<b>3 Hours</b>			
Definition, Origin and features of Design Thinking, Design thinker in organization, Principles and stages of Design thinking. Design Shared model in team-based design, Theory and practice in Design thinking. Collaborative design thinking. Live examples of MVP or Prototyping															
Case Study	Innovative design thinking problem														
<b>MODULE-2</b>	<b>TOOLS FOR DESIGN THINKING</b>										<b>21EEK58.3</b>	<b>3 Hours</b>			
Visualization, Journey mapping, Value Chain Analysis, The mind map, Rapid Concept development, Assumption testing, Prototype, Co creation, Learning launches and Storytelling.															
<b>MODULE-3</b>	<b>DESIGN THINKING IN IT</b>										<b>21EEK58.4</b>	<b>3 Hours</b>			
Business process modelling (BPM). Agile in Virtual collaboration environment. Scenario based Prototyping. Case studies on Design thinking															
Applications	Business process modelling														
<b>MODULE-4</b>	<b>DESIGN THINKING FOR STRATEGIC INNOVATION</b>										<b>21EEK58.5</b>	<b>3 Hours</b>			
Strategic management and Innovation management, Types of Innovations, Features and Scope of strategic innovations, Design thinking and strategic innovation, Practices of integrating Design thinking in Strategic Innovation.															
Case study	Practices of integrating Design thinking in Strategic Innovation.														
<b>MODULE-5</b>	<b>DESIGN THINKING WORK SHOP</b>										<b>21EEK58.6</b>	<b>3 Hours</b>			
Focus, Need and stages of Design thinking workshop. Empathize, Design, Ideate, Prototype and Test															
Applications	Develop a prototype using design thinking														
<b>CIE Assessment Pattern (50 Marks - Theory) -</b>															
<b>RBT Levels</b>		<b>Marks Distribution</b>													
		<b>Test (s)(15)</b>	<b>Assignment (10)</b>	<b>Seminar/ Activity (25)</b>											
		<b>15</b>	<b>10</b>	<b>25</b>											
<b>L1</b>	<b>Remember</b>	5	-	-											
<b>L2</b>	<b>Understand</b>	5	-	5											
<b>L3</b>	<b>Apply</b>	5	5	5											
<b>L4</b>	<b>Analyze</b>	-	5	10											

L5	Evaluate	-	-	5	
L6	Create	-	-	-	
<b>SEE Assessment Pattern (50 Marks - Theory)</b>					
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>			
L1	Remember	10			
L2	Understand	25			
L3	Apply	15			
L4	Analyze	--			
L5	Evaluate	--			
L6	Create	--			
<b>Suggested Learning Resources:</b>					
<ol style="list-style-type: none"> <li>1. Christian Mueller-Roterberg, Handbook of Design Thinking - Tips &amp; Tools for how to design thinking.</li> <li>2. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International edition) Second Edition, 2013.</li> <li>3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.</li> <li>4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand - Improve - Apply", Springer, 2011</li> <li>5. Yousef Haik and Tamer M. Shahin, "Engineering Design Process", Cengage Learning, Second Edition, 2011.</li> <li>6. Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover - 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author)</li> </ol>					
<b>Web links and Video Lectures (e-Resources):</b>					
<ul style="list-style-type: none"> <li>• <a href="https://www.ibm.com/design/thinking/">https://www.ibm.com/design/thinking/</a></li> <li>• <a href="https://www.ideo.com/pages/design-thinking">https://www.ideo.com/pages/design-thinking</a></li> <li>• <a href="https://www.youtube.com/watch?v=3RemkU4BH8U">https://www.youtube.com/watch?v=3RemkU4BH8U</a></li> </ul>					
<b>Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning</b>					
<ul style="list-style-type: none"> <li>➤ Group Discussion</li> <li>➤ Online courses</li> <li>➤ Seminar</li> <li>➤ Video lecture</li> </ul>					



## **Syllabus of Sixth Semester BE**

<b>OPERATIONS RESEARCH AND MANAGEMENT</b>														
<b>Course Code</b>	21EEE61							<b>CIE Marks</b>	50					
<b>L:T:P:S</b>	3:0:0:0							<b>SEE Marks</b>	50					
<b>Hrs / Week</b>	3							<b>Total Marks</b>	100					
<b>Credits</b>	03							<b>Exam Hours</b>	03					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE61.1</b>	Apply basic principles of project management for real time projects.													
<b>21EEE61.2</b>	Promote entrepreneurship as an individual or as a group by creating awareness on its needs and roles with respect to growth of economic development													
<b>21EEE61.3</b>	Develop solutions for barriers in Small scale industries.													
<b>21EEE61.4</b>	Estimate the interest rates, cash flows and costing materials, production and overheads													
<b>21EEE61.5</b>	Analyse the sequence of jobs on various machines.													
<b>21EEE61.6</b>	Evaluate the significance of game theory and determine the optimal solution.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE61.1</b>	3	-	-	-	3	-	-	-	-	-	3	3	-	1
<b>21EEE61.2</b>	3	-	-	-	-	-	-	-	-	-	2	3	-	1
<b>21EEE61.3</b>	3	-	-	-	-	-	-	-	-	-	2	2	-	2
<b>21EEE61.4</b>	3	3	3	3	3	-	-	-	-	-	3	2	2	-
<b>21EEE61.5</b>	3	3	3	-	3	-	-	-	-	-	2	2	3	-
<b>21EEE61.6</b>	3	3	3	-	3	-	-	-	-	-	2	2	1	-
<b>MODULE-1</b>	<b>Basics of Project Management</b>							<b>21EEE61.1</b>			<b>8 Hours</b>			
Introduction, Definition of project, characteristics of projects, types of projects, need for project management, phases of project life cycle management, impact of delays in project completions, roles and responsibilities of project leader.														
Self-study					Create project management plan by taking any real time project as example.									
Text Book					Text Book 3: 1.1, 1.1, 1.8, 1.9, 1.10, 1.18, 1.16.									
<b>MODULE-2</b>	<b>ENTREPRENEUR AND SSI</b>							<b>21EEE61.2</b>			<b>8 Hours</b>			
Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Stages in entrepreneurial process; Role of entrepreneurs in Economic Development. Entrepreneurship in India; women entrepreneurs, Entrepreneurship - its Barriers, SSI Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GATT Supporting Agencies of Government for SSI, Meaning, Nature of support. Objectives; Functions; Types of Help.														
Applications					List out some of the Small Scale Industries which are mainly focused on women empowerment.									
Text Book					Text Book 4: 2.2, 2.3, 2.4 to 2.15									
<b>MODULE-3</b>	<b>INTEREST, CASH FLOW, ESTIMATION AND COSTING</b>							<b>21EEE61.4</b>			<b>8 Hours</b>			
Law of demand and supply, Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment, Exercises and Discussion. Components of costs such as Direct Material Costs, Direct Labor Costs, Fixed Over-Heads, Factory cost, Administrative Over-Heads, First cost, Marginal cost, Selling price, Estimation for simple components.														
Text Book					Text Book 5: 2.1 to 2.10									
<b>MODULE-4</b>	<b>SEQUENCING</b>							<b>21EEE61.5</b>			<b>8 Hours</b>			
Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule- 'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing 2 jobs on 'm' machines using graphical method.														
Case Study					Case study on sequencing by taking any real time examples.									
Text Book					Text Book 2 : Chapter 11									
<b>MODULE-5</b>	<b>GAMETHEORY</b>							<b>21EEE61.6</b>			<b>8 Hours</b>			

Formulation of games, Two person-Zero sum game, games with and without saddle point, Graphical solution (2x n, m x 2 game), and dominance property.

Case Study | Case study on game theory by taking any real time examples.

Text Book | Text Book 2: Chapter 14

**CIE Assessment Pattern (50 Marks - Theory) -**

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

**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) Operation Research, S D Sharma, KedarNathRamNath publication, 2014 edition, ISBN-13: 1234567142552
- 2) Contemporary Project Management, Timothy J Kloppenborg, Cengage Learning, 2 nd Edition, ISBN: 97881315187
- 3) Project Management a System approach to Planning Scheduling & Controlling, Harold Kerzner, CBS Publishers and Distributors.2nd Ed., ISBN: 9788123908670
- 4) Engineering Economy, Riggs J.L., 4 TH ed. , McGraw Hill, 2002
- 5) Engineering Economy, Thuesen H.G. PHI , 2002

**Reference Books:**

- 1) Operations Research: An Introduction, H A Taha, Pearson; 10th edition (17 January 2017), ISBN-13: 978-1292165547

**Web links and Video Lectures (e-Resources):**

- [https://onlinecourses.nptel.ac.in/noc22\\_ge24/preview](https://onlinecourses.nptel.ac.in/noc22_ge24/preview)
- <https://projectmanagement.berkeley.edu/project-managemenet-course/>
- <https://www.youtube.com/watch?v=cwxXY9Qe8ss>
- <https://www.youtube.com/watch?v=V2GvQXvjhLA>
- [https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report\\_2232327\\_October%202022\\_Final.508.pdf](https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report_2232327_October%202022_Final.508.pdf)

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

- Demonstration of project management by taking any real time examples
- Demonstration of implementation of game theory in industries.
- Demonstration of application of sequencing in the industries
- Motivational videos from a women entrepreneurs.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

<b>ADVANCED INDUSTRIAL AND BUILDING AUTOMATION</b>														
<b>Course Code</b>	<b>21EEE62</b>								<b>CIE Marks</b>			<b>50</b>		
<b>L:T:P:S</b>	<b>3:0:0:0</b>								<b>SEE Marks</b>			<b>50</b>		
<b>Hours / Week</b>	<b>3</b>								<b>Total Marks</b>			<b>100</b>		
<b>Credits</b>	<b>03</b>								<b>Exam Hours</b>			<b>03</b>		
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE62.1</b>	Develop the architecture of an advanced industrial automation system and SCADA													
<b>21EEE62.2</b>	Build the connections between elements of an advanced building automation system.													
<b>21EEE62.3</b>	Examine the fire alarm system the components													
<b>21EEE62.4</b>	Develop different configurations of CCTV and access control system													
<b>21EEE62.5</b>	Analyze the various security system for home automation													
<b>21EEE62.6</b>	Design and Develop a basic CBUS application for building application management.													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
<b>21EEE62.1</b>	3	3	3	3	2	-	-	-	-	-	-	2	-	2
<b>21EEE62.2</b>	3	3	3	3	2	-	-	-	-	-	-	2	-	2
<b>21EEE62.3</b>	3	3	3	3	2	-	-	-	-	-	-	2	-	2
<b>21EEE62.4</b>	3	3	3	3	2	-	-	-	-	-	-	2	-	2
<b>21EEE62.5</b>	3	3	3	3	2	-	-	-	-	-	-	2	-	2
<b>21EEE62.6</b>	3	3	3	3	2	-	-	-	-	-	-	2	-	2
<b>MODULE-1 Introduction to Advanced PLC and SCADA</b>														
<b>21EEE62.1</b>	<b>8 Hours</b>													
Need of SCADA systems, features of SCADA, Block diagram of SCADA, Function of SCADA, Network Protocols, Protocol standards, Serial Communication – Device Net – Control Net – EthernetRS232, RS48, Modbus – Fieldbus – Probus - Subnetting – Subnet mask - File transfer protocol.														
Case Study	Investigate the Challenges of Advanced PLC and SCADA, Compare with traditional areas of science and engineering.													
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16													
<b>MODULE-2 Introduction to Building management system and energy management systems</b>														
<b>21EEE62.2</b>	<b>8 Hours</b>													
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														
Case Study	Investigate Building management system and energy management systems													
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15													
<b>MODULE-3 Fire alarm systems</b>														
<b>21EEE62.3</b>	<b>8 Hours</b>													
Applications, FAS architecture: Types of Architecture and Examples. Fire Alarm System Devices and Standards														
Self-study	Explore the FAS architecture constructions and development.													
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10													
<b>MODULE-4 CCTV and access control systems</b>														
<b>21EEE62.4</b>	<b>8 Hours</b>													

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.

Self-study	Scrutinize the Different types of CCTV and access control systems		
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
<b>MODULE-5</b>	<b>Home automation systems</b>	<b>21EEE62.5</b>	<b>8 Hours</b>

Home automation system necessity-block diagram of home automation system-Introduction to Security Systems, Concepts-Components, Technology,Advanced Applications. Security Design-Concept of automation in access control system for safety, Physical security system with components, RFID enabled access control with components -Standards for communication: CBUS – KNX,

Case Study	Survey on Home automation systems, design, applications
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Text Book	Text Book 2: 12.1 to 12.10
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**CIE Assessment Pattern (50 Marks - Theory)**

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	3	5
L4	Analyze	5	7	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

**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:**

- Intelligent Building Systems by Albert Ting-Pat So, WaiLok Chan, Kluwer Academic publisher,3rd ed., 2012  
ISBN, 1461550203, 9781461550204.
- PLCs & SCADA: Theory and Practice by Rajesh Mehra, edition2018, ISBN-13: 978-9381159118 ISBN-10: 9381159114

**Reference Books:**

- The High Performance HMI Handbook 1st Edition, by Bill Hollifield (Author), Dana Oliver (Author), Ian Nimmo (Author), Eddie Habibi (Author).
- Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs) by Reinhold A. Carlson, Robert A. Di Giandomenico, pub. by R.S. Means Company, 1991
- Design of Special Hazards and Fire Alarm Systems by Robert Gagnon, Thomson Delmar Learning; 2nd edition, 2007. ISBN-10. 1418039500 ; ISBN-13. 978-1418039509

4. Energy Management Handbook, Turner, W. C, 5 th Edition, 2004 ISBN: 0-88173-542-6 (print) — 0-88173-543-4 (electronic).

**Web links and Video Lectures (e-Resources):**

- <https://nptel.ac.in/courses/108105063>
- <https://www.youtube.com/watch?v=ReEp0HH91ZU>
- <https://www.electricalengineering.xyz/videos/introduction-to-bms-building-management-system/>
- <https://www.se.com/in/en/work/products/product-launch/smart-home-automation-wiser/>

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

- Demonstration of PLC
- Video demonstration of latest trends in industrial and building automation
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues
- Seminars

## ADVANCED INDUSTRIAL AND BUILDING AUTOMATION LABORATORY

<b>Course Code</b>	<b>21EEL62</b>	<b>CIE Marks</b>	<b>50</b>
<b>L:T:P:S</b>	<b>0:0:1:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Hrs / Week</b>	<b>2</b>	<b>Total Marks</b>	<b>100</b>
<b>Credits</b>	<b>01</b>	<b>Exam Hours</b>	<b>03</b>

### Course outcomes:

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

<b>21EEL62.1</b>	Design the SCADA system for Industrial applications
<b>21EEL62.2</b>	Solve the problems in a building using building management systems (BMS) and energy management systems (EMS)
<b>21EEL62.3</b>	Apply the SFC based solutions for building a Smart industry
<b>21EEL62.4</b>	Analyze the configurations of CCTV, Fire alarm, access control system for a smart home

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

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
<b>21EEL62.1</b>	3	2	2	3	3	-	-	-	-	-	-	-	1	1
<b>21EEL62.2</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEL62.3</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1
<b>21EEL62.4</b>	3	3	3	3	3	-	-	-	-	-	-	-	1	1

<b>Exp. No. / Pgm. No.</b>	<b>List of Experiments / Programs</b>	<b>Hours</b>	<b>COs</b>
<b>Prerequisite Experiments / Programs / Demo</b>			
	<ul style="list-style-type: none"> <li>• Industrial Automation</li> <li>• PLC</li> <li>• Digital Logic Circuits.</li> </ul>	2	NA

### PART-A

1	Design the lamp control using Screen operation and unity pro.	2	21EEL62.1
2	Design the temperature monitoring system using analog input module.	2	21EEL62.1
3	Design the basic animation in mimic screen using SCADA.	2	21EEL62.1
4	Execute the regulation of water treatment plant using SCADA.	2	21EEL62.1
5	Design and configuration of Building Management Systems.	2	21EEL62.2
6	Apply Lua program to make the automatic HVAC systems.	2	21EEL52.2

### PART-B

7	Design a basic Trolley control system in an industry using SFC.	2	21EEL62.3
8	Design a SFC for advanced control in trolley management.	2	21EEL62.3
9	Design of CCTV system for live monitoring and recording of videos using PELCO	2	21EEL62.4
10	Design and configuration of a pre-programming home automation system.	2	21EEL62.4

### PART-C

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

1. <https://plc-coep.vlabs.ac.in>

2. <https://ial-coep.vlabs.ac.in/>

**CIE Assessment Pattern (50 Marks - Lab)**

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

**SEE Assessment Pattern (50 Marks - Lab)**

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

**Suggested Learning Resources:****Reference Books:**

1. Intelligent Building Systems by Albert Ting-Pat So, WaiLok Chan, Kluwer Academic publisher, 3rd ed., 2012  
ISBN, 1461550203, 9781461550204.
2. PLCs & SCADA: Theory and Practice by Rajesh Mehra, edition 2018, ISBN-13: 978-9381159118 ISBN-10: 9381159114
3. Design of Special Hazards and Fire Alarm Systems by Robert Gagnon, Thomson Delmar Learning; 2nd edition, 2007. ISBN-10. 1418039500 ; ISBN-13. 978-1418039509
4. Turner, W. C., "Energy Management Handbook", 5th Edition, 2004 ISBN: 0-88173-542-6 (print) — 0-88173-543-4 (electronic).



<b>POWER SYSTEM ANALYSIS</b>														
<b>Course Code</b>	21EEE63								<b>CIE Marks</b>				50	
<b>L:T:P:S</b>	3:0:0:0								<b>SEE Marks</b>				50	
<b>Hours / Week</b>	3								<b>Total Marks</b>				100	
<b>Credits</b>	03								<b>Exam Hours</b>				03	
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE63.1</b>	Apply the concept of per-unit reactance, bus incidence, Y-bus and Z-bus matrices for modelling the actual power system													
<b>21EEE63.2</b>	Determine steady state power flow analysis of power system using Gauss-Seidel, Newton-Raphson and fast decoupled iterative methods													
<b>21EEE63.3</b>	Analyze symmetrical and unsymmetrical faults in a power system													
<b>21EEE63.4</b>	Compare various types of faults by analyzing real time power system applications													
<b>21EEE63.5</b>	Analyze steady state and transient stability of power system													
<b>21EEE63.6</b>	Design mathematical models for power system using dedicated software tools and thus analyze power system stability													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE63.1</b>	3	3	3	-	-	-	-	-	-	-	-	-	2	2
<b>21EEE63.2</b>	3	3	3	2	-	-	-	-	-	-	-	-	2	2
<b>21EEE63.3</b>	3	2	3	3	-	-	-	-	-	-	-	-	2	2
<b>21EEE63.4</b>	3	3	3	3	-	-	-	-	-	-	-	-	2	2
<b>21EEE63.5</b>	3	3	3	3	-	-	-	-	-	-	-	-	2	2
<b>21EEE63.6</b>	3	3	3	2	-	-	-	-	-	-	-	-	2	2
<b>MODULE-1 PER-UNIT SYSTEM MODELLING AND NETWORK MATRICES</b>														
											<b>21EEE63.1, 21EEE63.3</b>		<b>8 Hours</b>	
Introduction, Single line diagram, per unit system, per unit impedance and reactance diagram of power system														
Bus Incidence matrix, Formation of Bus Admittance Matrix-Inspection method (Without half line charging admittance), Singular transformation method (with and without mutual coupling), Bus impedance matrix (Building algorithm without mutual coupling)														
Text Book Text Book 1: 4.1-4.4														
<b>MODULE-2 LOAD FLOW STUDIES AAND TECHNIQUES</b>														
											<b>21EEE63.2, 21EEE63.6</b>		<b>8 Hours</b>	
Introduction, Power flow equations, Classification of buses, Operating constraints. Gauss-Seidal Method, Acceleration of convergence; Newton Raphson's Method, Fast Decoupled load flow method, Comparison of Load Flow Methods. (Numerical problems for one iteration only)														
Self- study Load flow analysis using FDLF method														
Text Book Text Book 2: 6.1-6.8														
<b>MODULE-3 SYMMETRICAL FAULT ANALYSIS AND COMPONENTS</b>														
											<b>21EEE63.3, 21EEE63.4</b>		<b>8 Hours</b>	
Transients on a transmission line, Short circuit current and reactance of synchronous machines on no load and on load, Selection of circuit breaker ratings.														
Analysis of Unbalanced load against														
Balanced 3 phase supply, resolution of unbalanced phasors into their symmetrical Components-Power in terms of symmetrical components.														
Text Book Text Book 2: 9.1-9.5, 10.1-10.9														
<b>MODULE-4 UNSYMMETRICAL FAULTS</b>														
											<b>21EEE63.3, 21EEE63.4</b>		<b>8 Hours</b>	
Sequence Networks, sequence impedances and sequence networks of power system elements (alternators, transformers and transmission lines), Positive sequence network, negative sequence network and zero sequence network of power system elements														
Conceptual study of L-G,L-L,L-L-G, faults on an unbalanced alternator without and with fault impedance, Unsymmetrical faults on power system, Numerical problems														

Text Book	Text Book 2: 11.1-11.5 Reference Book 1: 10.1-10.8			
<b>MODULE-5</b>	<b>STABILITY ANALYSIS</b>	<b>21EEE63.6</b>	<b>8 Hours</b>	
Introduction, Dynamics of a synchronous machine-swing equation, power angle equation, steady state and transient stability. Equal area criterion for transient stability evaluation, Factors affecting transient stability, Methods of improving transient stability, Recent trends of improving transient stability.				
Self- study	Methods to improve stability in power system			
Text Book	Text Book 2: 12.1 to 12.8 Reference Book 1:11.1-11.5			
<b>CIE Assessment Pattern (50 Marks – Theory)</b>				
<b>RBT Levels</b>		<b>Marks Distribution</b>		
		<b>Test (s)</b>	<b>Qualitative Assessment (s)</b>	<b>MCQ's</b>
		<b>25</b>	<b>15</b>	<b>10</b>
<b>L1</b>	<b>Remember</b>	-	-	-
<b>L2</b>	<b>Understand</b>	5	-	2
<b>L3</b>	<b>Apply</b>	10	7.5	4
<b>L4</b>	<b>Analyze</b>	5	7.5	4
<b>L5</b>	<b>Evaluate</b>	5	-	-
<b>L6</b>	<b>Create</b>	-	-	-
<b>SEE Assessment Pattern (50 Marks – Theory)</b>				
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>		
<b>L1</b>	<b>Remember</b>	5		
<b>L2</b>	<b>Understand</b>	5		
<b>L3</b>	<b>Apply</b>	15		
<b>L4</b>	<b>Analyze</b>	15		
<b>L5</b>	<b>Evaluate</b>	10		
<b>L6</b>	<b>Create</b>	-		
<b>Suggested Learning Resources:</b>				
<b>Text Books:</b>				
1) G. W. Stagg, A. H. El-Abiad (2008), Computer Methods in power System Analysis, 2nd edition, Tata McGraw Hill Publications, New Delhi.				
2)I. J. Nagrath, D. P. Kothari (2005), Modern Power System Analysis, 3rd edition, Tata McGraw Hill Publications, New Delhi, India.				
<b>Reference Books:</b>				
1)HadiSaadat (2010), Power System Analysis, Revised Edition, PSA Publishers, New Delhi.				
2)M. A. Pai (2008), Computer Techniques in Power System Analysis, 2nd edition, Tata McGraw Hill Publications, New Delhi, India.				
<b>Web links and Video Lectures (e-Resources):</b>				
<ul style="list-style-type: none"> <li>• <a href="https://onlinecourses.nptel.ac.in/noc19_ee62/preview">https://onlinecourses.nptel.ac.in/noc19_ee62/preview</a></li> <li>• <a href="https://archive.nptel.ac.in/courses/108/107/108107127/">https://archive.nptel.ac.in/courses/108/107/108107127/</a></li> <li>• <a href="https://www.youtube.com/@lecturesinelectricalengine4298">https://www.youtube.com/@lecturesinelectricalengine4298</a></li> </ul>				
<b>Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning</b>				
<ul style="list-style-type: none"> <li>• Visit to any substation/Design /Power system component manufacturing industry or any power plant</li> <li>• Video demonstration of latest trends in Power system</li> <li>• Contents related activities (Activity-based discussions)</li> <li>• For active participation of students, instruct the students to prepare Flowcharts and Handouts</li> <li>• Organizing Group wise discussions on issues</li> <li>• Seminars</li> </ul>				

<b>POWER SYSTEM ANALYSIS LABORATORY</b>														
<b>Course Code</b>	21EEL63								<b>CIE Marks</b>			50		
<b>L:T:P:S</b>	0:0:1:0								<b>SEE Marks</b>			50		
<b>Hrs / Week</b>	2								<b>Total Marks</b>			100		
<b>Credits</b>	01								<b>Exam Hours</b>			03		
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
21EEL63.1	Compute per-unit reactance diagrams, bus incidence, Y-bus and Z-bus matrices for modelling the actual power system using simulation tool													
21EEL63.2	Simulate power flow analysis using Gauss-Seidel, Newton-Raphson and fast decoupled iterative methods													
21EEL63.3	Analyze steady state and transient stability of power system using simulink													
21EEL63.4	Design mathematical models for power system using software tools													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
21EEL63.1	3	3	3	1	3	-	-	-	1	-	-	-	3	3
21EEL63.2	3	3	-	3	-	-	-	-	1	-	-	-	3	3
21EEL63.3	3	3	1	3	-	-	-	-	1	-	-	-	3	3
21EEL63.4	3	3	1	3	-	-	-	-	1	-	-	-	3	3
<b>Exp. No. / Pgm. No.</b>	<b>List of Experiments / Programs</b>											<b>Hours</b>	<b>COs</b>	
<b>Prerequisite Experiments / Programs / Demo</b>														
	<ul style="list-style-type: none"> <li>Basic Knowledge in MATLAB</li> <li>Load Flow Equations</li> <li>Bus Formation</li> </ul>											2	NA	
<b>PART-A</b>														
1	Computation of Parameters and Modelling of Transmission Lines												21EEL63.1	
2	Formation of Bus Admittance Matrices and Solution of Networks. i) By Inspection method ii) By Singular Transformation Method (without Mutual coupling) iii) By Singular Transformation Method (with Mutual coupling)											2	21EEL63.2	
3	Determination of bus currents, bus power, line flows and line losses for a specified system profile.											2	21EEL63.2	
4	Determination of power angle plot for a) Salient pole synchronous machine b) Non salient pole synchronous machine											2	21EEL63.4	
5	Formation of Bus impedance matrix using Building algorithm.											2	21EEL63.1 21EEL63.4	
6	Formation of Jacobian for a system not exceeding 4 buses (without PV buses) in polar coordinates.											2	21EEL63.3	
<b>PART-B</b>														
7	Transient stability analysis of SMIB system using swing equation											2	21EEL63.4	
8	Short circuit analysis for power system-Using Mi-Power											2	21EEL63.3	
9	Load Flow Analysis – I: Solution of load flow and related problems using Gauss-Seidel Method											2	21EEL63.4	
10	Load Flow Analysis – II: Solution of load flow and related problems using Newton Raphson.											2	21EEL63.3	
11	Load Flow Analysis – III: Solution of load flow and related problems using Fast CO3 Decoupled Method.											2	21EEL63.3	
12	Economic Dispatch in Power system-Using Mi-Power											2	21EEL63.3	

**PART-C**

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

1. <https://vp-dei.vlabs.ac.in/Dreamweaver/>
2. <https://srmeevlab.github.io/PSA/loe.html>

**CIE Assessment Pattern (50 Marks - Lab)**

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

**SEE Assessment Pattern (50 Marks - Lab)**

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

**Suggested Learning Resources:**

**Reference Books:**

1. Modern Power System, D. P. Kothari, McGraw Hill, 4TH Edition, 2011
2. Power System Analysis, Hadi Sadat, McGraw Hill, 1 st Edition, 2002

## 21EEE64X-Professional Elective Course-II

<b>INTRODUCTION TO CYBER SECURITY</b>														
<b>Course Code</b>	21EEE641						<b>CIE Marks</b>				50			
<b>L:T:P:S</b>	3:0:0:0						<b>SEE Marks</b>				50			
<b>Hours / Week</b>	3						<b>Total Marks</b>				100			
<b>Credits</b>	03						<b>Exam Hours</b>				03			
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE641.1</b>	Apply the knowledge of the cybercrime terminologies in various situations													
<b>21EEE641.2</b>	Understand the Cyber offenses and Botnets													
<b>21EEE641.3</b>	Identify the tools and methods used on Cybercrime													
<b>21EEE641.4</b>	Analyse Phishing and identity theft													
<b>21EEE641.5</b>	Examine the need of computer forensics in practical situations													
<b>21EEE641.6</b>	Compare and apply the security concepts in real time applications													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PS01</b>	<b>PS02</b>
<b>21EEE641.1</b>	1	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>21EEE641.2</b>	1	2	-	-	-	-	-	-	-	-	-	-	-	-
<b>21EEE641.3</b>	1	1	2	-	-	-	-	-	-	-	-	-	1	-
<b>21EEE641.4</b>	3	1	2	-	-	-	-	-	-	-	-	-	1	-
<b>21EEE641.5</b>	1	2	3	-	-	-	-	-	-	-	-	-	2	1
<b>21EEE641.6</b>	1	1	1	1	2	-	-	-	-	-	-	-	1	1
<b>MODULE-1 INTRODUCTION TO CYBERCRIME</b>														
											<b>21EEE641.1</b>	<b>8 Hours</b>		
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														
Text Book Text Book 1: 1.1 to 1.5, 1.7-1.9														
<b>MODULE-2 CYBER OFFENSES</b>														
											<b>21EEE641.2</b>	<b>8 Hours</b>		
How Criminals Plan Them: Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercafe& cybercrimes. Botnets: The fuel for cybercrime, Attack Vector.														
Case Study Cybercrime														
Text Book Text Book 1: 2.1 to 2.7														
<b>MODULE-3 TOOLS AND METHODS USED IN CYBERCRIME</b>														
											<b>21EEE641.3</b>	<b>8 Hours</b>		
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.														
Text Book Text Book 1: 4.1 to 4.9, 4.12														
<b>MODULE-4 PHISHING AND IDENTITY THEFT</b>														
											<b>21EEE641.4</b>	<b>8 Hours</b>		
Introduction, methods of phishing, phishing, vphishing techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft														
Case Study Identity Theft														
Text Book Text Book 1: 5.1, 5.2. 5.3														
<b>MODULE-5 UNDERSTANDING COMPUTER FORENSICS</b>														
											<b>21EEE641.5,</b> <b>21EEE641.6</b>	<b>8 Hours</b>		
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.														

Text Book	Text Book 1: 7.1. to 7.5, 7.7 to 7.9
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### CIE Assessment Pattern (50 Marks - Theory)

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

### 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) Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by SumitBelapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)

#### Reference Books:

- 1) Pfleeger, C.P., Security in Computing 5th Edition, Prentice Hall, Copyright 2010 ISBN 0-13-239077-9. Schneier, Bruce. Applied Cryptography, Second Edition, John Wiley & Sons, 1996.
- 2) Cyber Crime Impact in the New Millennium, by R. C Mishra ,Auther Press. Edition 2010.
- 3) Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13<sup>th</sup> November, 2001)
- 4) Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

### 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\\_rt9swsu](https://www.youtube.com/watch?v=yC_hFm0BX28&list=PLxApjaSnQGi6Jm7LLSxvmNQjS_rt9swsu)
- [https://www.youtube.com/watch?v=nzZkKoREEGo&list=PL9ooVrP1hQOGPQVeapGsJCKtzI04DtI4\\_](https://www.youtube.com/watch?v=nzZkKoREEGo&list=PL9ooVrP1hQOGPQVeapGsJCKtzI04DtI4_)
- [https://www.youtube.com/watch?v=6wi5DI6du-4&list=PL\\_uaeekrhGzjIB8XQBxU3z\\_hDwT95xIk](https://www.youtube.com/watch?v=6wi5DI6du-4&list=PL_uaeekrhGzjIB8XQBxU3z_hDwT95xIk)
- <https://www.youtube.com/watch?v=KqSqyKwVuA8>
- [https://onlinecourses.nptel.ac.in/noc23\\_cs127/preview](https://onlinecourses.nptel.ac.in/noc23_cs127/preview)

### 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)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues, Seminars

<b>DATA STRUCTURES AND ALGORITHMS USING PYTHON</b>														
<b>Course Code</b>	<b>21EEE642</b>							<b>CIE Marks</b>	<b>50</b>					
<b>L:T:P:S</b>	<b>3:0:0:0</b>							<b>SEE Marks</b>	<b>50</b>					
<b>Hours / Week</b>	<b>3</b>							<b>Total Marks</b>	<b>100</b>					
<b>Credits</b>	<b>03</b>							<b>Exam Hours</b>	<b>03</b>					
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
21EEE642.1	Apply python concepts to primitive functions.													
21EEE642.2	Implement stacks, queues and linked lists for real time applications													
21EEE642.3	Utilize various sorting techniques for mathematical primitives													
21EEE642.4	Develop optimized programs using binary trees													
21EEE642.5	Evaluate the performance of trees and graphs													
21EEE642.6	Develop searching, insertion, deletion, traversing mechanism operations on various data													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
21EEE642.1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
21EEE642.2	3	3	2	-	-	-	-	-	-	-	-	-	-	-
21EEE642.3	3	3	2	3	3	-	-	-	-	-	-	-	-	-
21EEE642.4	3	3	2	3	3	-	-	-	-	-	-	-	-	-
21EEE642.5	3	3	2	3	-	-	-	-	-	-	-	-	-	-
21EEE642.6	3	3	2	3	3	-	-	-	-	-	-	-	-	-
<b>MODULE-1 Introduction to Python 21EEE642.1 8 Hours</b>														
Python Overview, Objects in Python, Expressions, Operators, and Precedence, Control Flow, Functions, Simple Input and Output, Exception Handling, Iterators and Generators, Additional Python Conveniences, Scopes and Namespaces, Modules and the Import Statement														
Case study	Program to perform exception handling in python													
Text Book	Text Book 1: 1.1,1.2, 1.3, 1.4,1.5,1.6,1.7,1.8,1.9, 1.10, 1.11													
<b>MODULE-2 Stacks and Queues 21EEE642.2, 21EEE642.6 8 Hours</b>														
Types of data structures, Stack, stack implementation, simple balanced parentheses, converting decimal numbers to Binary numbers, Infix, Prefix and Postfix expressions, Queue, Queue implementation, simulation, Deques.														
Case study	Program to perform Queue implementation													
Text Book	Text Book 2: 4.2,4.4, 4.5 to 4.15													
<b>MODULE-3 Linked List and sorting techniques 21EEE642.2, 21EEE642.3,21EEE642.6 8 Hours</b>														
The Unordered List Abstract Data Type, Implementing an Unordered List: Linked Lists, The Ordered List Abstract Data Type, Recursion, Sorting and Searching techniques														
Text Book	Text Book 2: 4.19,4.20,4.21,4.22, 5,6													
<b>MODULE-4 Trees 21EEE642.4, 21EEE642.6 8 Hours</b>														
Introduction, Parse Tree, Tree Traversals, Binary Heap Operations, Binary Heap Implementations, Binary search Trees, AVL Trees.														
Text Book	Text Book 2: 7.6,7.7,7.9,7.10,7.11,7.16													
<b>MODULE-5 Graphs 21EEE642.5, 21EEE642.6 8 Hours</b>														
Introduction, Adjacency Matrix, Adjacency list, implementation, Breadth First Search, Depth First Search, Topological Sorting. Shortest Path Algorithms														

Text Book	Text Book 2: 14.2,14.3,14.5,14.6
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**SEE Assessment Pattern (50 Marks – Theory)**

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	5
L3	Apply	20
L4	Analyze	25
L5	Evaluate	-
L6	Create	-

**Suggested Learning Resources:**

**Text Books:**

- 1) Data Structures and Algorithms in Python. Michael T. Goodrich , Roberto Tamassia ,Michael H. Goldwasser, Wiley, 2013.ISBN: 9781118290279.
- 2) Problem Solving with Algorithms and Data Structures Using Python by Brad Miller, David Ranum. Publisher: Franklin, Beedle& Associates 2011,ISBN: 9781590282571.

**Reference Books:**

- 1) Data Structures and Algorithms Using Python, RanceNecaise, Wiley 2011,ISBN: 9788126562169.
- 2) Think Python: How to Think Like a Computer Scientist” Allen B. Downey, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016, <http://greenteapress.com/wp/think-python/>
- 3) Grokking Algorithms. An illustrated guide for programmers and other curious people, AdityaBhargava, Manning Publications, 2016.ISBN: 9781617292231.

**Web links and Video Lectures (e-Resources):**

- [https://onlinecourses.nptel.ac.in/noc19\\_cs40/preview](https://onlinecourses.nptel.ac.in/noc19_cs40/preview)
- [https://www.youtube.com/watch?v=t2GVaQasRY&list=PLeo1K3hJS3uu\\_n\\_a\\_MI\\_KktGTLYopZ12](https://www.youtube.com/watch?v=t2GVaQasRY&list=PLeo1K3hJS3uu_n_a_MI_KktGTLYopZ12)
- [https://www.youtube.com/watch?v=WwfhLC16bis&list=PLBZBJbE\\_rGRV8D7XZ08LK6z-4zPoWzu5H&index=5](https://www.youtube.com/watch?v=WwfhLC16bis&list=PLBZBJbE_rGRV8D7XZ08LK6z-4zPoWzu5H&index=5)
- <https://ocw.mit.edu/courses/6-006-introduction-to-algorithms-spring-2020/resources/lecture-2-data-structures-and-dynamic-arrays/>

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

- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues
- Seminars



## CMOS VLSI Design

<b>Course Code</b>	<b>21EEE643</b>		<b>CIE Marks</b>	<b>50</b>										
<b>L:T:P:S</b>	<b>3:0:0:0</b>		<b>SEE Marks</b>	<b>50</b>										
<b>Hours / Week</b>	<b>3</b>		<b>Total Marks</b>	<b>100</b>										
<b>Credits</b>	<b>03</b>		<b>Exam Hours</b>	<b>03</b>										
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE643.1</b>	Analyse the MOSFET characteristics and delay models													
<b>21EEE643.2</b>	Apply physical design process for designing digital logic circuits													
<b>21EEE643.3</b>	Evaluate the types of MOSFET and select an appropriate processing technology for physical design process													
<b>21EEE643.4</b>	Examine CMOS digital circuits to optimize the design parameters													
<b>21EEE643.5</b>	Use delay models to perform timing analysis on MOSFET based design													
<b>21EEE643.6</b>	Solve the digital logic problems using circuit families													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE643.1</b>	2	3	2	-	-	-	-	-	-	-	-	1	-	1
<b>21EEE643.2</b>	3	2	2	-	-	-	-	-	-	-	-	1	-	1
<b>21EEE643.3</b>	2	2	2	2	-	-	-	-	-	-	-	1	-	1
<b>21EEE643.4</b>	2	3	2	-	-	-	-	-	-	-	-	1	-	1
<b>21EEE643.5</b>	3	2	2	-	-	-	-	-	-	-	-	1	-	1
<b>21EEE643.6</b>	3	2	2	-	-	-	-	-	-	-	-	1	-	1
<b>MODULE-1 MOS Transistor Theory</b>						<b>21EEE643.1, 21EEE643.3</b>			<b>8 Hours</b>					
Introduction, MOS transistors, CMOS Logic, Design partitioning 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 MOSFETs													
Text Book	Text Book 1: 1.3, 1.4, 1.6, 2.1, 2.2, 2.3 (up to 2.3.1), 2.4, 2.5													
<b>MODULE-2 CMOS Processing Technology:</b>						<b>21EEE643.2, 21EEE643.3, 21EEE643.6</b>			<b>8 Hours</b>					
CMOS Fabrication and Layout, Exercises for stick diagram and layout, CMOS Technologies, Layout Design Rules, CMOS Process Enhancements														
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													
<b>MODULE-3 Delay AND Combinational Circuit Basics</b>						<b>21EEE643.1, 21EEE643.2, 21EEE643.5</b>			<b>8 Hours</b>					
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														
Text Book	Text Book 1: 4.1, 4.2, 4.3 (excluding 4.3.7), 4.4 (up to 4.4.4) & Text Book 1: 9.1, 9.2 (up to 9.2.1)													
<b>MODULE-4 Combinational AND SEQUENTIAL Circuit Design</b>						<b>21EEE643.2, 21EEE643.4, 21EEE643.6</b>			<b>8 Hours</b>					
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 MOSFETs													
Text Book	Text Book 1: 9.2 (up to 9.2.4.1), 9.5, 10.1, 10.2, 10.3 (up to 10.3.4)													
<b>MODULE-5 Timing Analysis</b>						<b>21EEE643.4, 21EEE643.5</b>			<b>8 Hours</b>					

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, Timing Terms - Analysis - Models - Goals, Static Timing Analysis, Timing Constraints & Verification, Timing Convergence, Timing driven Logic and Layout Synthesis.

Case Study Perform timing analysis on the given CMOS circuits

Text Book Text Book 2:10.1 -10.6, 10.8- 10.10, 10.12 -10.15, 10.19 - 10.39

#### CIE Assessment Pattern (50 Marks - Theory)

RBT Levels		Marks Distribution	
		Test (s)	NPTEL
		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. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E. Weste, David Money Harris, 4th Edition, Pearson Education, 2015 2.
2. VLSI Design, Debaprasad Das, 2nd edition, 2016, Oxford University Press.

##### Reference Books:

1. CMOS Digital Integrated Circuits, Analysis and Design, Sung-Mo Kang & Yusuf Leblebici, 3rd Edition, 2007, TMH.
2. Digital Integrated Circuits – A design Perspective, Jan M. Rabaey, AnanthaChandrasekaran, BorivojeNikolic, 2nd Edition, 2009, Prentice-Hall.
3. Basic VLSI Design, Douglas A. Pucknell and Kamran Eshraghian, 3rd Edition, 2011, PHI. 4.
4. Static Timing Analysis for Nanometer Designs - A Practical Approach, J. Bhasker, RakeshChadha, Springer, 2009

#### Web links and Video Lectures (e-Resources):

- <http://vlsi-iitg.vlabs.ac.in/>
- <http://icbook.eecs.berkeley.edu/resources/powerpoint-slides>
- <https://ocw.mit.edu/courses/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/download/>
- <https://digimat.in/nptel/courses/video/108107129/L01.html>

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

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

## HIGH VOLTAGE ENGINEERING

<b>Course Code</b>	<b>21EEE644</b>	<b>CIE Marks</b>	<b>50</b>
<b>L:T:P:S</b>	<b>3:0:0:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Hours / Week</b>	<b>3</b>	<b>Total Marks</b>	<b>100</b>
<b>Credits</b>	<b>03</b>	<b>Exam Hours</b>	<b>03</b>

**Course outcomes:**

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

<b>21EEE644.1</b>	Apply the concept of electric field distribution and computation in different configuration of electrode systems
<b>21EEE644.2</b>	Differentiate the Gaseous, liquid and solid dielectric behavior under High Voltage and different applications of the insulating materials in electrical power apparatus.
<b>21EEE644.3</b>	Determine the generation method and measuring methods of high voltage and current with safety measure
<b>21EEE644.4</b>	Analyze insulation testing of various components in power systems for different types of voltages which requires for generation of high voltage in laboratories
<b>21EEE644.5</b>	Identify the necessary conditions for electrical equipment which are capable of withstanding the over voltages by lightning discharge and the principles of insulation Coordination
<b>21EEE644.6</b>	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	PO12	PS01	PS02
<b>21EEE644.1</b>	3	1	-	-	-	-	-	-	-	-	-	-	-	1
<b>21EEE644.2</b>	3	2	-	-	-	-	-	-	-	-	-	-	-	1
<b>21EEE644.3</b>	3	3	1	1	-	-	-	-	-	-	-	-	-	1
<b>21EEE644.4</b>	3	3	1	1	-	-	-	-	-	-	-	-	-	1
<b>21EEE644.5</b>	3	1	2	-	-	-	-	-	-	-	-	-	-	1
<b>21EEE644.6</b>	3	3	1	-	-	-	-	-	-	-	-	-	-	1

<b>MODULE-1</b>	<b>INTRODUCTION TO HIGH VOLTAGE ENGINEERING</b>	<b>21EEE644.1, 21EEE644.6</b>	<b>8 Hours</b>
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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 bushings

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

<b>MODULE-2</b>	<b>BREAK DOWN IN DIELECTRIC MATERIALS</b>	<b>21EEE644.2</b>	<b>8 Hours</b>
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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

<b>MODULE-3</b>	<b>GENERATION AND MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS</b>	<b>21EEE644.3</b>	<b>8 Hours</b>
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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

<b>MODULE-4</b>	<b>TESTING OF MATERIALS &amp; ELECTRICAL APPARATUS</b>	<b>21EEE644.4</b>	<b>8 Hours</b>
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Measurement of D.C Resistivity, Measurement of Dielectric Constant and loss factor, Partial discharge measurements, Testing of insulators, bushings, circuit breakers, cables, transformers, surge arrestors.

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

<b>MODULE-5</b>	<b>OVER-VOLTAGES AND INSULATION COORDINATION</b>	<b>21EEE644.5,21EEE644.6</b>	<b>8 Hours</b>
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Natural Causes for Over voltage -Lightning phenomenon, Over voltage due to switching surges, Principle of insulation Coordination on High Voltages

Text Book Text Book 1: 8.1,8.2,8.3

**CIE Assessment Pattern (50 Marks - Theory)**

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

**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.High Voltage Engineering by M.S.Naidu and V. Kamaraju – TMH Publications, 6<sup>th</sup> Edition,2020.
2. High Voltage Engineering by C.L.Wadhwa, New Age Internationals (P) Limited, 2010.

**Reference Books:**

1. Extra High Voltage AC Transmission Engineering , Rakosh Das Begamudre, New Age International (P) Ltd., New Delhi – 2007.
- 2.High Voltage Engineering: Fundamentals by E.Kuffel, W.S.Zaengl, J.Kuffel by Elsevier, 2nd Edition, 2000
3. High Voltage Engineering:, E. Kuffel, W. S. Zaengl, J. Kuffel, Cbs Publishers New Delhi, 2nd Edition, 2005.

**Web links and Video Lectures (e-Resources):**

- [https://onlinecourses.nptel.ac.in/noc23\\_ee92/preview](https://onlinecourses.nptel.ac.in/noc23_ee92/preview)
- <https://www.youtube.com/watch?v=DI8Yt1AQRH8>

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

- Visit to any manufacturing high voltage industry,CPRI
- Demonstration of multisatge impulse generator
- Demonstration of working of measurement of high volatge
- Video demonstration of latest trends in high voltage

- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues
- Seminars

## SPECIAL ELECTRICAL MACHINES

<b>Course Code</b>	<b>21EEE645</b>	<b>CIE Marks</b>	<b>50</b>											
<b>L:T:P:S</b>	<b>3:0:0:0</b>	<b>SEE Marks</b>	<b>50</b>											
<b>Hours / Week</b>	<b>3</b>	<b>Total Marks</b>	<b>100</b>											
<b>Credits</b>	<b>03</b>	<b>Exam Hours</b>	<b>03</b>											
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE645.1</b>	Apply the knowledge on construction and working principles of special electrical machines while utilizing the machines for specific application													
<b>21EEE645.2</b>	Analyze the performance of special electrical machines													
<b>21EEE645.3</b>	Acquire knowledge on various types of controllers for special motors													
<b>21EEE645.4</b>	Understand the linear and nonlinear characteristics of special electrical machines													
<b>21EEE645.5</b>	Derive the EMF and torque equations of special electrical machines to obtain the relation between different parameters													
<b>21EEE645.6</b>	Choose appropriate special machines based on applications													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE645.1</b>	3	3	3	2	3	-	-	-	-	-	-	-	1	2
<b>21EEE645.2</b>	3	3	3	2	3	-	-	-	-	-	-	-	1	2
<b>21EEE645.3</b>	3	3	3	2	3	-	-	-	-	-	-	-	1	2
<b>21EEE645.4</b>	3	3	3	2	3	-	-	-	-	-	-	-	1	2
<b>21EEE645.5</b>	3	3	3	2	3	-	-	-	-	-	-	-	1	2
<b>21EEE645.6</b>	3	3	3	2	3	-	-	-	-	-	-	-	1	2
<b>MODULE-1 Reluctance Motors</b>														
												<b>21EEE645.1</b>	<b>8 Hours</b>	
Constructional features, Principle of operation, Types, Axial and radial air gap motors, Phasor diagram, Torque Characteristics, Non-linear analysis, Power controllers, Microprocessor based control and Computer based control and Applications.														
Case Study	Investigate the Challenges of SRM and Synchronous Motor, Compare with traditional areas of science and engineering.													
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16													
<b>MODULE-2 Permanent Magnet Brushless Dc Motors &amp; its Controllers</b>												<b>21EEE645.2</b>	<b>8 Hours</b>	
Commutation in DC motors, Hall sensors, Torque and EMF equation, Torque- speed characteristics, Multiphase Brushless motor, Square wave permanent magnet brushless motor drives, Microprocessor based controller, Sensor less control and Applications														
Applications	Investigate BLDC and its Controllers													
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15													
<b>MODULE-3 Stepping Motors &amp; its Drive Systems</b>												<b>21EEE645.3</b>	<b>8 Hours</b>	
Constructional features, principle of operation, modes of excitation, single phase stepping motors, torque production in variable Reluctance (VR) stepping motor, Dynamic characteristics, Circuit for open loop & Closed loop control of stepping motor, microprocessor based controller and Applications.														
Self-study	Explore the Stepper motor architecture constructions and characteristics.													

Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
<b>MODULE-4</b>	<b>Permanent Magnet Synchronous Motors &amp; its controllers</b>	<b>21EEE645.4</b>	<b>8 Hours</b>
Principle of operation, EMF equation, power input and torque expressions, Phasor diagram, Power controllers, Torque speed characteristics, Self-control, Vector control, Current control schemes and Sensor less control, Applications			
Self-study	Scrutinize the Different types of PMSM and its Controllers		
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
<b>MODULE-5</b>	<b>Industrial Special Machines &amp; Applications</b>	<b>21EEE645.5</b>	<b>8 Hours</b>
AC servomotors, D.C servo motors, universal motors, hysteresis motor, Repulsion motor, Vernier motor, Construction, Working Principles, Characteristics and Applications			
Applications	Analysis on Industrial Special machines, design and applications		
Text Book	Text Book 2: 12.1 to 12.10		
<b>CIE Assessment Pattern(50 Marks - Theory)</b>			
<b>RBT Levels</b>		<b>Marks Distribution</b>	
		<b>Test (s)</b>	<b>NPTEL</b>
		<b>25</b>	<b>25</b>
<b>L1</b>	<b>Remember</b>	-	-
<b>L2</b>	<b>Understand</b>	-	-
<b>L3</b>	<b>Apply</b>	10	5
<b>L4</b>	<b>Analyze</b>	10	10
<b>L5</b>	<b>Evaluate</b>	5	5
<b>L6</b>	<b>Create</b>	-	-
<b>SEE Assessment Pattern(50 Marks - Theory)</b>			
<b>RBT Levels</b>		<b>Exam Marks Distribution (50)</b>	
<b>L1</b>	<b>Remember</b>	-	
<b>L2</b>	<b>Understand</b>	-	
<b>L3</b>	<b>Apply</b>	20	
<b>L4</b>	<b>Analyze</b>	20	
<b>L5</b>	<b>Evaluate</b>	10	
<b>L6</b>	<b>Create</b>	-	
<b>Suggested Learning Resources:</b>			
<b>Text Books:</b>			
1. Special Electrical Machines, mrunaldespande,scitech publications,2017.ISBN:9789385983511			
2. Stepping Motors – A Guide to Motor Theory and Practic,P.P. Aearnley, ,Peter Perengrinus, London, 2002. ISBN:978-085296029			
<b>Reference Books:</b>			
1.Special electrical machines, E.G. Janardanan, PHI learning Private Limited, 2014,ISBN:9788120348806			
2.Special Electrical Machines, K. V. Rathnam Orient Blackswan 2008,ISBN: 978-8173716317			
3.Permanent Magnet and Brushless DC Motors, T. Kenjo and S. Nagamori, Clarendon Press, London, 1988, ISBN: 9780849308373			
4.Stepping Motors and Their Microprocessor Controls, Kenjo, Takashi, Sugawara, Akira, Clarendon Press London, 2003.ISBN: 9780198593850			
5. Stepper Motors–Fundamentals,Applications and Design,V.V.Athani,New Age International Publications, 2006 . ISBN: 978-8122410068			
6. Switched Reluctance Motor and Drives, R. Krishnan, CRC Press, Washington. ISBN: 9780849308383			

**Web links and Video Lectures (e-Resources):**

- <https://archive.nptel.ac.in/courses/108/102/108102156/>
- <https://www.youtube.com/watch?v=NvRAvfrLI-o>
- <https://unacademy.com/lesson/special-electrical-machines-part-1/F7ET5TT0>
- <https://www.youtube.com/watch?v=lfPTKulGxSQ>

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

- Visit to any manufacturing/Special Electrical Machines/ABB industry or any power plant
- Demonstration of different Motoring operations
- Demonstration of working of BLDC
- Demonstration of SRM
- Video demonstration of latest trends in Special Electrical Machines
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues

Seminars



## SOCIAL CONNECT AND RESPONSIBILITY

<b>Course Code</b>	<b>22SCK65</b>	<b>CIE Marks</b>	<b>50</b>
<b>L:T:P:S</b>	<b>0:0:1:0</b>	<b>SEE Marks</b>	<b>--</b>
<b>Hrs / Week</b>	<b>02</b>	<b>Total Marks</b>	<b>50</b>
<b>Credits</b>	<b>01</b>	<b>Exam Hours</b>	<b>02</b>

### Course outcomes:

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

<b>22SCK65.1</b>	Communicate and connect to the surrounding
<b>22SCK65.2</b>	Understand the needs and problems of the community and involve them in problem –solving
<b>22SCK65.3</b>	Develop among themselves a sense of social & civic responsibility and utilize their knowledge in finding practical solutions to individual and community problems
<b>22SCK65.4</b>	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>22SCK65.1</b>	-	-	-	-	-	3	2	-	2	3	-	1
<b>22SCK65.2</b>	-	-	-	-	-	3	2	-	2	3	-	1
<b>22SCK65.3</b>	-	-	-	-	-	3	2	-	2	3	-	1
<b>22SCK65.4</b>	-	-	-	-	-	3	2	-	2	3	-	1

<b>MODULE-1</b>	<b>PLANTATION AND ADOPTION OF A TREE</b>	<b>22SCK65.1, 22SCK65.2</b>	<b>3 Hours</b>
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Plantation of a tree that will be adopted for three years by a group of B. Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature -- Objectives, Visit, case study, report, outcomes.

<b>MODULE-2</b>	<b>HERITAGE WALK AND CRAFTS CORNER</b>	<b>22SCK65.2, 22SCK65.3</b>	<b>3 Hours</b>
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Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms- Objectives, Visit, case study, report, outcomes.

<b>MODULE-3</b>	<b>ORGANIC FARMING AND WASTE MANAGEMENT</b>	<b>22SCK65.4, 22SCK65.5</b>	<b>3 Hours</b>
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Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.

<b>MODULE-4</b>	<b>WATER CONSERVATION</b>	<b>22SCK65.5, 22SCK65.6</b>	<b>3 Hours</b>
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Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

<b>MODULE-5</b>	<b>FOOD WALK</b>	<b>22SCK65.1, 22SCK65.3</b>	<b>3 Hours</b>
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City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

### CIE Assessment Pattern (50 Marks – Activity based) –

- Each module is evaluated as given below and 100 marks in scaled down to 50 as final marks.

CIE component for each module	Marks
Field Visit, Plan, Discussion	10
Commencement of activities and its progress	20
Case study-based Assessment Individual performance with report	20
Module wise study & its consolidation 5*5 = 25	25
Video based seminar for 10 minutes by each student at the end of semester with Report. Activities 1 to 5, 5*5 = 25	25

- Implementation strategies of the project (NSS work).
- Individual student has to submit a final report which should be signed by NSS Officer, the HOD and Principal.
- Finally, the consolidated marks sheet and the reports should be available in the department. .

#### **Activity-Based Learning / Practical Based learning**

- Platform to connect to others and share the stories with others:
  - Jamming session
  - Open mic
  - Poetry
- Share the experience of Social Connect.
- Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

#### **Pedagogy:**

- The students will be divided into groups. Each group will be handled by faculty mentor.
- A total of 40 - 50 hrs engagement in the semester
- Faculty mentor will design the activities (particularly Jamming sessions, open mic and poetry)
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.
- Students should present the progress of the activities as per the schedule in the prescribed practical session in the field.
- There should be positive progress in the vertical order for the benefit of society in general through activities.

#### **Plan of Action:**

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty mentor for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1<sup>st</sup> to 5<sup>th</sup>, compiled report should be submitted as per the instructions and scheme.
- Practice Session Description:
  - Lecture session in field to start activities
  - Students Presentation on Ideas
  - Commencement of activity and its progress
  - 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.

<b>Sl No</b>	<b>Topic</b>	<b>Groupsize</b>	<b>Location</b>	<b>Activity execution</b>	<b>Reporting</b>	<b>Evaluation of the Topic</b>
1.	<b>Plantation and adoption of a tree</b>	May be individual or team (3-5)	Farmers land/ parks / Villages / roadside/ community area / College campus	Site selection / Proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus

2.	<b>Heritage walk and crafts corner</b>	May be individual or team (3-5)	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations /Government Schemes officers/ campus	Site selection /Proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
3.	<b>Organic farming and waste management</b>	May be individual or team (3-5)	Farmers land / parks /Villages visits / roadside/ communityarea / College campus	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
4.	<b>Water conservation : Conservation techniques</b>	May be individual or team (3-5)	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers / campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
5.	<b>Food walk: Practices in society</b>	May be individual or team (3-5)	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus

## MINI PROJECT

<b>Course Code</b>	<b>21EEE67</b>		<b>CIE Marks</b>	<b>50</b>										
<b>L:T:P:S</b>	<b>0:0:1:0</b>		<b>SEE Marks</b>	<b>50</b>										
<b>Hrs / Week</b>	<b>02</b>		<b>Total Marks</b>	<b>100</b>										
<b>Credits</b>	<b>01</b>		<b>Exam Hours</b>	<b>03</b>										
<b>Course outcomes:</b>														
At the end of the course, the student will be able to:														
<b>21EEE67.1</b>	Apply the knowledge learned via several courses to practical issues													
<b>21EEE67.2</b>	Evaluate small hardware systems by using modern tools and technologies													
<b>21EEE67.3</b>	Able to work in teams and manage the conduct of the research study													
<b>21EEE67.4</b>	Communicate and comprehend the work through articles													
<b>21EEE67.5</b>	Articulate the project related activities and findings													
<b>21EEE67.6</b>	Extend or use the idea in mini project for Major project													
<b>Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:</b>														
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>21EEE67.1</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE67.2</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE67.3</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE67.4</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE67.5</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<b>21EEE67.6</b>	3	3	3	2	3	2	2	2	3	3	3	2	2	2
<p>Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. The student shall be capable to recognize a problem in the area of Electrical and Electronics Engineering and solve it using latest technologies in a mini-project. Based on the ability/abilities of the student/s and recommendations of the guide, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students. The mini-project work will be reviewed by a panel of experts throughout the semester. The CIE marks awarded for the Mini-project work shall be based on the work accomplishment, project presentation skill, and question and answer session. The Plagiarized projects will automatically result an F grade and the student will be liable for further disciplinary action. At the completion of a mini project the student will submit a project report, which will be evaluated by duly appointed examiner(s).</p>														
<b>CONTENTS</b>											<b>CO's</b>		<b>Hours</b>	
Perform a literature search to review current knowledge and developments in the chosen technical area. Review and finalization of the Approach to the Problem relating to the chosen topic/title. Preparation of work schedule with a team.											21EEE67.1, 21EEE67.3		<b>5</b>	
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as required for the chosen field											21EEE67.1, 21EEE67.2		<b>5</b>	
Development of product/process, testing, results, conclusions and future directions.											21EEE67.1, 21EEE67.2		<b>5</b>	
Present the work in a forum involving poster presentations and demonstrations of operational hardware and software.											21EEE67.4		<b>5</b>	
Preparation of a project report in the standard format for being evaluated by the guide and the department with plagiarism certificate.											21EEE67.3, 21EEE67.4		<b>5</b>	

**CIE Assessment Pattern (50 Marks - Theory) -**

RBT Levels		Marks Distribution	
		Review 1 (25 Marks)	Review 2 (25 Marks)
		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 - Theory)**

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

**Suggested Learning Resources:****Reference Books:**

1. J B Gupta, "Fundamentals of electrical and Electronics Engineering". S K Kataria and Sons, 2012.
2. Arsath Natheem, 300 electronics projects for inventors with tested circuits, Kindle edition, 2018.

**Web links and Video Lectures (e-Resources):**

- <https://nevonprojects.com/project-ideas/electronics-ideas/>
- <https://schoolmetro.com/1000-electrical-electronics-engineering-final-year-project-topics/>

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

- Video sessions
- Organizing Group wise discussions
- Seminars

<b>NATIONAL SERVICE SCHEME (NSS)</b>												
<b>Course Code</b>	<b>21NSS84</b>						<b>CIE Marks</b>	<b>50</b>				
<b>L:T:P:S</b>	<b>0:0:0:0</b>						<b>SEE Marks</b>	<b>50</b>				
<b>Hrs / Week</b>	<b>2</b>						<b>Total Marks</b>	<b>100</b>				
<b>Credits</b>	<b>00</b>						<b>Exam Hours</b>	<b>2</b>				
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
21NSS84.1	Understand the importance of his / her responsibilities towards society											
21NSS84.2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.											
21NSS84.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.											
21NSS84.4	Implement government or self-driven projects effectively in the field.											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>
21NSS84.1	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.2	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.3	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.4	-	-	-	-	-	3	1	1	3	2	2	1
<b>Semester</b>	<b>CONTENT</b>											<b>HOURS</b>
5 <sup>th</sup> to 8 <sup>th</sup>	<p style="text-align: center;"><b>PART A</b></p> <p>ONENSS-CAMP @College/University/State or Central Govt Level/ NGO's/General Social Camps</p> <p style="text-align: center;"><b>PART B</b></p> <ol style="list-style-type: none"> <li>Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing</li> <li>Waste management-Public, Private and Govt organization, 5R's.</li> <li>Setting of the information imparting club for women leading to contribution in social and economic issues.</li> <li>Water conservation techniques-Role of different stakeholders-Implementation.</li> <li>Preparing an actionable business proposal for enhancing the village income and approach for implementation.</li> <li>Helping local schools to achieve good results and enhance their enrolment in Higher/technical/vocational education.</li> <li>Developing Sustainable Water management system for rural areas and implementation approaches.</li> </ol>											Total 32 Hrs/ Semester  2 Hrs/week
		<ol style="list-style-type: none"> <li>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.</li> <li>Spreading public awareness under rural outreach programs. (minimum 5 programs).</li> <li>Organize National integration and social harmony events/workshops / Seminars. (Minimum 02 programs).</li> <li>Govt. school Rejuvenation and helping them to achieve good infrastructure.</li> </ol>										
<b>CIE Assessment Pattern (50 Marks - Practical) -</b>												
<ol style="list-style-type: none"> <li><b>PART A:</b> Compulsorily students have to attend one camp.</li> <li><b>PART B:</b> Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.</li> </ol>												

3. CIE will be evaluated based on their presentation, approach and implementation strategies.

<b>CIE Components</b>	<b>Marks</b>
Presentation1-Selection of topic-(phase1)	10
Experiential Learning Presentation 2 (phase2)	10
Case Study-based Teaching-Learning	10
Sector-wise study & consolidation	10
Video based seminar (4-5 minutes per student)	10
<b>Total</b>	<b>50</b>

**SEE Assessment Pattern (50 Marks – Practical)**

- Implementation strategies of the project with report duly signed by the Dept’s Coordinator, HoD and Principal.
- At last it should be evaluated by the NSS Coordinator.
- Finally consolidated report should be sent to the University.

**Suggested Learning Resources:**

**Reference Books:**

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

**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.

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)													
Course Code	21PES84							CIE Marks	50				
L:T:P:S	0:0:0:0							SEE Marks	50				
Hrs / Week	2							Total Marks	100				
Credits	00							Exam Hours	02				
<b>Course outcomes:</b> At the end of the course, the student will be able to:													
21PES84.1	Demonstrate the starting and finishing positions of different track and jump events.												
21PES84.2	Demonstrate the holding and releasing stances in various throwing events, and takeoff and landing position in various jumping events of Athletics.												
21PES84.3	Demonstrate the specific skills and techniques of the selected game/event.												
21PES84.4	Demonstrate and describe the rules and regulations of specific games.												
<b>Mapping of Course Outcomes to Program Outcomes:</b>													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
21PES84.1	-	-	-	-	-	-	-	1	2	-	-	1	
21PES84.2	-	-	-	-	-	-	-	1	2	-	-	1	
21PES84.3	-	-	-	-	-	-	-	1	2	-	-	1	
21PES84.4	-	-	-	-	-	-	-	1	2	-	-	1	
<b>Semester</b>													
<b>CONTENT</b>													
<b>HOURS</b>													
5th	<p><b>Fitness Components:</b> Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips.</p> <p><b>Practical Components:</b> Speed, Strength, Endurance, Flexibility, and Agility</p> <p><b>Athletics:</b></p> <ol style="list-style-type: none"> <li>Track -Sprints: <ul style="list-style-type: none"> <li>Starting Techniques: Standing start and Crouch start(its variations)use of Starting Block.</li> <li>Acceleration with proper running techniques.</li> <li>Finishing technique: Run Through, Forward Lunging and Shoulder Shrug.</li> </ul> </li> <li>Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing</li> <li>Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique)</li> </ol> <p style="text-align: center;"><b>Kabaddi OR Kho-Kho</b></p> <p><b>Kabaddi:</b></p> <p>A. Fundamental skills</p> <ol style="list-style-type: none"> <li>Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line.</li> <li>Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques.</li> <li>Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense.</li> <li>Game practice with application of Rules and Regulations.</li> </ol> <p>B. Rules and their interpretations and duties of the officials.</p> <p><b>Kho-Kho:</b></p> <p>A Fundamental skills</p> <ol style="list-style-type: none"> <li>Skills in Chasing: Sit on the box (Parallel &amp; Bullet toe method), Getup from the box (Proximal &amp; Distal foot method), Give Kho (Simple, Early, Late &amp; Judgment), Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul.</li> </ol>											Total 32 Hrs/ Semester	
													2 Hrs/week



	<p>2. Skills in running: Chain Play, Ring play and Chain &amp; Ring mixed play.</p> <p>3. Game practice with application of Rules and Regulations.</p> <p><b>B. Rules and their interpretations and duties of the officials.</b></p>	
<b>6th</b>	<p><b>Athletics:</b></p> <p>1. Track -110 Mtrs and 400Mtrs:</p> <ul style="list-style-type: none"> <li>• Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles</li> <li>• Crouch start (its variations)use of Starting Block.</li> <li>• Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing.</li> </ul> <p>2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing.</p> <p>3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).</p> <p style="text-align: center;"><b>Volleyball OR Throw Ball</b></p> <p><b>Volleyball:</b></p> <p>A. Fundamental skills</p> <p>1. Service: Under arm service, Side arm service, Tennis service, Floating service.</p> <p>2. Pass: Under arm pass, Over-head pass.</p> <p>3. Spiking and Blocking.</p> <p>4. Game practice with application of Rules and Regulations</p> <p>B. Rules and their interpretation and duties of officials.</p> <p><b>Throw Ball:</b></p> <p>A. Fundamental skills: Over hand service, Side arm service, two hand catching, one hand over head return, side arm return.</p> <p>B. Rules and their interpretations and duties of officials</p> <p style="text-align: center;"><b>Football OR Hockey</b></p> <p><b>Football:</b></p> <p>A. Fundamental Skills</p> <p>1. Kicking: Kicking the ball with inside of the foot, Kicking the 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.</p> <p>2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot.</p> <p>3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot.</p> <p>4. Heading: In standing, running and jumping condition.</p> <p>5. Throw-in: Standing throw-in and Running throw-in.</p> <p>6. Feinting: With the lower limb and upper part of the body.</p> <p>7. Tackling: Simple Tackling, Slide Tackling.</p> <p>8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting.</p> <p>9. Game practice with application of Rules and Regulations.</p> <p>C. Rules and their interpretation and duties of officials.</p> <p><b>Hockey:</b></p> <p>A. Fundamental Skills</p> <p>1. Passing: Short pass, Longpass, pushpass, hit</p> <p>2. Trapping.</p> <p>3. Dribbling and Dozing</p> <p>4. Penalty stroke practice.</p>	

	<p>5. Penalty corner practice.</p> <p>6. Tackling: Simple Tackling, Slide Tackling.</p> <p>7. Goal Keeping, Ball clearance- kicking, and deflecting.</p> <p>8. Game practice with application of Rules and Regulations.</p> <p>B. Rules and their interpretation and duties of officials.</p>	
7th	<p><b>Athletics:</b></p> <ol style="list-style-type: none"> <li>1. Track -Relay Race: <ul style="list-style-type: none"> <li>• Starting, Baton Holding/Carrying, Baton Exchange in between zone, and Finishing</li> <li>• Crouch start (its variations) use of Starting Block.</li> <li>• Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing.</li> </ul> </li> <li>2. Jumps- Triple Jump: Approach Run, Take-off, Flight in the Hop, Step, Jump and Landing</li> <li>3. Throws- Javelin Throw: Grip, Carry, and Recovery (3/5 Impulse stride). Release</li> </ol> <p style="text-align: center;"><b>Cricket OR Baseball</b></p> <p><b>Cricket:</b></p> <ol style="list-style-type: none"> <li>A. Fundamental skills</li> <li>1. Batting- Forward Defense Stroke, Backward Defense Stroke, OffDrive, On Drive, Straight Drive, Cover Drive, Square Cut.</li> <li>2. Bowling-Out-swing, In-swing Off Break, Leg Break and Googly.</li> <li>3. Fielding: Catching - The High Catch, The Skim Catch, The Close Catch and throwing at the stumps from different angles. Long Barrier and Throw, Short Throw, Long Throw, Throwing on the Turn.</li> <li>4. Wicket Keeping</li> <li>B. Rules and their interpretation and duties of officials.</li> </ol> <p><b>Baseball:</b></p> <ol style="list-style-type: none"> <li>A. Fundamental skills:</li> <li>1. Player Stances – walking, extending walking, L stance, cat stance Grip – standard grip, choke grip</li> <li>2. Batting – swing and bunt.</li> <li>3. Pitching</li> <li>4. Baseball: slider, fast pitch, curve ball, drop ball, rise ball, change up, knuckle ball, screw ball</li> <li>B. Rules and their interpretations and duties of officials</li> </ol> <p style="text-align: center;"><b>Basketball OR Net Ball</b></p> <p><b>Basketball:</b></p> <ol style="list-style-type: none"> <li>A. Fundamental Skills</li> <li>1. Passing: Two hand Chest Pass, Two hands Bounce Pass, One hand Baseball Pass, Side arm Pass, Overhead Pass, Hook Pass.</li> <li>2. Receiving: Two hand receiving, One hand receiving, Receiving in stationary position, Receiving while Jumping and Receiving while Running.</li> <li>3. Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble.</li> <li>4. Shooting: Lay-up shot and its variations, One hand set shot, Two hands jump shot, Hook shot, Free Throw.</li> <li>5. Rebounding: Defensive rebound and Offensive rebound.</li> <li>6. Individual Defence: Guarding the player with the ball and without the ball, Pivoting.</li> <li>7. Game practice with application of Rules and Regulations.</li> </ol> <p><b>Netball:</b></p> <ol style="list-style-type: none"> <li>A. Fundamental Skills</li> <li>1. Catching: one handed, two handed, with feet grounded and in flight.</li> <li>2. Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce).</li> </ol>	

	<p>3. Footwork: Landing on one foot, landing on two feet, Pivot, Running pass.</p> <p>4. Shooting: One hand, forward step shot, and backward step shot.</p> <p>5. Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed.</p> <p>6. Defending: Marking the player, marking the ball, blocking, inside the circle, outside the circle. Defending the circle edge against the passing.</p> <p>7. Intercepting: Pass and shot.</p> <p>8. Game practice with application of Rules and Regulations.</p> <p>B. Rules and their interpretation and duties of officials.</p>	
<p style="text-align: center;"><b>8th</b></p>	<p><b>Athletics:</b></p> <p>A. Track -Combined Events:</p> <ol style="list-style-type: none"> <li>a. Heptathlon all the 7 events</li> <li>b. Decathlon: All 10 Events</li> </ol> <p>B. Jumps- Pole Vault: Approach Run, Planting the Pole, Take-off, Bar Clearance and Landing.</p> <p>C. Throws- Hammer Throw: Holding the Hammer, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).</p> <p style="text-align: center;"><b>Shuttle Badminton OR Table Tennis</b></p> <p><b>Shuttle Badminton:</b></p> <p>A. Fundamental skills</p> <p>D. Basic Knowledge: Various parts of the Racket and Grip.</p> <p>E. Service: Short service, Long service, Long-high service.</p> <p>F. Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash.</p> <p>G. Game practice with application of Rules and Regulations.</p> <p>B. Rules and their interpretation and duties of officials.</p> <p><b>Table Tennis:</b></p> <p>A. Fundamental skills:</p> <ol style="list-style-type: none"> <li>1. Basic Knowledge: Various parts of the Racket and Grip(Shake Hand &amp; PenHold Grip).</li> <li>2. Stance: Alternate &amp; Parallel.</li> <li>3. Push and Service: Backhand &amp;Forehand.</li> <li>4. Chop: Backhand &amp; Forehand.</li> <li>5. Receive: Push and Chop with both Backhand &amp; Forehand.</li> <li>6. Game practice with application of Rules and Regulations.</li> </ol> <p>B. Rules and their interpretations and duties of officials</p> <p style="text-align: center;"><b>Handball OR Ball Badminton</b></p> <p><b>Handball:</b></p> <p>A. Fundamental Skills</p> <ol style="list-style-type: none"> <li>1. Catching, Throwing and Ball control,</li> <li>2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot.</li> <li>3. Dribbling: High and low.</li> <li>4. Attack and counter attack, simple counter attack, counter attack from two wings and center.</li> <li>5. Blocking, Goal Keeping and Defensive skills.</li> <li>6. Game practice with application of Rules and Regulations.</li> </ol> <p>B. Rules and their interpretations and duties of officials</p> <p><b>Ball badminton:</b></p> <p>A. Fundamental Skills</p> <ol style="list-style-type: none"> <li>1. Basic Knowledge: Various parts of the Racket and Grip.</li> <li>2. Service: Short service, Long service, Long-high service.</li> <li>3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash.</li> <li>4. Game practice with application of Rules and Regulations.</li> </ol> <p>B. Rules and their interpretation and duties of officials.</p>	

**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
5 <sup>th</sup> Semester	10
6 <sup>th</sup> Semester	10
7 <sup>th</sup> Semester	15
8 <sup>th</sup> Semester	15
<b>Total</b>	<b>50</b>

**SEE Assessment Pattern (50 Marks - Practical)**

SEE	Marks
Athletics	20
Kabaddi OR Kho-Kho	05
Volleyball / Throw ball	05
Football/Hockey	05
Netball/Basketball	05
Shuttle Badminton / Table Tennis	05
Handball/ Badminton	05
<b>Total</b>	<b>50</b>

**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, etal. Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, NewDelhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, NewDelhi.
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, NewDelhi.
10. Dubey, H.C. Basketball, Discovery Publishing House, NewDelhi.
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, NewDelhi.
14. Sally Kus, Coaching Volleyball Successfully, Human Kinetics.
15. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
16. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata

YOGA												
Course Code	21YOG84						CIE Marks	50				
L:T:P:S	0:0:0:0						SEE Marks	50				
Hrs / Week	2						Total Marks	100				
Credits	00						Exam Hours	02				
<b>Course outcomes:</b>												
At the end of the course, the student will be able to:												
21YOG84.1	Use Yogasana practices in an effective manner											
21YOG84.2	Become familiar with an authentic foundation of Yogic practices											
21YOG84.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas											
21YOG84.4	Use the teachings of Patanjali in daily life.											
<b>Mapping of Course Outcomes to Program Outcomes:</b>												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21YOG84.1	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.2	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.3	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.4	-	-	-	-	-	3	-	-	2	-	-	1
<b>Semester</b>	<b>CONTENT</b>										<b>HOURS</b>	
<b>5th</b>	<p><b>Introduction of Yoga:</b> Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer</p> <p><b>Brief introduction of yogic practices for common man:</b> Yogic practices for common man to promote positive health</p> <p><b>Rules and regulations:</b> Rules to be followed during yogic practices by practitioner</p> <p><b>Misconceptions of yoga:</b> Yoga its misconceptions, Difference between yogic and non-yogic practices.</p> <p><b>Suryanamaskara:</b></p> <ol style="list-style-type: none"> <li>1. Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar.</li> <li>2. Suryanamaskar 12 count, 2 rounds</li> </ol> <p><b>Kapalabhati:</b> Meaning, importance and benefits of Kapalabhati - 40 strokes/min 3 rounds</p> <p><b>Different types of Asanas:</b></p> <ol style="list-style-type: none"> <li>1. Sitting: Padmasana, Vajrasana, Sukhasana</li> <li>2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana</li> <li>3. Prone line: Bhujangasana, Shalabhasana</li> <li>4. Supine line: Utthitadvipadasana, Ardhalasana, Halasana</li> </ol> <p><b>Patanjali's Ashtanga Yoga:</b> Yama, Niyama</p> <p><b>Pranayama:</b> Suryanuloma - Viloma, Chandranuloma - Viloma</p>										Total 32 Hrs/ Semester  2 Hrs/week	
<b>6th</b>	<p><b>Suryanamaskara:</b> Suryanamaskar 12 count, 4 rounds</p> <p><b>Kapalabhati:</b> Revision of Kapalabhati - 60 strokes/min 3 rounds</p> <p><b>Different types of Asanas:</b></p> <ol style="list-style-type: none"> <li>1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana</li> <li>2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana</li> <li>3. Prone line: Dhanurasana</li> <li>4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana</li> </ol> <p><b>Patanjali's Ashtanga Yoga:</b> Asana, Pranayama</p> <p><b>Pranayama:</b> Chandra Bhedana, Nadishodhana, Surya Bhedana</p>											
<b>7th</b>	<p><b>Suryanamaskara:</b> Suryanamaskar 12 count, 8 rounds</p> <p><b>Kapalabhati:</b> Revision of Kapalabhati - 80 strokes/min 3 rounds</p> <p><b>Different types of Asanas:</b></p> <ol style="list-style-type: none"> <li>1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana,</li> </ol>											

	<p>Yogamudra in Vajrasana</p> <p>2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana</p> <p>3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana</p> <p>4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana</p> <p><b>Patanjali's Ashtanga Yoga:</b> Pratyahara, Dharana</p> <p><b>Pranayama:</b> Ujjayi, Sheetali, Sheektari</p>	
<b>8th</b>	<p><b>Suryanamaskara:</b> Suryanamaskar 12 count, 12 rounds</p> <p><b>Kapalabhati:</b> Revision of Kapalabhati - 100 strokes/min 3 rounds</p> <p><b>Different types of Asanas:</b></p> <p>1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana</p> <p>2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana</p> <p>3. Prone line: Mayurasana</p> <p>4. Supine line: Setubandhasana, Shavasana (Relaxation posture)</p> <p>5. Balancing: Sheershasana</p> <p><b>Patanjali's Ashtanga Yoga:</b> Dhyana (Meditation), Samadhi</p> <p><b>Pranayama:</b> Bhastrika, Bhramari, Ujjai</p> <p><b>Shat Kriyas:</b> Jalaneti and sutraneti, Sheetkarma Kapalabhati</p>	

#### CIE Assessment Pattern (50 Marks - Practical) -

CIE to be evaluated every semester end based on practical demonstration of Yogasana learnt in the semester.

CIE	Marks
5 <sup>th</sup> Semester	10
6 <sup>th</sup> Semester	10
7 <sup>th</sup> Semester	15
8 <sup>th</sup> Semester	15
<b>Total</b>	<b>50</b>

#### SEE Assessment Pattern (50 Marks - Practical)

SEE	Marks
Suryanamaskara	10
Kapalabhati	10
Asanas	10
Patanjali's Ashtanga Yoga	10
Pranayama / Shat Kriyas	10
<b>Total</b>	<b>50</b>

#### Suggested Learning Resources:

##### Reference Books:

- Swami Kuvilyananda: Asma (Kavalyadhama, Lonavala)
- Tiwari, O P: Asana Why and How
- Ajitkumar: Yoga Pravesha (Kannada)
- Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
- Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
- Nagendra H R: The art and science of Pranayama
- Tiruka: Shatkriyegalu (Kannada)
- Iyengar B K S: Yoga Pradipika (Kannada)
- Iyengar B K S: Light on Yoga (English)

## **APPENDIX A**

### **List of Assessment patterns**

1. Assignment
2. Group Discussions
3. Case studies
4. Practical Orientation on design thinking, Creative & Innovation
5. Participatory & Industry-Integrated Learning
6. Practical Activities/Problem Solving Exercises
7. Class Presentations
8. Analysis of Industry/Technical/Business Reports
9. Reports on Industrial Visits
10. Industrial/Social/Rural Projects
11. Participation in External Seminars/Workshops
12. 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.

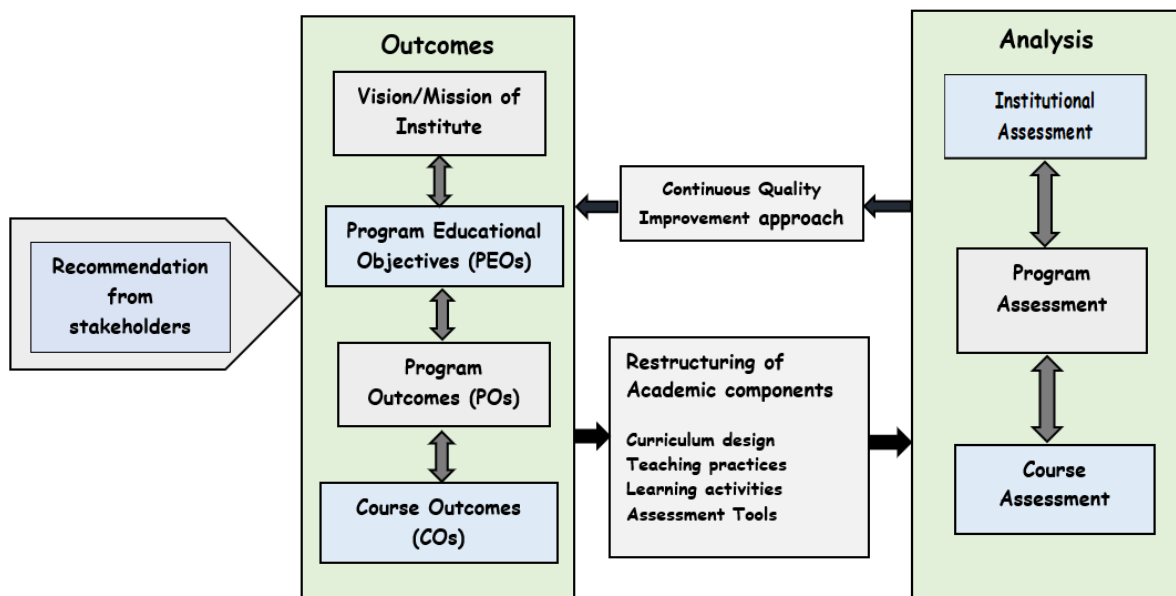
There are three educational Outcomes as defined by the National Board of Accreditation:

**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. [nbaindia.org]

**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. Hat 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. [eduglosarry.org]

