

**Dr. Ambedkar Institute of Technology, Bengaluru-560056**  
**Outcome Based Education(OBE) and Choice Based Credit System**  
**B.E. Name of the programme: Electrical and Electronics Engineering**  
**Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24( Batches 2022 & 2023)**

**V SEMESTER**

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	22EET501	Management and Entrepreneurship	EEE	3	0	0		03	50	50	100	3
2	IPCC	22EEU502	Linear Control Systems	EEE	3	0	2		03	50	50	100	4
3	PCC	22EET503	Power System Analysis	EEE	4	0	0		03	50	50	100	4
4	PCCL	22EEL504	Scilab/MATLAB for Electrical Measurements Lab	EEE	0	0	2		03	50	50	100	1
5	PEC	22EET505x	Professional Elective Course	EEE	3	0	0		03	50	50	100	3
6	PROJ	22EEM506	Mini Project		0	0	4		03	100		100	2
7	AEC	22RMT507	Research Methodology and IPR	EEE department	2	2	0		03	50	50	100	3
8	MC	22CVT507	Environmental Studies	TD: CV PSB: CV	2	0	0		02	50	50	100	2
9	HS	22CDN508	Aptitude and Verbal Ability Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN509	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	PP/ NP
		22PEN509	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON509	Yoga	Yoga Teacher									
Total									500	300	800	22	

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study CIE: Continuous Internal Evaluation, SEE:Semester End Evaluation. K : The letter in the course code indicates common to all the stream of Engineering. PROJ: Project /Mini Project. PEC: Professional Elective Course

**Professional Elective Course 22XXT505x**

22EET505A	Programmable Logic Controller	22EET505C	Electrical Vehicle Technology
22EET505B	Smart Grid Technologies and Applications	22EET505D	OOPS with C++

22EET505E	Transmission and Distribution		
<p><b>Professional Core Course (IPCC):</b> Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23</p> <p><b>National Service Scheme /Physical Education/Yoga:</b> All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.</p>			
<p><b>Mini-project work:</b> 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 single discipline or multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.</p> <p><b>CIE procedure for Mini-project:</b></p> <p><b>(i) Single discipline:</b> 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 batch mates.</p> <p><b>(ii) Interdisciplinary:</b> 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 ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.</p> <p><b>No SEE component for Mini-Project.</b></p>			
<p><b>Professional Elective Courses (PEC):</b> 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. Each group will provide an option to select one course. The minimum number of students’ strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.</p>			

Course Title	<b>MANAGEMENT AND ENTREPRENEURSHIP</b>						
Course Code	<b>22EET501</b>						
Category	<b>HSMC</b>						
Scheme and Credits	No. of Hours/Week					Total teaching + Lab hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>03</b>
CIE Marks: <b>40+5(A)+5(GA)</b>	SEE Marks: <b>50</b>	<b>Total Max. marks:100</b>			Duration of SEE: <b>03 Hours</b>		

**COURSE OBJECTIVE:**

1. To introduce the field of management, task of the manager, importance of planning and types of planning, staff recruitment and selection process.
2. To discuss the ways in which work is allocation, structure of organizations, modes of communication and importance of managerial control in business.
3. To explain need of coordination between the manager and staff, the social responsibility of business and leadership.
4. To discuss the importance of Small Scale Industries and the related terms and problems involved.
5. To introduce the concepts of project management and discuss capitol building process.

<b>UNIT I</b>	<b>8 hours</b>
<b>Management:</b> Definition, Importance – Nature and Characteristics of Management, Management Functions, Roles of Manager, Levels of Management, Managerial Skills, Management & Administration, Management as a Science, Art & Profession.	
<b>Planning:</b> Nature, Importance and Purpose Of Planning, Types of Plans, Steps in Planning, Limitations of Planning, Decision Making – Meaning, Types of Decisions- Steps in Decision Making.	
<b>UNIT II</b>	<b>8 hours</b>
<b>Organizing and Staffing:</b> Meaning, Nature and Characteristics of Organization – Process of Organization, Principles of Organization, Departmentalization, Committees – meaning, Types of Committees, Centralization Versus Decentralization of Authority and Responsibility, Span of Control (Definition only), Nature and Importance of Staffing, Process of Selection and Recruitment.	
<b>Directing and Controlling:</b> Meaning and Nature of Directing-Leadership Styles, Motivation Theories Communication – Meaning and Importance, Coordination- Meaning and Importance, Techniques of Coordination. Controlling – Meaning, Steps in Controlling.	
<b>UNIT III</b>	<b>8 hours</b>
<b>Social Responsibilities of Business:</b> Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance.	
<b>Entrepreneurship:</b> Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Intrapreneur – An Emerging Class, Comparison between Entrepreneur and Intrapreneur, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs.	
<b>UNIT IV</b>	<b>8 hours</b>
<b>Modern Small Business Enterprises:</b> Role of Small Scale Industries, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Impact of Globalization on SSI, Impact of WTO/GATT on SSIs, Ancillary Industry and Tiny Industry (Definition only).	
<b>Institutional Support for Business Enterprises:</b> Introduction, Policies & Schemes of Central–Level Institutions, State-Level Institutions.	
<b>UNIT V</b>	<b>8 hours</b>
<b>Project Management:</b> Meaning of Project, Project Objectives & Characteristics, Project Identification- Meaning & Importance; Project Life Cycle, Project Scheduling, Capital Budgeting, Generating an Investment Project Proposal, Project Report-Need and Significance of Report, Contents, Formulation, Project Analysis-Market, Technical, Financial, Economic, Ecological, Project Evaluation and Selection, Project Financing, Project Implementation Phase, Human & Administrative aspects of	

Project Management, Prerequisites for Successful Project Implementation.

**New Control Techniques-** PERT and CPM, Steps involved in developing the network, Uses and Limitations of PERT and CPM .

**TEACHING LEARNING PROCESS:** Chalk and Talk, power point presentation, animations, videos

**COURSE OUTCOMES:** On completion of the course, student should be able to:

**CO1:** Explain the field of management, task of the manager, planning and steps in decision making.

**CO2:** Discuss the structure of organization, importance of staffing, leadership styles, modes of communication, techniques of coordination and importance of managerial control in business.

**CO3:** Explain the concepts of entrepreneurship and a businessman's social responsibilities towards different groups.

**CO4:** Show an understanding of role of SSI's in the development of country and state/central level institutions/ agencies supporting business enterprises.

**CO5:** Discuss the concepts of project management, capital budgeting, project feasibility studies, need for project report and new control techniques.

### TEXT BOOKS

1. Principles of Management, P.C.Tripathi, P.N.Reddy, McGraw Hill, 6th Edition, 2017.
2. Entrepreneurship Development And Small Business Enterprises, Poornima, M.Charanthimath, Pearson, 2nd Edition, 2014.

### REFERENCE BOOKS

1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2007.
2. Essentials of Management: An International, Innovation and Leadership Perspective, Harold Koontz, Heinz Wehrich, McGraw Hill, 10th Edition, 2016

### ONLINE RESOURCES

1. <http://dSPACE.vnbrims.org:13000/xmlui/bitstream/handle/123456789/4983/Management%20and%20Entrepreneurship.pdf?sequence=1>
2. <https://www.gopalancolleges.com/gcem/course-material/ece/course-plan/sem-V/management-and-entrepreneurship-10AL51.pdf>
3. [https://bmsce.ac.in/Content/CS/MnE\\_course\\_content\\_22\\_KS.pdf](https://bmsce.ac.in/Content/CS/MnE_course_content_22_KS.pdf)

### SCHEME FOR EXAMINATIONS

- (i) The question paper will have ten full questions carrying equal marks.
- (ii) Each full question will be for 20 marks.
- (iii) There will be two full questions from each module.
- (iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
- (v) The students have to answer five full questions, selecting one full question from each module.

### MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1								1	3	1	3	1			3
CO2								1	3	1	3	1			3
CO3						3		1	3	1	3	1			3
CO4						3		1	3	1	3	1			3
CO5								1	3	1	3	1			3

Strength of correlation: Low-1, Medium- 2, High-3

Course Title	<b>LINEAR CONTROL SYSTEM</b>						
Course Code	<b>22EEU502</b>						
Category	<b>Integrated Professional Core Course (IPCC)</b>						
Scheme and Credits	No. of Hours/Week					Total teaching hours + Lab hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>02</b>	<b>00</b>	<b>05</b>	<b>40+20</b>	<b>04</b>
CIE Marks: <b>30T+20L</b>	SEE Marks: <b>50</b>	Total Max. marks: <b>100</b>			Duration of SEE: <b>03 Hours</b>		

### COURSE OBJECTIVE:

1. Learn the type of System, dynamics of physical systems, classification of control system, analysis and design objective.
2. Represent the system by a transfer function, block diagram reduction method, and Mason's gain formula.
3. Learn time response analysis and demonstrate their knowledge of frequency response.
4. Learn stability analysis of the system using Root locus, bode plot and Nyquist plot.
5. Learn the concept of Compensator and controller.

### COURSE CONTENT:

<b>UNIT I</b>	<b>08 hours</b>
<p>a) <b>Modelling of Systems:</b> The control system, mathematical models of physical systems introduction, differential equations of physical systems, Mechanical systems, Friction, Translational systems, Rotational systems, Electrical systems, Analogous systems.</p> <p>b) <b>Block diagram and signal flow graph:</b> To find the overall transfer function.</p>	
<b>UNIT II</b>	<b>08 hours</b>
<p>a) <b>Time Response of feedback control systems:</b> Standard test signals, Unit step response of first and second-order systems, Time response specifications, Time response specifications of second-order systems, steady-state errors and error constants.</p> <p>b) <b>Compensators:</b> RC lag, RC lead, RC lag-lead networks.</p>	
<b>UNIT III</b>	<b>08 hours</b>
<p>a) <b>Stability analysis:</b> Concepts of stability, Necessary conditions for stability, Routh-stability criterion, Relative stability analysis.</p> <p>b) <b>Root Locus Techniques:</b> Introduction, root locus concepts, Construction of root loci and stability studies. (Numerical only with max. 2-Poles, 2-Zeros)</p>	
<b>UNIT IV</b>	<b>08 hours</b>
<p>a) <b>Stability in Frequency Domain:</b> Frequency Domain Specifications, Correlation between time and frequency responses, Bode plot (Numerical only with max. 2-Poles, 2-Zeros), Determination of transfer function from Bode plot.</p> <p>b) <b>Controllers:</b> Introduction to Controllers, Necessity of Controllers, Block diagram representation of feedforward and feedback controller, Effects of Addition of Poles and zeros in plant transfer function (With respect to stability), Introduction to PID Control: Effect of Proportional, Integral, and Differential controller on time domain behaviour of the system.</p>	
<b>UNIT V</b>	<b>08 hours</b>
<p>a) <b>State Variable Analysis and Design:</b> Introduction, concept of state, state variables and state model, state modelling of linear systems. State space representation using physical variables, phase variables &amp; canonical variables. Introduction to state equation.</p>	

S.No	Laboratory Component	No. of Hours	BTL
1.	Simulation of a typical second order system and determination of step response and evaluation of time- domain specifications using MATLAB.	2	1-4
2.	Speed – torque characteristic of a two - phase A.C. servomotor.	2	1-4
3.	Speed torque characteristic of a D.C. servomotor.	2	1-4
4.	Study of the effect of P, PI, PD and PID controller on the step response of a feedback control system using MATLAB.	2	1-4
5.	Simulation of a D. C. position control system and its step response using MATLAB.	2	1-4
6.	Determination of phase margin and gain margin of a transfer function by Bode Plots and verification by simulation.	2	1-4
7.	Construction of Root locus for transfer function and verification by simulation.	2	1-4
<b>Beyond Syllabus</b>			
1.	Design and implementation of RC lead compensator.	2	1-4
2.	Design and implementation of RC lag compensator.	2	1-4
3.	Synchro pair characteristics.	2	1-4

**TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos**

**COURSE OUTCOMES:** On completion of the course, student should be able to:

**CO1:** Develop mathematical models of a variety of physical systems.

**CO2:** Understand the time response of the system for various inputs.

**CO3:** Analyze the stability of the system in the time domain and frequency domain.

**CO4:** Understand the need for a compensator and PID controller.

**CO5:** Construct state space models of SISO and MIMO systems.

**TEXT BOOKS**

- Control Systems Engineering, J. Nagrath and M. Gopal, New Age International (P) Ltd, 4th Edition.

**REFERENCE BOOKS**

- Modern Control Engineering, K. Ogata, Pearson Education Asia / PHI, 4th Edition.
- Automatic Control Systems, Benjamin Kuo, PHI, 7th Edition.
- Concepts of Control Systems, P. S. Satyanarayana, 1st edition, Dynaram publishers, 2001

**ONLINE RESOURCES**

- [https://ctms.engin.umich.edu/CTMS/index.php?aux=About\\_Tutorials](https://ctms.engin.umich.edu/CTMS/index.php?aux=About_Tutorials)
- <https://www.youtube.com/watch?v=HcLYoCmWOjI&list=PLBlnK6fEyqRhqzJT87LsdQKYZBC93ezDo>
- <https://www.youtube.com/watch?v=NwK5dPESz7w&list=PLgzL8klq6DKZ90WIGyN3UH3Xu11toztr>

**SCHEME FOR EXAMINATIONS**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions from each module.
- Each full question will have sub-questions (subject to a maximum of four sub-questions)
- The students have to answer five full questions, selecting one full question from each module.

**MAPPING of COs with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO1	3	3			1					1			3		1
CO2	3	3			1					1			3		1
CO3	3	3			1					1			3		1
CO4	3	3			1					1			3		1
CO5	3	3			1					1			3		1
<b>Strength of correlation:</b> Low-1, Medium- 2, High-3															

Course Title	<b>POWER SYSTEM ANALYSIS</b>						
Course Code	<b>22EET503</b>						
Category	<b>PCC</b>						
Scheme and Credits	No. of Hours/Week					Total teaching + Lab hours	Credits
	L	T	P	SS	Total		
	<b>04</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>04</b>	<b>52</b>	<b>04</b>
CIE Marks: <b>40+5(A)+5(GA)</b>	SEE Marks: <b>50</b>	Total Max. marks: <b>100</b>			Duration of SEE: <b>03 Hours</b>		

**COURSE OBJECTIVE:**

1. Modelling of power system elements and representing the power system by single line diagram.
2. Apply symmetrical components in power system analysis.
3. Perform fault analysis on power system network.
4. Perform stability analysis on power system network.
5. Evaluate the performance of induction machine under unbalanced supply conditions

<b>UNIT I</b>	<b>10 hours</b>
<b>Representation of Power System Components:</b> Circuit models of transmission line, synchronous machines, transformers and load. Single line diagram, impedance and reactance diagrams. Per unit system, per unit impedance diagram of power system.	
<b>UNIT II</b>	<b>10 hours</b>
<b>Symmetrical 3 - Phase Fault:</b> Transients in power system network under short circuit. Transient, sub transient and steady state reactance's. Short circuit current envelopes of synchronous machines. Determination of Short-circuit currents of synchronous machines and power system. Short circuit capacity of a bus. Selection of Circuit Breakers.	
<b>UNIT III</b>	<b>11 hours</b>
<b>a) Symmetrical Components:</b> Introduction, three phase operator-a. Synthesising & Resolving of unbalanced vectors & symmetrical components. Symmetrical components of line & phase voltages in star & delta connected circuits. Phase shift of symmetrical components in transformer banks. Power in terms of symmetrical component.	
<b>b) Sequence impedances-</b> in symmetrical and unsymmetrical circuits, power system components. Positive, negative and zero sequence networks of power system	
<b>UNIT IV</b>	<b>11 hours</b>
<b>Unsymmetrical Faults: a) Shunt faults:</b> Introduction. Single line to ground fault (LGF), line to line fault (LLF) and double line to ground fault (LLGF): Determination of faults currents, terminal currents & voltages and connection of sequence networks. Fault with fault impedance. Fault on power system.	
<b>b) Series faults:-</b> Open circuit faults. Unbalanced and single phase operation of three phase induction motor	
<b>UNIT V</b>	<b>10 hours</b>
<b>Power System Stability:</b> Introduction, classification of stability, steady state and transient stability. Power angle equation of salient and non-salient pole machines. Power angle curves. Stability limits and methods to improving the stability. Rotor dynamics and the swing equation. Equal area criterion and critical clearing angle & time. Apply equal area criterion for transient stability evaluation under different operating conditions of power system.	

**TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos**

**COURSE OUTCOMES:** On completion of the course, student should be able to:

- CO1:** Reproduce the equivalent circuits of power system components and to draw the single line & impedance diagrams of power system network.
- CO2:** Analyze the behaviour of power system under short circuit fault conditions.
- CO3:** Apply concept of symmetrical components to power system network.
- CO4:** Analyze the behaviour of power system under unsymmetrical short circuit fault conditions and open circuit fault.
- CO5:** Evaluate the steady state and transient stability of the Power Systems.

**TEXT BOOKS**

1. W.D.Stevenson, “Elements of Power System Analysis”, Fourth Edition, TMH, 2013
2. I.J.Nagrath and D.P.Kothari, “Modern Power System Analysis”, 3<sup>rd</sup> Edition TMH, 2003
3. Lab manual for practical’s

**REFERENCE BOOKS**

1. Hadi Sadat “Power System Analysis”, Second Edition, TMH, 2009
2. R.Bergen, and Vijay Vittal, “Power System Analysis”, 2<sup>nd</sup> edition, CRC Press, 2006
3. G.L. Kusic. “Computer Aided Power system analysis”, PHI.Indian Edition, 2010
4. Naser A and Boldea I, “Linear Electric Motors: Theory”, First Edition,Prentice, 2003
5. W.D. Stevenson & Grainger, “Power System Analysis”, Clarendon Press, Oxford, 1989.

**ONLINE RESOURCES**

1. <https://onlinecourses.nptel.ac.in/https://www.eeeguide.com/analysis-of-unsymmetrical-faultshttps://www.eeeguide.com/analysis-of-unsymmetrical-faults//>
2. <https://www.bvmengineering.ac.in/syllabi/UG1920/EE/3EE02.pdf>
3. [http://www.brainkart.com/subject/Special-Electrical-Machines\\_185/](http://www.brainkart.com/subject/Special-Electrical-Machines_185/)

**SCHEME FOR EXAMINATIONS**

- (i) The question paper will have ten full questions carrying equal marks.
- (ii) Each full question will be for 20 marks.
- (iii) There will be two full questions from each module.
- (iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
- (v) The students have to answer five full questions, selecting one full question from each module.

**MAPPING of COs with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
<b>CO11</b>	3	3	1						1	1		2	3	1	1
<b>CO2</b>	3	3	1	2	1				1	1		2	3	1	1
<b>CO3</b>	3	3	1	2	1				1	1	1	2	3	1	1
<b>CO4</b>	3	3	1	2	1				1	1	1	2	2	1	1
<b>CO5</b>	3	3	1	2	1				1	1	1	2	3	1	1
<b>Strength of correlation: Low-1, Medium- 2, High-3</b>															

Course Title:	<b>SCILAB/MATLAB FOR ELECTRICAL MEASUREMENTS</b>						
Course Code:	<b>22EEL504</b>						
Category	<b>PCCL</b>						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	<b>00</b>	<b>00</b>	<b>02</b>	<b>00</b>	<b>02</b>	<b>24</b>	<b>01</b>
CIE Marks: <b>50</b>	SEE Marks: <b>50</b>	Total Max. marks: <b>100</b>			Duration of SEE: <b>03 Hours</b>		

### COURSE OBJECTIVE:

1. Understand the main features and importance of the SCILAB mathematical programming environment.
2. Understand the method of measurement of Resistance, Inductance and Capacitance.
3. Understand the measurement of Frequency, power and power factor in Single and Three Phase Circuits.
4. Understand the method of measurement of Energy in Three Phase Circuits.
5. Analyse the characteristic behavior of Current Transformer and Voltage Transformer.

Sl. NO	Laboratory Component	No. of hours	BTL
1.	Design and Analysis of measurement of Resistance using Wheatstone and Kelvins double bridge.	2	L1, L2, L3
2.	Design and Analysis of measurement of Inductance using Schering and De-Sauty's Bridges.	2	L1, L2, L3
3.	Design and Analysis of measurement of Inductance using Maxwells and Anderson Bridges.	2	L1, L2, L3,L4
4	Design and Analysis of measurement of Frequency in Single and Three Phase Circuits.	2	L1, L2, L3, L4
5	Design and Analysis of measurement of Real Power, Reactive and Power Factor in Three Phase Circuits.	2	L1, L2, L3
6	Design and Analysis of measurement of Energy in Three Phase Circuits.	2	L1, L2, L3
7	Design and Analysis of measurement of Flux and Flux density.	2	L1, L2, L3
	<b>Experiments beyond the Syllabus</b>		
8	Testing and Analysis of Current Transformer using Silsbee's Deflection Method.	2	L2, L3
9	Testing and Analysis of Voltage Transformer using Silsbee's Deflection Method.	2	L1, L2, L3, L4
10	Design and Analysis of True RMS Reading Volt Meters.	2	L1, L2, L3, L4

**COURSE OUTCOMES:** On completion of the course, student should be able to:

- CO1:** Apply the main features and importance of the MATLAB/ SCILAB mathematical programming environment.  
**CO2:** Simulate the measurement of resistance, inductance and capacitance  
**CO3:** Simulate measurement of frequency, power and power factor in Single and Three Phase Circuits  
**CO4:** Simulate of measurement of energy in Three Phase Circuits  
**CO5:** Analyse the characteristic behavior of Current Transformer and Voltage Transformer.

### TEXT BOOKS

1. Scilab Textbook A course in Electrical and Electronic Measurement and Instrument by A K Sawhney

### REFERENCE BOOKS

1. Scilab / Matlab Manual for Electrical and Electronic Measurement Lab



Course Title:	<b>PROGRAMMABLE LOGIC CONTROLLERS</b>						
Course Code:	<b>22EET505A</b>						
Category	<b>Professional Elective Course (PEC)</b>						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>03</b>
CIE Marks: <b>40+5(A)+5(GA)</b>	SEE Marks: <b>50</b>	Total Max. marks: <b>100</b>			Duration of SEE: <b>03 Hours</b>		

**COURSE OBJECTIVE:**

1. The need of automation in the industry with basic controller mechanisms involved.
2. The programming concepts to achieve the desired goal or to define the various steps involved in the automation and the programming languages involved with basic subroutine functions.
3. To make use of the internal hardware circuits of automation circuit to control the devices during various states with monitoring the timers and counters
4. To handle the data of the I/O devices to interface the data with the controller and auxiliary devices.

**COURSE CONTENT:**

<b>UNIT I</b>	<b>8 hours</b>
<b>Introduction:</b> programmable logic controller (PLC). Role in automation (SCADA). Advantages and Disadvantages, Hardware of PLC, Internal Architecture, Sourcing and Sinking, <b>Input and Output Devices:</b> Characteristics of I/O devices, List of input devices- mechanical switches, proximity switches, photoelectric sensor and switches, temperature sensor. Output devices- relay, directional control valve and motor. Examples of applications- conveyor belt, lift and Liquid level monitoring.	
<b>UNIT II</b>	<b>8 hours</b>
<b>I/O Processing:</b> Input unit / Output unit, Signal conditioning- changing voltage level, Remote connection- serial and parallel communication, serial standard. Networks and its types. <b>Programming:</b> Ladder Diagrams- PLC ladder programming, Logic Functions, Latching, Multiple Outputs, Function Blocks- Logic gates, Boolean Algebra, Program Examples- Signal lamp task, Valve operation program.	
<b>UNIT III</b>	<b>8 hours</b>
<b>Programming Methods:</b> Instruction Lists- Ladder programs and Instruction lists, Branch codes, Programming Examples- Signal lamp task and Valve operation program. Sequential Function Charts- Branching and convergence. Structured Text- Conditional statement and iteration statements <b>i) Internal Relays:</b> internal relay, ladder programs- programs with multiple input conditions and Latching programs, Battery-Backed relays.	
<b>UNIT IV</b>	<b>8 hours</b>
<b>ii) Internal relays:</b> One-Shot Operation, Set and Reset, Program Examples- Fire alarm system and Loading system, Master control relay. <b>Jump and Call:</b> jump- jumps within jumps, Subroutines call. <b>Timers:</b> Types of Timers, On-Delay Timers, Excluded- sequencing and cascaded timers. Off-Delay Timer, Pulse Timers, Programming Examples- Flashing light and Traffic light sequence. Counters: Forms of Counter, Programming, Counter Application- Counting task. Up and Down counting.	
<b>UNIT V</b>	<b>8 hours</b>
<b>Shift Registers:</b> Ladder Programs-4 bit shift register, Sequencing Application- sequencing cylinders and keeping track of faulty items. <b>Data Handling:</b> Registers and Bits, Data Handling- Data movement, Data comparison, Data Selection. Arithmetic Functions- Conversion BCD-to-binary and binary-to-BCD.	

**TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos**

**COURSE OUTCOMES:** On completion of the course, student should be able to:

- CO1:**Need of automation and its various control strategies with its auxiliary devices.
- CO2:** Programs for various functional block consisting of multiple inputs and outputs and to control
- CO3:** Programming issues with subroutines and debugged.
- CO4:**The use of auxiliary units of a controller with hardware exposure
- CO5:** The data handling with simple hardware

## TEXT BOOKS

1. Programmable Logic Controllers, W Bolton, Elsevier- newness, 5th Edition, 2009.
2. Programmable Logic Controllers - Principles and Applications, John W Webb, Ronald A Reis, Pearson Education, 5th Edition, 2007

## REFERENCE BOOKS

1. Programmable Controller Theory and Applications, L.A.Bryan, E. A Bryan, An Industrial Text Company Publication, 2nd Edition, 1997.
2. Programmable Logic Controllers, E. A Paar, An Engineers Guide. Newness, 3rd Edition, 2003.
3. Introduction to Programmable Logic Controller, Garry Dunning, Thomson Asia Pte Ltd. Publication , 3rd Edition , 2006
4. Programmable Logic Controllers and Industrial Automation, Madhuchhanda Mitra and Samarjt Sengupta,,Pripenram, 2nd Edition, 2017
5. PLCs & SCADA - Theory and Practice, Rajesh Mehra, Vikrant Vij, Laxmi Publisher, 2nd edition, 2016

## ONLINE RESOURCES

1. [news.mit.edu/topic](http://news.mit.edu/topic)
2. <https://www.allaboutcircuits.com/textbook/digital/chpt-6/programmable-logic-controllers>
3. <https://onlinecourses.nptel.ac.in>

## SCHEME FOR EXAMINATIONS

- (i) The question paper will have ten full questions carrying equal marks.
- (ii) Each full question will be for 20marks.
- (iii) There will be two full questions from each module.
- (iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
- (v) The students have to answer five full questions, selecting one full question from each module.

## MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1									2		2
CO2	3		1	2							1		2		2
CO3			1	2	2				2				3		2
CO4	3	3							2		2	2	3		2
CO5	3	3							2		2	2	3		2

Course Title	<b>SMART GRID TECHNOLOGIES AND APPLICATIONS</b>						
Course Code	<b>22EET505B</b>						
Category	<b>Professional Elective Course (PEC)</b>						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>03</b>
CIE Marks: <b>40+5(A)+5(GA)</b>	SEE Marks: <b>50</b>	Total Max. marks: <b>100</b>			Duration of SEE: <b>03 Hours</b>		

**COURSE OBJECTIVE:**

1. To familiarize with the fundamentals of smart grid technologies.
2. To get exposure to Communication infrastructure and protocols.
3. To study the Wide Area Measurement Systems and energy storage technologies for smart grids.
4. To know about the various stability assessment tools in smart grid.
5. To familiarize with the Power Quality issues of Grid-connected Renewable Energy Sources.

<b>UNIT I</b> <b>INTRODUCTION TO SMART GRID:</b> Overview of Electrical Grid, Smart Grid, Characteristics, Inventory Technologies, Operating Principles, Models of Components, Implementation, Early initiatives, Overview of technologies, Key Challenges, Self-Healing Grid, Opportunities and Barriers, Recent Research technology.	<b>8 hours</b>
<b>UNIT II</b> <b>SMART METERING AND COMMUNICATION:</b> Smart meters, Communications infrastructure, protocols and hardware, Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers – benefits, Power line communication (PLC), Machine to machine communication models, Home Area Networks (HAN), Wide Area Networks (WAN) and Neighbourhood Area Networks (NAN), Wired and Wireless communication technologies – Cryptosystem - Internet of things(IoT).	<b>8 hours</b>
<b>UNIT III</b> <b>WAMS AND ENERGY STORAGE TECHNOLOGIES:</b> Synchro-Phasor Measurement Units (PMUs), Wide Area Measurement Systems (WAMS), Geographic Information system (GIS) and Google Mapping Tools, Multiagent Systems (MAS) Technology, Sensor Networks, Fault Detection, Phasor Data Concentrator (PDC), Road Map for synchro-phasor technology, Operational experience and Blackout analysis using PMU. Batteries, Fuel cells, Flywheels, SMES systems, and Supercapacitors.	<b>8 hours</b>
<b>UNIT IV</b> <b>INTEGRATION, CONTROL AND OPERATION OF DISTRIBUTED GENERATION:</b> Distributed Generation Technologies, benefits, Utilization Barriers, integration to the power grid, Renewable Energy Technologies, Micro grids, Storage Technologies, Advantages and disadvantages of DG, Vehicle to Grid technology and Grid to vehicle technology, Performance and stability analysis in smart grid.	<b>8 hours</b>
<b>UNIT V</b> <b>POWER QUALITY MANAGEMENT IN SMART GRID:</b> Power Quality, issues, Conditioners, Web-based monitoring, Audit, Cyber Security, Power Quality Improvement methods, Introduction to EMC in smart grid.	<b>8 hours</b>

**TEACHING LEARNING PROCESS:** Chalk and Talk, power point presentation, animations, videos

**COURSE OUTCOMES:** On completion of the course, student should be able to:

- CO1:** Understand the features of Smart Grid.
- CO2:** Outline the protocols and networks used in Smart grid.
- CO3:** Explain the importance of WAM and energy storage technologies used in smart grid.
- CO4:** Acquire knowledge on distributed generation and micro grids in smart grid.
- CO5:** Analyze the power quality issues in smart grid.

## TEXTBOOKS

1. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, Nick Jenkins, “Smart Grid Technology and Applications”, John Wiley and Sons Publication, 1st Edition, 2015.
2. Stuart Borlase, “Smart Grids: Infra structure, Technology and Solutions”, CRC Press, 1st Edition, 2013.
3. James A. Momoh, “Smart Grid: Fundamentals of Design and Analysis”, Wiley-IEEE Press, 1st Edition, 2012.

## REFERENCE BOOKS

1. Jean Claude Sabonnadiere, Nouredine Hadjsaid, “Smart Grids”, Wiley Blackwell, 1st Edition, 2012.
2. Fereidoon. P. Sioshansi, “Smart grid – integrating renewable, distributed and efficient energy”, Academic Press, 1st Edition, 2011.
3. Tony Flick, Justin Morehouse, “Securing the Smart Grid: Next Generation Power Grid Security”, Academic Press, 1st Edition, 2011.
4. Krzysztof Iniewski, “Smart Grid Infrastructure and Networking”, Tata McGraw Hill, 1st Edition, 2012.
5. Sawan Sen, Samarjit Sengupta, Abhijit Chakrabarti, “Electricity pricing- regulated, deregulated and smart grid systems”, CRC press, 1st Edition, 2018.

## ONLINE RESOURCES

1. [https://onlinecourses.nptel.ac.in/noc19\\_ee64/preview](https://onlinecourses.nptel.ac.in/noc19_ee64/preview)
2. <https://npti.gov.in/smart-grid-technologies>
3. [https://www.youtube.com/watch?v=Q\\_OdV8m6cqk&list=PLLy\\_2iUCG87AjWoOk0A3y4hpGOVTdtl6G](https://www.youtube.com/watch?v=Q_OdV8m6cqk&list=PLLy_2iUCG87AjWoOk0A3y4hpGOVTdtl6G)
4. [https://mrcet.com/downloads/digital\\_notes/EEE/14062023/Smart%20Grid%20technologies.pdf](https://mrcet.com/downloads/digital_notes/EEE/14062023/Smart%20Grid%20technologies.pdf)

## SCHEME FOR EXAMINATIONS

- (i) The question paper will have ten full questions carrying equal marks.
- (ii) Each full question will be for 20 marks.
- (iii) There will be two full questions from each module.
- (iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
- (v) The students have to answer five full questions, selecting one full question from each module.

## MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										3	1	1
CO2	3	2	2										3	1	1
CO3	3	2	2										3	1	1
CO4	3	2	2										3	1	1
CO5	3	2	2										3	1	1

Strength of correlation: Low-1, Medium-2, High-3

Course Title	<b>ELECTRIC VEHICLE TECHNOLOGY</b>						
Course Code	<b>22EET505C</b>						
Category	<b>PEC</b>						
Scheme and Credits	No. of Hours/Week					Total teaching + Lab hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>03</b>
CIE Marks: <b>40+5(A)+5(GA)</b>	SEE Marks: <b>50</b>	Total Max. marks: <b>100</b>			Duration of SEE: <b>03 Hours</b>		

**COURSE OBJECTIVE:**

1. Understand and acquire knowledge of battery driven electric vehicle, characteristics and their applications
2. Acquire knowledge about vehicle dynamics, Motors, Power Electronics, Batteries, and Charging
3. Study the performance of different types of electric drives.
4. Learn vehicle dynamics with constant and variable parameters
- 5 Analyse through Mat lab/ Simulink tool in real time applications

**COURSE CONTENT:**

<b>UNIT I</b> <b>Introduction to Electric Vehicle:</b> Historical background of hybrid and electric vehicles, benefits of EVs, overview of types of EVs and its challenges motor drive technologies; IC engine based technology, requirements of EVs different types of EV motors used for electric vehicle. energy source technologies; Regone plot, types and comparison of batteries, ultra-capacitors/ ultra-fly wheels, fuel cells, on-board renewable energy sources.	<b>7 hours</b>
<b>UNIT II</b> <b>EV Battery Charging Technologies:</b> Charging schemes, charging algorithms, medium of charge transfer, types of wireless power transfer, battery management system. <b>EV Systems and Configuration:</b> Typical BEV configuration, hybridisation of energy sources, modes of operation, HEV systems and configuration: power train efficiency and energy efficiency improvement, types of HEV, HEV systems and configurations; modes of operation, classification and comparison of EVs,	<b>8 hours</b>
<b>UNIT III</b> <b>Vehicle Dynamics 1: Introduction,</b> tractive effort, aerodynamic drag, the resistance offered by tire, rolling resistance etc.; gradient and hill climbing force, vehicle road load force, gradability, acceleration force. Tractive effort- simulation	<b>8 hours</b>
<b>UNIT IV</b> <b>Vehicle Dynamics 2:</b> Dynamic equation with constant Fte- constant tractive effort, terminal velocity, distance, time and energy equations; dynamic equation variable Fte- derivation of different dynamic equations with variable FTE- variable tractive effort and different regions of vehicle speeds.	<b>8 hours</b>
<b>UNIT V</b> <b>Vehicle Dynamics Modelling and simulation:</b> Simulation of vehicle dynamic equation constant Fte; simulation of vehicle dynamic equation variable Fte. vehicle dynamics modelling and Simulation in Mat Lab/Simulink with real time application. Driving cycle, Range modelling.	<b>8 hours</b>

**TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos**

**COURSE OUTCOMES:** On completion of the course, student should be able to:

- CO1:** Summarize the fundamental concepts of Electric Vehicles.
- CO2:** Understand principles of operation of hybrid and electric vehicles.
- CO3:** Analyze the Electric Vehicle dynamics with constant and variable parameters
- CO4:** Apply Electric Vehicle dynamics for real time applications
- CO5:** Estimate the transient stability of the power system through different numerical methods.

**REFERENCE BOOKS**

- 1 Iqbal Husain, “ Electric and Hybrid Vehicles, Design Fundamentals”, CRC Press,2003
- 2 M. Ehsani, Y. Gao, S. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles” CRC Press,2005.

- 3 Tom Denton. , “Electric And Hybrid Vehicles” Routledge / Taylor & Francis Group 2016  
 4 Donald L Anglin & William H. Crouse, “Automotive Mechanics” ,McGraw-Hill,1985

#### ONLINE RESOURCES

4. [https://swayam.gov.in/nd1\\_noc20\\_ee18](https://swayam.gov.in/nd1_noc20_ee18)  
 5. <https://youtu.be/Ay-4AZTnTEQ> Electric Vehicle Part -1,Dr Amit Jain, IIT Delhi  
 6. <https://nptel.ac.in/courses/108/102/108102121/>

#### SCHEME FOR EXAMINATIONS

- i. The question paper will have ten full questions carrying equal marks.
- ii. Each full question will be for 20 marks.
- iii. There will be two full questions from each module.
- iv. Each full question will have sub-questions (subject to a maximum of four sub-questions)
- v. The students have to answer five full questions, selecting one full question from each module.

#### MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
<b>CO11</b>	3	3	2		1							1		2	2
<b>CO2</b>	3	3		1	2	1								1	1
<b>CO3</b>	3				2						1	1	1	2	1
<b>CO4</b>	4	3			1	1							1	2	2
<b>CO5</b>	4	3		3				3					3	3	3
<b>Strength of correlation:</b> Low-1, Medium- 2, High-3															

Course Title	<b>OOPS with C++</b>						
Course Code	<b>22EET505D</b>						
Category	<b>Professional Elective Course (PEC)</b>						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>03</b>
CIE Marks: <b>40+5(A)+5(GA)</b>	SEE Marks: <b>50</b>	Total Max. marks: <b>100</b>			Duration of SEE: <b>03 Hours</b>		

#### COURSE OBJECTIVE:

1. To understand Object Oriented Programming concepts using the C++ language.
2. Introduces the principles of function, classes and objects.
3. Introduces to Constructors, Destructors and Operator overloading.
4. Introduces the principles of inheritance, pointers, virtual functions and polymorphism.
5. Introduces the concept of streams and handling files.

<b>UNIT I</b> <b>Beginning with C++ and its features:</b> What is C++? Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading and control structures in C++	<b>8 hours</b>
<b>UNIT II</b> <b>Functions, classes and Objects:</b> Functions, Inline function, function overloading, friend and virtual functions, specifying a class, C++ program with a class, arrays within a class, memory allocation to objects, array of objects, members, pointers to members and member functions.	<b>8 hours</b>
<b>UNIT III</b> <b>Constructors, Destructors and Operator overloading:</b> Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors, Defining operator overloading, Overloading Unary and binary operators, Manipulation of strings using operators.	<b>8 hours</b>
<b>UNIT IV</b> <b>Inheritance, Pointers, Virtual Functions, Polymorphism:</b> Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual and pure virtual functions.	<b>8 hours</b>
<b>UNIT V</b> <b>Streams and Working with files:</b> C++ streams and stream classes, formatted and unformatted I/O operations, Output with manipulators, Classes for file stream operations, opening and closing a file, EOF.	<b>8 hours</b>

**TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos**

**COURSE OUTCOMES:** On completion of the course, student should be able to:

- CO1:** Understand the basics of Object Oriented Programming concepts using the C++ language.  
**CO2:** Understand dynamic memory management techniques using pointers, constructors, destructors, etc.  
**CO3:** Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.  
**CO4:** Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.  
**CO5:** Use I/O operations and file streams in programs.

#### TEXT BOOKS

1. Object Oriented Programming with C++, E. Balaguruswamy, 6th Edition, TMH, 2013.

#### REFERENCE BOOKS

1. Object Oriented Programming in C++, Robert Lafore, 4th edition, Pearson publication, 2008.

#### ONLINE RESOURCES

1. <https://www.javatpoint.com/cpp-oops-concepts>
2. <https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/>
3. <https://www.programiz.com/cpp-programming/oop>

4. [https://www.w3schools.com/cpp/cpp\\_oop.asp](https://www.w3schools.com/cpp/cpp_oop.asp)

### SCHEME FOR EXAMINATIONS

- (i) The question paper will have ten full questions carrying equal marks.
- (ii) Each full question will be for 20 marks.
- (iii) There will be two full questions from each module.
- (iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)
- (v) The students have to answer five full questions, selecting one full question from each module.

### MAPPING of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO11	PSO2	PSO3
CO1	2	2	2		1					1			2	1	1
CO2	2	2	2		1					1			2	1	1
CO3	2	2	2		1					1			2	1	1
CO4	2	2	2		1					1			2	1	1
CO5	2	2	2		1					1			2	1	1
<b>Strength of correlation:</b> Low-1, Medium- 2, High-3															

Course Title	<b>TRANSMISSION AND DISTRIBUTION</b>						
Course Code	<b>22EET505E</b>						
Category	<b>Professional Core Course ( PEC)</b>						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	<b>03</b>	<b>00</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>03</b>
CIE Marks: <b>40+5(A)+5(GA)</b>	SEE Marks: <b>50</b>	Total Max. marks: <b>100</b>			Duration of SEE: <b>03 Hours</b>		

### COURSE OBJECTIVE:

1. To introduce the basic concepts of power transmission, and Sag calculation in over- head transmission lines .
2. To describe the different overhead line insulators and basic concept of Corona in over-headlines.
3. To describe the structure of UG cables and types of AC & DC distribution systems.
- 4 To evaluate the line parameters of transmission Lines.
5. To analyze the performance of power transmission lines.

<b>UNIT I</b>	<b>08 hours</b>
<b>Typical Transmission &amp; Distribution Systems Scheme:</b> General layout of power system, Standard voltages for transmission, advantages of high voltage transmission- Transmission line efficiency and line drop. Feeders, distributors & service mains.	
<b>Overhead Transmission Lines:</b> Types of supporting structures and line conducting materials used. Sag calculation- supports at same level and at different levels. Effect of wind and ice, Sag at erection, Stringing chart and sag templates. Line vibration dampers.	
<b>UNIT II</b>	<b>08 hours</b>
<b>Insulators:</b> Introduction, materials used, constructional features of Ceramic and Polymeric insulators, potential distribution over a string of suspension insulators. String efficiency & methods of increasing string efficiency, grading rings and arcing horns. Testing of insulators.	
<b>Corona:</b> Phenomena, disruptive and visual critical voltages, corona power loss. Advantages and disadvantages of corona.	
<b>UNIT III</b>	<b>08 hours</b>
<b>Underground Cables:</b> Types, material used, insulation resistance, charging current, grading of cables, capacitance grading & inter sheath grading, testing of cables.	
<b>Distribution:</b> Requirements of power distribution, radial & ring main systems, AC and DC distribution: calculation for concentrated loads and uniform loading.	
<b>UNIT IV</b>	<b>08 hours</b>
<b>Line Parameters:</b> Calculation of inductance of single phase line, 3phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite conductor lines. Capacitance of single-phase line, 3phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines.	
<b>UNIT V</b>	<b>08 hours</b>
<b>Performance of Power Transmission Lines:</b> Short transmission lines, medium transmission lines- nominal T, end condenser and $\pi$ models, long transmission lines, ABCD constants of transmission lines, Ferranti effect, line regulation.	

**TEACHING LEARNING PROCESS:** Chalk and Talk, power point presentation, animation videos

**COURSE OUTCOMES:** On completion of the course, student should be able to

**CO1:** Explain the concepts of power transmission & Sag calculations in Over-headlines.

**CO2:** Describe the overhead line insulators and concepts of Corona in overhead lines.

**CO3:** Illustrate the structure of UG cables and different AC & DC Distribution systems.

**CO4:** Evaluate the Line constants of transmission lines.

**CO5:** Analyze the performance of transmission lines.

**TEXT BOOKS:**

- 1.S.M Singh, Electric Power Generation, Transmission & Distribution, second edition, PHI Publishers, 2009.
- 2.Soni, Gupta & Bhatnagar, A Course in Electrical Power, Dhanapath Roy & Sons, third edition, 2010.

**REFERENCE BOOKS:**

1. W.D Stevenson, Elements of Power System Analysis, Fourth edition, TMH Publisher, 2017
2. Dr.S.L Uppal, Electrical Power Systems, Fifteen edition, Khanna Publications, 1987.
3. C.L Wadhwa, Electrical Power Systems, Sixth edition, New Age International Publishers, 2010.

**WEB LINKS:**

- 1.<https://nptel.ac.in/courses/108/102/108102047/>
2. <https://www.Smartzworld.com/notes/transmission-and-distribution-pdf-vtu/>

**MAPPING of COs with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	1	2				2		2		2	3	1	1
<b>CO2</b>	3	3	1	2				2		2		2	3	1	1
<b>CO3</b>	3	3	1	2				2		2		2	3	1	1
<b>CO4</b>	3	3	1	2				2		2		2	3	1	1
<b>CO5</b>	3	3	1	2				2		2		2	3	1	1
<b>Strength of correlation:</b> Low-1, Medium- 2, High-3															

Course Title	<b>RESEARCH METHODOLOGY &amp; INTELLECTUAL PROPERTY RIGHTS</b>						
Course Code	<b>22RMT507</b>						
Category	<b>Ability Enhancement Course(AEC)</b>						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	<b>02</b>	<b>02</b>	<b>00</b>	<b>00</b>	<b>03</b>	<b>40</b>	<b>03</b>
<b>CIE Marks: 40+05(Assgmt)+ 05(GA)</b>	<b>SEE Marks: 50</b>	<b>Total Max. marks=100</b>			<b>Duration of SEE: 03 Hours</b>		

#### COURSE OBJECTIVE:

1. Understand the knowledge on basics of research and its types.
2. Learn the concept of Literature Review and technical Reading.
3. Understanding the importance of giving credit to citations and attributions.
4. Learn ethics in Engineering Research.
5. Discuss the concepts of Intellectual Property Rights in engineering.

#### COURSE CONTENT:

<b>UNIT I</b>	<b>8 hours</b>
<b>Introduction:</b> Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem.	
Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.	
<b>UNIT II</b>	<b>8 hours</b>
<b>Literature Review and Technical Reading:</b> New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet.	
<b>Attributions and Citations:</b> Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.	
<b>UNIT III</b>	<b>8 hours</b>
<b>Introduction to Intellectual Property:</b> Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India.	
<b>Patents:</b> Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting.	
<b>Process of Patenting.</b> Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained. Do I Need First to File a Patent in India? Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models.	
<b>UNIT IV</b>	<b>8 hours</b>
<b>Copyrights and Related Rights:</b> Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights	

and the Word ‘Indian Work’. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases.

**Trademarks:** Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

**UNIT V**

**8 hours**

**Industrial Designs:** Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

**Geographical Indications:** Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.

**TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos**

**COURSE OUTCOMES:** On completion of the course, student should be able to:

**CO1:** Understand the meaning of engineering research.

**CO2:** Recognize the procedure of literature review and technical reading.

**CO3:** Know the fundamentals of patent laws and drafting procedure.

**CO4:** Understand the copyright laws and subject matters of copyrights and designs.

**CO5:** Realize the basic principles of design rights.

**TEXT BOOKS**

1. Dipankar Deb, Rajeeb Dey, Valentina E. Balas “Engineering Research Methodology”, ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), <https://doi.org/10.1007/978-981-13-2947-0>.

2. Intellectual Property A Primer for Academia by Prof. Rupinder Tewari Ms. Mamta Bhardwaj.

**REFERENCE BOOKS**

1. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488- 4.

2. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9.

**ONLINE RESOURCES**

1. <https://www.slideshare.net/indravi/intellectual-property-rights-ipr-in-engineering>

2. [http://bpublications.net/downloads/050e6a699258c8\\_IPR\\_chapter1.pdf](http://bpublications.net/downloads/050e6a699258c8_IPR_chapter1.pdf)

**SCHEME FOR EXAMINATIONS**

(i) The question paper will have ten full questions carrying equal marks.

(ii) Each full question will be for 10 marks.

(iii) There will be two full questions from each module.

(iv) Each full question will have sub-questions (subject to a maximum of four sub-questions)

(v) The students have to answer five full questions, selecting one full question from each module.

**MAPPING of COs with POs and PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1				2		3		1				3	1
CO2		1				2		3		1				3	1
CO3		1				2		3		1				3	1
CO4		1				2		3		1				3	1
CO5		1				2		3		1				3	1

**Strength of correlation:** Low-1, Medium- 2, High-3