AISSMS
INSTITUTE OF INFORMATION TECHNOLOGY
(IOIT)
ADDING VALUE TO ENGINEERING
An Autonomous Institute Affiliated to Savitribai Phule Pune University
Approved by AICTE, New Delhi and Recognised by Govt. of Maharashtra
Accredited by NAAC with "A+" Grade | NBA - 5 UG Programmes

ACADEMIC COURSE STRUCTURE

AND

DETAILED CURRICULUM OF

B. TECH

Program - Electrical Engineering

B. Tech 4 Year UG Curriculum

(2025 Pattern)

AISSMS INSTITUTE OF INFORMATIONTECHNOLOGY
Kennedy Road, Near RTO,
Pune – 411 001, Maharashtra State, India
Email: principal@aissmsioit.org ,

Website: https://aissmsioit.org/

Department Vision & Mission

VISION

To be known for imparting quality education in the field of electrical engineering and preparing competent professionals with high human values to serve society.

MISSION

- To train the graduates with the latest technologies through industry institute interactions and experiential teaching learning practices to meet the emerging global challenges.
- To enhance engineering skills, employability skills, and research through professional activities.
- To develop globally competent electrical engineers with professional ethics and commitment to society.

PROGRAM EDUCATION OBJECTIVES

Graduates will

- Investigate problems in electrical engineering and provide effective solutions.
- Excel in the professional career, research, higher studies, and entrepreneurship.
- Engage in lifelong learning by adapting a professional, social, and ethical attitude for contributing to societal needs.

Program Specific Outcomes (PSOs)

PSO 1: The graduates will be able to proficiently employ the software tools used in the design and analysis of electrical systems.

PSO2: The graduates will be able to acquire skills in electric mobility, power quality, and renewable energy.

Program Outcomes (POs)

1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. [Engineering knowledge]
2. Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. [Problem analysis]
3. 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. [Design/development of solutions]
4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. [Conduct investigations of complex problems]
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. [Modern tool usage]
6. 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. [The engineer and society]
7. Understandtheimpactoftheprofessionalengineeringsolutionsinsocietalandenvironmental contexts, and demonstrate the knowledge of, and need for sustainable development. [Environment and sustainability]
8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. [Ethics]
9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. [Individual and teamwork]
10. Communicateeffectivelyoncomplexengineeringactivitieswiththeengineeringcommunity 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. [Communication]
11. Demonstrateknowledgeandunderstandingoftheengineeringandmanagementprinciples and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. [Project management and finance]
12. 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. [Life-long learning]

Electrical Engineering – B. Tech (Semester –VII)												
Sr. No.	Course Code	Course Name	Hours per week			Credits	Examination scheme					
			L	T	P		ISE	ESE	TW	PR	OR	Total
1	ELPCC701	Power Quality: Issues and Mitigation	2	--	--	**02**	40#	60*	--	--	--	**100**
2	ELPEC702	Elective-III	3	--	--	**03**	40#	60*	--	--	--	**100**
3	ELPEC703	Elective-IV(MOOCs)	3	--	--	**03**	40$	60$$	--	--	--	**100**
4	ELPCC704	Power Quality: Issues and Mitigation lab	--	--	2	**01**	--	--	--	--	50	**50**
5	ELPEC705	Elective-III Lab @@	--	--	2	**01**	--	--	50	50	--	**100**
6	IOELC7P1	Project Stage-I @@	--	--	4	**02**	--	--	100	--	50	**150**
Total			**08**	**--**	**08**	**12**	**120**	**180**	**150**	**50**	**100**	**600**

L-Lecture, T-Tutorial, P-Practical

* **End Semester Examination (ESE)** based on subjective questions.

\# **In Semester Evaluation (ISE)**
In Semester I : Subjective Examination.
In Semester II: Examination - based on Presentation/ Group Discussion/ Laboratory Work/ Course Project/ Home Assignment/ Comprehensive Viva Voce/ Blog Writing/ Case Study/ Survey/ Gate based Multiple-Choice Questions (MCQ)/ Numerical based Subjective Questions

$ **For MOOCs:** Assignments marks will be converted on the scale of 40 marks.

$$ **For MOOCs:** Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Note: @@ Passing is mandatory in both the examination heads to gain total Course Credits.

Elective-III	Elective-IV (MOOCs)
A. PLC, SCADA and its Applications	A. Advances in UHV transmission and Distribution https://onlinecourses.nptel.ac.in/noc20_ee67/preview
B. Digital Control System	B. Advance linear continuous control system: Application with MATLAB programming and simulation https://onlinecourses.nptel.ac.in/noc21_ee70/preview
C. High Voltage Engineering	C. Machine Learning and Deep Learning: fundamentals and applications https://onlinecourses.nptel.ac.in/noc23_ee87/preview
	D. Project Management https://onlinecourses.nptel.ac.in/noc24_mg01/preview

Electrical Engineering – B. Tech (Semester –VIII)												
Sr. No.	**Course Code**	**Course Name**	**Hours per week**			**Credits**	**Examination scheme**					
			L	**T**	**P**		**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**
1	IOELC801	Internship/ Global certification/ Entrepreneurship/ Research Project/ Foreign University Certification @@	--	--	30	**12**	--	--	200	--	100	**300**
2	IOELC8P2	Project Stage-II @@	--	--	4	**02**	--	--	200	--	100	**300**
	Total		--	--	**34**	**14**	--	--	**400**	--	**200**	**600**

L-Lecture, T-Tutorial, P-Practical

Note: @@ Passing is mandatory in both the examination heads to gain total Course Credits.

B. Tech Electrical Engineering			
Power Quality: Issues and Mitigation (ELPCC701)			
Course Code :	**ELPCC701**	**Credit :**	**02**
Contact Hours :	2 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	Internal	**60**

Prerequisite:

1. Concept of power and energy in three phase and single phase.
2. Electrical Measurements.
3. Power Systems basics.
4. Power Electronics basics.

Course Objective:	
1	To discuss and explain various categories of power quality problems.
2	To explain the voltage sag/transient phenomenon and investigate the voltage sag / transient problems.
3	To explain harmonics concepts and techniques for mitigation of harmonics.
4	To discuss power quality analysis, monitoring and various modern tools used for the same.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
701.1	Distinguish various categories of power quality problems.
701.2	Explain the voltage sag/transient phenomenon and investigate the voltage sag/transient problems.
701.3	Explain harmonics concepts and mitigate the harmonics.
701.4	Describe power quality analysis and select PQ monitoring equipment.

Unit 01	**:**	**Power Quality Basics**	**(06 Hrs)**
Definition of Power Quality, Power Quality Stakeholders, Importance of Power Quality, symptoms of poor power quality, Power Quality terminologies. Power Quality disturbances/issues. Power Quality Standards (Brief Review): EN50160, IEEE 1159 and IEC 61000-series standards. Power Quality Regulations (Indian & International)			
Unit 02	**:**	**Voltage Variations**	**(06 Hrs)**
Terms - short duration voltage variations, long duration voltage variations, voltage imbalance, voltage fluctuations, voltage flicker, Transients. Sources, effect and characterization of sag, swell, flicker, unbalance, Transients Mitigation techniques for - Voltage sag and swell, flicker, Transients			

Unit 03	**:**	**Harmonics**	**(06 Hrs)**
Waveform Distortion - Harmonics, Harmonic phase sequences. Triplen harmonics, Voltage Verses Current distortion, Voltage and current harmonic indices, Introduction to Supraharmonics. Sources of harmonics, General and special Effects of Harmonics on Electrical Equipment. Harmonic mitigation techniques. Series and parallel resonance.			
Unit 04	**:**	**Power Quality Monitoring**	**(06 Hrs)**
Objectives & Types of Power quality monitoring. Power quality monitoring equipment, Power quality analyser specification requirement as per EN50160 and IEC 61000-4-30 Standard. Selection of power quality equipment for cost effective power quality monitoring. Computer Tools for analysis of power quality.			
Syllabus content required for competitive exams (GATE, UPSC, MPSC etc.) Not Applicable			

Text Books:	
[T1]	R. C. Dugan, Mark F. McGranghan, Surya Santoso, H. Wayne Beaty, "Electrical Power System Quality", 2nd Edition, McGraw Hill Publication.
[T2]	M. H. J. Bollen, "Understanding Power Quality Problems, Voltage Sag and Interruptions", New York: IEEE Press, 2000, Series on Power Engineering.
[T3]	C.Sankaran "Power quality", CRC Press
[T4]	Arrillaga, M. R. Watson, S. Chan, "Power System Quality Assessment", John Wiley and Sons.
[T5]	Harmonics and Power Systems by Francisco C. De La Rosa, CRC Publication
Reference Books:	
[R1]	Angelo Baggini (Ed.) Handbook of Power Quality, Wiley, 2008
[R2]	Enriques Acha, Manuel Madrigal, "Power System Harmonics: Computer Modeling & Analysis", John Wiley and Sons.
[R3]	Ewald F. Fuchs, Mohammad A. S. Masoum, "Power Quality in Power Systems and Electrical Machines" Elsevier Publication.
[R4]	G. J. Heydt, "Electric Power Quality", Stars in Circle Publications
[R5]	EN50160 and IEEE 1100, 1346,519 and 1159 standards
[R6]	Arrillaga, M. R. Watson, "Power System Harmonics", John Wiley and Sons.
[R7]	Dranetz Power Quality Handbooks
[R8]	Singh, Bhim, Power quality problems and mitigation techniques
[R9]	Das J C, Power System Harmonics and Passive Filter Designs
[R10]	Gregorio Romero Rey, Luisa Martinez Muneta, Power Quality: Harmonics Analysis and Real Measurements Data
[R11]	Hirofumi Akagi; Edson Hirokazu Watanabe; Mauricio Aredes, "Instantaneous Power Theory and Applications to Power Conditioning", Wiley-IEEE Press
E-Resources :	
[1]	Open Graphic Calculator - https://www.desmos.com/calculator
[2]	Alex McEachern's FREE "Power Quality Teaching Toy" program - https://mcelabs.com/powerqualityteachingtoy

B. Tech Electrical Engineering			
Elective-III: A. PLC, SCADA and its Applications (ELPEC702A)			
Course Code :	**ELPEC702A**	**Credit :**	**03**
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	Internal	**60**

Course Objective:	
1	To explain the function of Industrial Automation in general.
2	To teach types of Industrial Sensors and actuators for different measurements.
3	To explain the architecture, various components of a Programmable Logic Controller and SCADA.
4	To inculcate knowledge of various PLCs and SCADA systems to real-life industrial applications.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
702A.1	Describe working of various blocks of basic industrial automation system
702A.2	Identify various valves and actuators for various applications.
702A.3	Classify input and output interfacing devices with PLC.
702A.4	Develop architecture of SCADA and explain the importance of SCADA in critical infrastructure.
702A.5	Describe various SCADA protocols along with their architecture
702A.6	Observe development of various industrial applications using PLC and SCADA.

Unit 01	**:**	**Introduction to Industrial Automation and Control**	**(06 Hrs)**
Role of automation in Industries, benefits of automation, Introduction to PLC, DCS, HMI. Benefits and inconveniences of automation. Definition of PLC as per NEEMA (National Electrical Engineering Manufacturers' Association), types – fixed/modular/dedicated, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, selection criterion, advantages and disadvantages, specifications.			

Unit 02	**:**	**Measurement of Various Process Parameters and Actuators**	**(06 Hrs)**
Measurement of quantities such as temperature, pressure, force, displacement, speed, flow, level, humidity, pH etc., signal conditioning, estimation of errors and calibration. Introduction to various actuators such as flow control valves, Hydraulic and pneumatic, servo motors, symbols and characteristics. ID controller and tuning			

Unit 03	**:**	**Interfacing and Programming of PLC**	**(06 Hrs)**
Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices.Programming languages for PLC, Ladder diagram fundamentals, Rules for proper construction of ladder diagram Timer and counter- types along with timing diagrams, Reset instruction, latch instruction MCR (master control relay) and control zones.			

Unit 04	**:**	**Applications of PLC**	**(06 Hrs)**
Developing ladder logic for Sequencing of motors, ON OFF Tank level control, Tank level controller using analog signals, ON OFF temperature control, temperature controller using RTD, elevator, bottle filling plant, car parking, traffic light controller, speed control of electric motor.			
Unit 05	**:**	**SCADA Systems**	**(06 Hrs)**
Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system Architecture, important definitions HMI, MTU, RTU, communication means, Desirable Properties of SCADA system, advantages, disadvantages and applications of SCADA. SCADA generations (First generation - Monolithic, Second generation - Distributed, Third generation – Networked Architecture), SCADA systems in operation and control of interconnected power system, Functions and features of SCADA systems, Automatic substation control, Energy management systems (EMS), System operating states, SCADA system in critical infrastructure: Petroleum Refining Process, Conventional electric power generation, Water Purification System, Chemical Plant.			
Unit 06	**:**	**SCADA Protocols**	**(06 Hrs)**
Open systems interconnection (OSI) Model, TCP/IP protocol, Modbus model, DNP3 protocol, IEC61850 layered architecture, Control and Information Protocol (CIP), Device Net, Control Net, Ether Net/IP, Flexible Function Block process (FFB), Process Field bus (Profibus).			
Syllabus content required for competitive exams (GATE, UPSC, MPSC etc.) Not Applicable			
Industrial Visit: SCADA and PLC based automation industry.			
Text Books:			
[T1]	John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition		
[T2]	John R. Hackworth, Frederick D., Hackworth Jr., "Programmable Logic Controllers Programming Methods and Applications", PHI Publishers		
[T3]	Ronald L. Kurtz, "Securing SCADA System", Wiley Publishing		
[T4]	Stuart A Boyer, "SCADA supervisory control and data acquisition", ISA, 4th Revised edition		
[T5]	Sunil S. Rao, "Switchgear and Protection", Khanna Publication		
Reference Books:			
[R1]	Gary Dunning, "Introduction to Programmable Logic Controllers", Thomson, 2nd Edition		
[R2]	Batten G. L., "Programmable Controllers", McGraw Hill Inc., Second Edition		
[R3]	P. K. Srivstava, "Programmable Logic Controllers with Applications", BPB Publications		
[R4]	Curtis Johnson, "Process Control Instrumentation Technology", Prentice Hall of India		

B. Tech Electrical Engineering			
Elective-III: B. Digital Control System (ELPEC702B)			
Course Code :	**ELPEC702B**	**Credit :**	**03**
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	Internal	**60**

Prerequisite:

1. Properties of Z-Transform, Inverse Z transform.
2. Initial and Final Value Theorem.
3. Basics of discrete systems.

Course Objective:	
1	To make students understand basic concepts of discrete signals and systems.
2	To explain students to analyze the stability of discrete systems.
3	To explain formulation of state space discrete model and design the digital controllers.
4	To elaborate digitize analog controllers using various numerical methods.
5	To explore application of the theory of digital control to practical problems.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
702B.1	Identify the regions of convergence in Z-transforms.
702B.2	Explain the Jury Stability Criterion and its application in determining the stability of discrete-time systems.
702B.3	Apply the basic working principles of A/D and D/A converters to convert continuous signals into digital form and vice versa.
702B.4	Analyze the performance of a digital control system by evaluating its steady-state accuracy and transient response.
702B.5	Evaluate the effectiveness of lead, lag, and lag-lead compensators for a given control system based on desired performance criteria.
702B.6	Design control strategies based on the state-space models for systems with specific performance goals.

Unit 01	**:**	**Introduction to Digital Control**	**(06 Hrs)**
Introduction to digital control system, examples of digital control system ,Z- Transform , Sampling Process, Region of convergence, Sample and Hold Circuit, Zero and First Order hold, Aliasing, Z transform of solution of difference equations. Transfer function models, frequency response.			
Unit 02	**:**	**Stability**	**(06 Hrs)**
Definition, BIBO stability, zero-input stability, Jury Stability Criterion, Choice of sampling rate, Principles of Discretization –Impulse invariant, Step invariant, finite difference approximation of derivatives, bilinear transformation.			

Unit 03	**:**	**Models of Digital Control Systems**	**(06 Hrs)**
Introduction, Model of A/D Converter, Model of D/A Converter, Implementation of Digital controllers- Recursive, Cascade, parallel Non recursive realizations, Digital PID Controllers, Digital temperature control system, Digital position control system.			
Unit 04	**:**	**Design of Digital Control Algorithms I**	**(06 Hrs)**
Introduction, basic routes to the design of digital Controllers, Z plane specification of control system design- Steady state accuracy and Transient accuracy. Root locus and Nyquist stability in Z plane.			
Unit 05	**:**	**Design of Digital Control Algorithms II**	**(06 Hrs)**
Digital compensator using frequency response plot, digital compensator using root locus plot–Lead compensation, lag compensation, Lag lead compensation.			
Unit 06	**:**	**State variable analysis of digital control system**	**(06 Hrs)**
Introduction, state description of digital processors, state description of sampled continuous time plants, systems with dead zone, solution of state difference equations, controllability and observability.			
Syllabus content required for competitive exams (GATE, UPSC, MPSC etc.) Not Applicable			
Text Books:			
[T1]	M.Gopal, 'Digital Control and State Variable Methods', Tata McGraw Hill, 3rd Edition, 4TH Edition, McGraw Hill Education Pvt.Ltd. 2012.		
[T2]	V.I.George and C.P.Kurien, Digital Control System, Cengage Learning, 2012.		
[T3]	M.SamiFadali and Antonio Visioli, Digital Control Engineering –Analysis and design Adcademic Press, Elsevier, 2009.		
Reference Books:			
[R1]	Kannan M. Moddgalya, Digital Control, Wiley India, 2007.		
[R2]	C. L. Philips and J. M. Pan, "Feedback Control System, Pearson, 2013.		
[R3]	C. M. Houpis, G. B. Lamount, 'Digital Control Systems- Theory, Hardware, Software', International Student Edition, McGraw Hill Book Co., 1985.		
E-Resources :			
[1]	https://www.sciencedirect.com/topics/computer-science/digital-control-system		
[2]	https://nptel.ac.in/courses/108103008		

B. Tech Electrical Engineering			
Elective-III: C. High Voltage Engineering (ELPEC702C)			
Course Code :	**ELPEC702C**	**Credit :**	**03**
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation	Internal	**40**
2.	End-sem. Examination	Internal	**60**

Prerequisite:

1. Basics of Physics

Course Objective:	
1	To explain various processes of breakdown in solid, liquid and gaseous dielectric materials.
2	To enable students understand and apply various methods of generation and measurement of DC, AC, impulse voltage and current.
3	To explain the causes of overvoltage, lightning phenomenon and application of statistical approach of insulation coordination.
4	To develop ability among learners to execute testing on various high voltage equipment as per standards.
5	To introduce students to the design, layout, safety precautions, earthing, and shielding of HV laboratory.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
702C.1	Explain the theories related to breakdown in gases.
C702C.2	Explain and compare various theories related to the breakdown of liquid and solid Insulating materials.
702C.3	Illustrate different methods of generation of high voltage and currents.
702C.4	Measure the high voltages and currents using various methods.
702C.5	State the causes of over voltages due to lightning and switching surges and apply statistical approach of insulation coordination.
702C.6	Design the high voltage laboratory and perform HV tests on various equipment

Unit 01	**:**	**Breakdown in Gases**	**(06 Hrs)**
Ionization process in gas, Townsend's Theory, Streamer mechanism, Paschen's Law, Corona discharges, time lag and factors on which time lag depends. Numerical on Townsend's theory and Paschen's law. Breakdown under Vacuum condition.			
Unit 02	**:**	**Breakdown in liquid and solid Insulating materials:**	**(06 Hrs)**
Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, Intrinsic breakdown: electronic breakdown, avalanche or streamer breakdown, electro-mechanical breakdown, thermal breakdown, treeing and tracking phenomenon, Chemical and electrochemical breakdown, Partial discharge/Internal discharge, Numerical on theories of liquid and solid dielectric materials.			

Unit 03	**:**	**Generation of High Voltages and Current**	**(06 Hrs)**
Cascading of transformers, series and parallel resonance system, Tesla coil, Cockroft Walton circuit, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators. Numerical on impulse generator and Cockroft Walton circuit.			
Unit 04	**:**	**Measurement of High Voltage and Currents**	**(06 Hrs)**
Sphere gap voltmeter, electrostatic volt meter, generating voltmeter, peak reading voltmeter, resistive, capacitive and mixed potential divider , capacitance voltage transformer, cathode ray oscilloscope for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.			
Unit 05	**:**	**Lightning and Switching Over Voltages**	**(06 Hrs)**
Causes of over voltages, lightning phenomenon, Different types of lightning strokes and mechanisms of lightning strokes, Charge separation theories, Wilson theory, Simpson theory, Reynolds and Mason theory, Over voltage due to switching surges and methods to minimize switching surges. Statistical approach of insulation coordination.			
Unit 06	**:**	**High Voltage Testing of Electrical Apparatus and H V Laboratories**	**(06 Hrs)**
a) Testing of insulators and bushings, Power capacitors and cables testing, testing of surge arresters. b) Design, planning and layout of High Voltage laboratory:-Classification and layouts, earthing and shielding of H.V. laboratories.			
Syllabus content required for competitive exams (GATE, UPSC, MPSC etc.) Not Applicable			
Industrial Visit: Substation / Special purpose high voltage laboratory			
Text Books:			
[T1]	High Voltage Engineering by M. S. Naidu, V. Kamaraju, Tata McGraw Hill Publication Co. Ltd New Delhi, 2013		
[T2]	High Voltage Engineering by C. L. Wadhwa, New Age International Publishers Ltd.		
[T3]	High Voltage Engineering by Prof. D. V. Razevig Translated from Russian by Dr. M. P. Chourasia Khanna Publishers, New Delhi		
Reference Books:			
[R1]	High Voltage Engineering Fundamentals by E. Kuffel, W. S. Zaengl, J. KuffelNewnes Publication, ISBN-0-7506-3634-3		
[R2]	High Voltage and Electrical Insulation Engineering by Ravindra Arora, WolfGang Mosch New Age International Publishers Ltd. Wiley Eastern Ltd., ISBN-978-0-470-60961-3		
[R3]	High Voltage Engineering Theory and Practice by M. Khalifa Marcel Dekker Inc. New York and Basel.		
[R4]	IS 731-1971: AMENDMENT NO. 7 JULY 2008 Porcelain insulator for overhead power lines with nominal voltage > 1000 Volt		
[R5]	Bushings: IS2099-1986, specification for bushings for A.C. Voltages > 1000 Volts		
[R6]	Pollution test: IEC 60507-2013 on external and internal insulator		
[R7]	High voltage test techniques, general definitions and test requirements: IS 2071(part 1) 1993, IEC Pub 60-1(1989)		

B. Tech Electrical Engineering			
Elective-IV: A. Advances in UHV transmission and Distribution (ELPEC703A)			
Course Code :	**ELPEC703A**	**Credit :**	**03**
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation (Assignment Marks)	Internal	**40**
2.	End-sem. Examination	Internal / External	**60**

MOOC: **1) Advances in UHV transmission and Distribution**: Link will be provided at the commencement of the course.
2) Assignments marks will be converted on the scale of 40 marks.
3) Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Course Link : https://onlinecourses.nptel.ac.in/noc20_ee67/preview

Course Layout :

Module 1: Introduction to the development of Power Transmission.

Module 2: Recent advances in UHV power transmission systems; present status and future growth.

Module 3 : General Design Criteria for overhead transmission lines: Methodologies,reliability, wind/ice loading etc

Module 4 : Major Components of HV transmission systems, types of conductor configurations conductor accessories/clamps
etc.
Module 5: Towers for UHV transmission: calculations of clearances for power frequency, switching and lightning surges, right of way(ROW)etc.

Module 6 : Selection of insulators for light, medium and heavy polluted areas

Module 7 : Up-gradation of existing transmission lines

Module 8: Design consideration of UHV substations, Comparison of AIS, Hybrid-AIS and GIS electric and magnetic fields.

Module 9 : Insulation coordination for UHV systems

Module 10 : Earthling and safety measures for UHV substation

Books and References:

1. Rakosh Das Begamudre, " Extra High Voltage AC Transmission Engineering", New Age International(P) Ltd, New Delhi, 2000.
2. E Kuffel, W S Zaengl and J Kuffel, "High Voltage Engg. Fundamentals", textbook published by Newness publishers, second edition, 2000.
3. CIGRE Working Group SC B.3-22 "Technical requirements for substations exceeding 800 kV", Brochure No: 400, Dec 2009.
4. IEC-60826, International standard, "Design criteria of overhead transmission lines", 2003.
5. Outdoor Insulators – Ravi gorur, Edward Cherney & Jeffery Burnham Text book

B. Tech Electrical Engineering			
Elective-IV: B. Advance linear continuous control system : Application with MATLAB programming and simulation (ELPEC703B)			
Course Code :	**ELPEC703B**	**Credit :**	**03**
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation (Assignment Marks)	Internal	**40**
2.	End-sem. Examination	Internal / External	**60**

MOOC: **1) Advance linear continuous control system:** Application with MATLAB programming and simulation: Link will be provided at the commencement of the course.

2) Assignments marks will be converted on the scale of 40 marks.

3) Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Course Link : https://onlinecourses.nptel.ac.in/noc21_ee70/preview

Course Layout:

Week 1:

1 Introduction to State Space
2 State Space Representation
3 State Space Representation: Companion Form (Controllable Canonical Form)
4 State Space Representation: Extended Controllable Canonical Form
5 State Space Representation: Observable Canonical Form

Week 2:

1 State Space Representation: Diagonal Canonical Form (Part I)
2 State Space Representation: Diagonal Canonical Form (Part II)
3 State Space Representation: Jordan Canonical Form
4 State Space Representation: Numerical Examples on State Space Modelling (Part I)
5 State Space Representation: Numerical Examples on State Space Modelling (Part II)

Week 3 :

1 Modelling of Mechanical Systems in State Space
2 Modelling of DC Servo Motor (Part I)
3 Modelling of DC Servo Motor (Part II)
4 Determination of Transfer Function from State Space Model (Part-I)
5 Determination of Transfer Function from State Space Model (Part-II)

Week 4:

1 Stability Analysis in State Space: Concept of Eigenvalues and Eigenvectors (Part I)
2 Stability Analysis in State Space (Part II)
3 Stability Analysis in State Space: Lyapunov Stability Analysis (Sylvester's Criterion) (Part III)
4 Stability Analysis in State Space: Lyapunov Stability Analysis (Stability Criterion) (Part IV)
5 Stability Analysis in State Space:Lyapunov Stability Analysis (Direct Method) (Part V)

Week 5:
1 Concept of Diagonalization
2 Solution of State Equation
3 Solution of State Equation (Forced system)
4 Steady State Error for State Space System
5 State Transition Matrix (Part-I)

Week 6:
1 State Transition Matrix (Part-II)
2 State Transition Matrix using Caley Hamilton Theorem (Part-III)
3 MATLAB Programming with State Space
4 Controllability in State Space (Part-I)
5 Controllability in State Space (Part-II)

Week 7:
1 Observability in State Space (Part-I)
2 Observability in State Space (Part-II)
3 Pole Placement by State Feedback (Part-I)
4 Pole Placement by State Feedback (Part-II)
5 Pole Placement by State Feedback (Part-III)

Week 8:
1 Tracking Problem in State Feedback Design (Part-I)
2 Tracking Problem in State Feedback Design (Part-II)
3 State Observer Design (Part-I)
4 State Observer Design (Part-II)
5 State Observer Design (Part-III)

Books and References:

Text books :

1. Katsuhiko Ogata, Modern Control Engineering, PHI, 2009.

2. Ashish Tewari, Modern Control Design: with MATLAB and SIMULINK, Wiley, 2002.

3. D. Roy Choudhuary, "Modern Control Engineering, PHI, 2005.

Reference book and research papers :

Stefani et al, Design of Feedback Control Systems, Oxford, Fourth edition, 2002.

Research papers :

[1] D.G. Luenberger , " An Introduction to Observer," IEEE Trans. Automatic Control, pp. 596-602, 1971.

[2] S-H Hou, "A Simple proof of the Leverrier Faddeev characteristic polynomial algorithm," Society for Industrial and Applied Mathematics, vol. 40, no. 3, pp. 706-709, Sept. 1998.

B. Tech Electrical Engineering			
Elective-IV: C. Machine Learning and Deep learning: Fundamentals and applications (ELPEC703C)			
Course Code :	**ELPEC703C**	**Credit :**	**03**
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation (Assignment Marks)	Internal	**40**
2.	End-sem. Examination	Internal / External	**60**

MOOC: 1) Machine Learning and Deep learning: fundamentals and applications:
Link will be provided at the commencement of the course.
2) Assignments marks will be converted on the scale of 40 marks.
3) Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Course Link : https://onlinecourses.nptel.ac.in/noc23_ee87/preview

Course Layout:

Week 1: Introduction
Introduction to ML, Performance Measures, Bias-Variance Trade off, Linear Regression.

Week 2: Bayes Decision Theory
Bayes Decision Theory, Normal Density and Discriminant Function, Bayes Decision Theory - Binary Features, Bayesian Belief Network

Week 3: Parametric and Non- Parametric Density Estimation
Parametric and Non- Parametric Density Estimation – ML and Bayesian Estimation, Parzen Window and KNN

Week 4:Perceptron Criteria and Discriminative Models
Perceptron Criteria, Discriminative models, Support Vector Machines (SVM)

Week 5: Logistic Regression, Decision Trees and Hidden Markov Model
Logistic Regression, Decision trees, Hidden Markov Model (HMM)

Week 6: Ensemble methods
Ensemble methods: Ensemble strategies, boosting and bagging, Random Forest

Week 7: Dimensionality Problem
Dimensionality Problem, Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA)

Week 8: Mixture Model and Clustering
Concept of mixture model, Gaussian mixture model, Expectation Maximization Algorithm, K-means clustering.

Week 9: Clustering
Fuzzy K-means clustering, Hierarchical Agglomerative Clustering, Mean-shift clustering.

Week 10: Neural Network
Neural network: Perceptron, multilayer network, back propagation, RBF Neural Network, Applications
Week 11: Introduction to Deep Neural Networks
Introduction to Deep Learning, Convolutional Neural Networks (CNN),
Vanishing and Exploding Gradients in Deep Neural Networks, LeNet - 5, AlexNet, VGGNet, GoogleNet, and ResNet**.**
Week 12: Recent Trends in Deep Learning
Generative Adversarial Networks (GAN), Auto Encoders and Relation to PCA, Recurrent Neural Networks, U-Net, Applications and Case studies.

Books and References:

1. E. Alpaydin, Introduction to Machine Learning, 3rd Edition, Prentice Hall (India) 2015.
2. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, 2nd Edn., Wiley India, 2007.
3. C. M. Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics), Springer, 2006.
4. M.K. Bhuyan, Computer Vision and Image Processing: Fundamentals and Applications, published by CRC press, USA, 2019.
5. S. O. Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson Education (India), 2016.
6. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016
7. Michael A. Nielsen, Neural Networks and Deep Learning , Determination Press, 2015
8. Yoshua Bengio, Learning Deep Architectures for AI, now Publishers Inc., 2009

B. Tech Electrical Engineering			
Elective-IV: D. Project Management (ELPEC703D)			
Course Code :	**ELPEC703D**	**Credit :**	**03**
Contact Hours :	3 Hrs./week (L)	**Type of Course :**	Lecture
Examination Scheme :	In-sem. Evaluation 40 Marks	End-sem. Examination 60 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	In-sem. Evaluation (Assignment Marks)	Internal	**40**
2.	End-sem. Examination	Internal / External	**60**

MOOC: **1) Project Management**: Link will be provided at the commencement of the course.
2) Assignments marks will be converted on the scale of 40 marks.
3) Score of examination conducted by the respective authority of MOOC or Score of ESE Conducted by Institute will be converted on the scale of 60 marks.

Course Link : https://onlinecourses.nptel.ac.in/noc24_mg01/preview

Course Layout:
Week 1:
Part-I Project Initiation
Lecture 1 - Introduction to project management - I
Lecture 2 - Introduction to project management -II
Lecture 3 - Agile project management
Lecture 4 - Project Selection Models
Lecture 5 - Examples of Project Selection Models
Week 2:
Part-I Project Initiation
Lecture 6 - Project manager
Lecture 7 - Attributes of Effective Project Manager
Lecture 8 - Managing for stakeholders
Lecture 9 - Resolving Conflicts
Lecture 10 - Negotiation
Week 3:
Part-I Project Initiation
Lecture 11 - Project in the organization structure
Lecture 12- Human factors and the project team
Part-II Project Planning
Lecture 13 - Traditional project activity planning
Lecture 14 - Agile project planning, Project charter
Lecture 15 - Coordination through integration management
Week 4:
Part-II Project Planning
Lecture 16 - Project feasibility analysis
Lecture 17 - Estimating project budgets
Lecture 18 - Project risk management
Lecture 19 - Quantitative risk assessment methodologies
Lecture 20 - Critical path method (CPM)

Week 5:
Part-II Project Planning
Lecture 21 - Programme evaluation and review technique (PERT)
Lecture 22 - Risk analysis with simulation for scheduling
Lecture 23 - Gantt Chart, Scheduling with scrum
Lecture 24 - Crashing a project
Lecture 25 - Resource loading
Week 6:
Part-II Project Planning
Lecture 26 - Resource levelling
Lecture 27 - Goldratt's critical chain
Part-III Project Execution
Lecture 28 - Planning-monitoring-controlling cycle
Lecture 29 - Earned value analysis
Lecture 30 - Agile tools for tracking project
Week 7:
Part-III Project Execution
Lecture 31 - Three types of project-controlling
Lecture 32 - Control of change scope and scope creep
Lecture 33 - Project audit
Lecture 34 - Essentials of an audit/evaluation
Lecture 35 - When to close a project
Week 8:
Part-III Project Execution
Lecture 36 - Benefits realization, Case study on the success of Chandrayan-3
Part-IV IT for Project Management
Lecture 37 - Software for project management
Lecture 38 - Demo on project management software
Lecture 39 - Simulations software for project management
Lecture 40 - Course Summary

Books and References:

Project Management (A Strategic Managerial Approach) by Meredith

B. Tech Electrical Engineering			
Power Quality: Issues and Mitigation Lab (ELPCC704)			
Course Code :	**ELPCC704**	**Credit :**	**01**
Contact Hours :	2 Hrs./week (P)	**Type of Course :**	Practical
Examination Scheme :	Oral 50 Marks		

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Oral Examination	External	**50**

Prerequisite:

1. Electrical Measurements
2. Power Systems basics
3. Power Electronics basics

Course Objective:	
1	To demonstrate Power quality analyser and explain the procedure to measure electrical parameters.
2	To explain the process of harmonic compliance as per IEEE 519.
3	To explain the measurement and characterisation process of voltage sag and transient.
4	To demonstrate use of software for Power Quality analysis.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
704.1	Use power quality analyser and measure advanced electrical parameters
704.2	Conduct harmonics PQ audit as per IEEE 519.
704.3	Measure and characterise voltage sag/transient.
704.4	Use software for analysis of PQ analyser data.

List of Experiments:

Compulsory experiments:

1. Study of power quality analyzer and measurement of voltage, current, power and power factor using it.
2. Measurement of harmonic distortion of various equipment such as LED lamp/UPS /VFD.
3. Harmonic compliance of institute as per IEEE 519-2014 standard using data from fixed/portable PQ Analyser and sizing of active filter.
4. Measurement and analysis of voltage sag using ITIC Curve/ swell/ flicker/ transient
5. Harmonic Load flow analysis by using professional software such as ETAP, PSCAD, ATP etc.

Any **three** experiments are to be performed out of the following:

1. Study of power quality monitoring standards such as EN50160/IEEE 1159/IEEE 519-2014/IEC 61000-4-30.
2. Power quality audit of institute/department/industry.
3. Reactive power audit of institute/department/industry.
4. PQ analysis of solar inverter / EV charging station (Supraharmonics)
5. Analysis of performance of induction motor/transformer operated with sinusoidal supply and under distorted supply conditions supplied by 3 phase inverter.
6. Simulation study of transient and/or flicker measurement.
7. Simulation studies of harmonic generation sources such as VFD and FACTS devices and harmonic measurement (THD) using professional software like MATLAB, ETAP, PSCAD etc.

B. Tech Electrical Engineering			
Elective-III Lab: A. PLC, SCADA and its Applications Lab (ELPEC705A)			
Course Code :	**ELPEC705A**	**Credit :**	**01**
Contact Hours :	2 Hrs./week (P)	**Type of Course :**	Practical
Examination Scheme :	Term Work 50 Marks	Practical Examination 50 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	**50**
2.	Practical Examination	External	**50**

Prerequisite:

1. Properties of Z-Transform, Inverse Z transform
2. Initial and Final Value Theorem
3. Basics of discrete systems.

Course Objective:	
1	To explain ladder diagram programming for practical applications.
2	To introduce analog PLC operations
3	To teach interfacing PLC with other technologies like SCADA, HMI, etc.
4	To introduce different applications in PLC in control systems.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
705A.1	Develop ladder logic for complex systems
705A.2	Interface PLC with SCADA
705A.3	Design HMIs and SCADA with control and monitoring attributes for various applications.
705A.4	Develop solutions for real-world industrial automation problems.

List of Experiments:

Compulsory experiments:

1. Interfacing of lamp and button with PLC for ON and OFF operation.
   Verification of all logic gates using PLC
2. Set / Reset operation: one push button for ON and other push button for OFF operation.
3. Study of EN, TT and DN bits of TON, TOF and RTO timers. Draw Timing diagrams of each timer.
4. A) Study of CU, DN and OV bits of UP counter with RESET instruction.
   B) Study of CD, DN and UN bits of DOWN counter with RESET instruction.
5. Combination of counter and timer for lamp ON/OFF operation.
6. PLC interfaced with SCADA and status read/command transfer operation.
7. Parameter reading of PLC in SCADA.
8. Alarm annunciation using SCADA.
9. Reporting and trending in SCADA system.

Any **four** experiments are to be performed out of the following:

1. DOL starter and star delta starter operation by using PLC.
2. PLC based thermal ON/OFF control.
3. Interfacing of Encoder with PLC

4. PLC based speed, position, flow, level, pressure measurement system.
5. Tank level control by using SCADA.
6. Temperature monitoring by using SCADA.
7. Speed control of Machine by using SCADA.
8. Pressure control by using SCADA.

B. Tech Electrical Engineering			
Elective-III Lab: B. Digital Control System Lab (ELPEC705B)			
Course Code :	**ELPEC705B**	**Credit :**	**01**
Contact Hours :	2 Hrs./week (P)	**Type of Course :**	Practical
Examination Scheme :	Term Work 50 Marks	Practical Examination 50 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	**50**
2.	Practical Examination	External	**50**

Prerequisite:

1. Properties of Z-Transform, Inverse Z transform
2. Initial and Final Value Theorem
3. Basics of discrete systems.

Course Objective:	
1	To make students understand basic concepts of discrete signals and systems.
2	To educate students to analyse the stability of discrete systems.
3	To teach formulation of state space discrete model and design the digital controllers.
4	To elaborate digitize analog controllers using various numerical methods.
5	To explore application of the theory of digital control to practical problems.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
705B.1	Identify the relationship between continuous-time systems and their discrete-time counterparts when converting state-space models.
705B.2	Describe the impact of sampling on system response and stability.
705B.3	Apply digital control design techniques to create temperature and position control systems with specified performance characteristics.
705B.4	Examine the controllability and observability of digital systems by analysing their state-space matrices.
705B.5	Evaluate the accuracy of the conversion process from continuous-time to discrete-time state-space models and their impact on system performance.

List of Experiments: Computer Usage / Lab Tool: Simulation on Matlab.

Any **Eight** experiments are to be performed out of the following:

1. Design of digital temperature control system.
2. Design of digital position control system.
3. Software Programming for Determining the State Transition Matrix (STM) of a Discrete-Time (DT) System
4. Software Programming for Determining the Controllability and Observability of a Discrete-Time (DT) System
5. Software Programming to Observe the Effect of Sampling on the Response of the System
6. Software Programming to Observe the Effect of Sampling on the Stability of a Discrete-Time (DT) System
7. Software Programming to find Solution of State Equations for Linear Time-Invariant (LTI) Systems.
8. Computer-Aided Solution of Differential Equations.
9. Conversion of Continuous-Time State Space Models to Discrete-Time State Space Models.

B. Tech Electrical Engineering			
Elective-III Lab: C. High Voltage Engineering Lab (ELPEC705C)			
Course Code :	**ELPEC705C**	**Credit :**	**01**
Contact Hours :	2 Hrs./week (P)	**Type of Course :**	Practical
Examination Scheme :	Term Work 50 Marks	Practical Examination 50 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	**50**
2.	Practical Examination	External	**50**

Course Objective:	
1	To enable students to measure and compare the breakdown voltages in solid, liquid and gaseous dielectric materials.
2	To enable students to visualise corona and record its parameters.
3	To enable students to simulate lightning and switching impulses using suitable software
4	To develop ability among learners to execute testing on various high voltage equipment as per standards
5	To perform Parametric analysis of Impulse current generator using virtual Laboratory

Course Outcomes : Upon successful completion of this course, the students will be able to:	
705C.1	Measure and compare the breakdown voltages in solid, liquid and gaseous dielectric materials.
705C.2	Visualise corona and record its parameters.
705C.3	Simulate lightning and switching impulses using suitable software.
705C.4	Carry out HV tests on various equipment's e. g. Cables, safety gloves safety shoes, using relevant testing IS and be able to give analysis of the test results.
705C.5	Perform Parametric analysis of Impulse current generator using virtual Laboratory.

List of Experiments:

Any **Eight** experiments are to be performed out of the following:

1. To find the constants of breakdown equation of transformer oil. (Analytical and graphical method).
2. Measurement of unknown high voltage using sphere gap.
3. To find out the breakdown of air in uniform and non-uniform field and compare it.
4. To obtain breakdown strength of composite insulation system, and observe the effect of parameter like no. of layers, thickness of layer, effect of interfacing
5. To understand basic principle of corona and obtain audible and visible corona inception and extinction voltage under non uniform field.
6. Simulation of lightning and switching impulse voltage generator using any simulation software.
7. To study surface flashovers on corrugated porcelain/polymeric insulation system.
8. To perform experiment on horn gap arrestor and understand arc quenching phenomenon.
9. To observe the development of tracks and trees on polymeric insulation system.
10. Parametric analysis of Impulse current generator using virtual Laboratory.
11. To perform High voltage withstand test on Cables/ Safety gloves/ Safety shoes etc.
12. study experiment/group discussion/assignment centred around current and innovative literature from reputed and peer-reviewed journal articles concerning high-voltage equipment testing.

B. Tech Electrical Engineering			
Project Stage-I (IOELC7P1)			
Course Code :	IOELC7P1	**Credit :**	**02**
Contact Hours :	4 Hrs./week (P)	**Type of Course :**	Practical
Examination Scheme :	Term Work 100 Marks	Oral Examination 50 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	**100**
2.	Oral Examination	External	**50**

Course Objective:	
1	To provide an opportunity to learn new software, interdisciplinary theory, concepts, technology, etc. not covered in earlier subjects.
2	To empower students to use engineering knowledge and skills learned in previous courses to deliver a product that has passed through the design, analysis, testing, and evaluation.
3	To encourage multidisciplinary project work through the integration of knowledge.
4	To allow students to develop problem-solving, analysis, synthesis, and evaluation skills.
5	To encourage teamwork.
6	To improve students' communication skills by asking them to produce both a professional report and to give an oral presentation.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
7P1.1	Define the project problem statement and identify the scope of the project.
7P1.2	Search the appropriate research papers, standards and e-resources and write a literature survey.
7P1.3	Identify tools, techniques, methods, concepts, measuring devices, and instruments required for the project to define the methodology of the project.
7P1.4	Justify the selection of electrical, electronic and mechanical components for the project prototyping.
7P1.5	Simulate or develop a system for software or hardware verification.
7P1.6	Write a project report with proper interpretation of results.

The student shall take up a project in the field closely related to Electrical Engineering. Preferably, group of 3/4 students should be formed for project work.
The project work should be based on the knowledge acquired by the student during the graduation and preferably it should meet and contribute towards the needs of the society. The project aims to provide an opportunity of designing and building complete system or subsystems based on area where the student likes to acquire specialized skills.
Project work in this semester is an integral part of the complete project. In this, the student shall complete the partial work of the project which will consists of problem statement, literature review, project overview and scheme of implementation. As a part of the progress report of project work, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic.

Guidelines for VIIth Semester for Project work:

1. To identify the problems in industry and society.
2. Perform Literature survey on the specific chosen topic through research papers, Journals, books etc. and market survey if required.

3. To narrow down the area taking into consideration his/her strength and interest. The nature of project can be analytical, simulation, experimentation, design and validation.
4. Define problem, objectives, scope and its outcomes.
5. Design scheme of implementation of project.
6. Data collection, simulation, design, hardware if any, needs to be completed.
7. Presentation based on partially completed work.
8. Submission of report based on the work carried out.
9. Student should maintain Project Work Book.

Course Contents :

1. Literature Survey and outline of Project
2. To prepare report on Literature Survey and Preliminary work
3. Presentation of work carried out in First semester

B. Tech Electrical Engineering			
Internship/ Global certification/ Entrepreneurship/Research Project/ Foreign University Certification (IOELC801)			
Course Code :	**IOELC801**	**Credit :**	**12**
Contact Hours :	30 Hrs./week (P)	**Type of Course :**	Practical
Examination Scheme :	Term Work 200 Marks	Oral Examination 100 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	**200**
2.	Oral Examination	Internal / External	**100**

Course Code	Course	Link
IOELC801A	Internship	https://drive.google.com/drive/folders/15VF7UtCY0Z9lPdzmW0Z2YhqaJGm8AZSV
IOELC801B	Global certification	
IOELC801C	Entrepreneurship	
IOELC801D	Research Project	
IOELC801E	Foreign University Certification	

B. Tech Electrical Engineering			
Project Stage-II (IOELC8P2)			
Course Code:	IOELC8P2	**Credit:**	**02**
Contact Hours:	4 Hrs./week (P)	**Type of Course:**	Practical
Examination Scheme:	Term Work 200 Marks	Oral Examination 100 Marks	

Sr. No.	Course assessment methods/tools	External/ Internal	Marks
1.	Term Work Evaluation	Internal	**200**
2.	Oral Examination	External	**100**

Course Objective:	
1	To develop student's knowledge for solving technical problems.
2	To provide an opportunity to learn about new ideas and concepts.
3	To provide an opportunity to work in team.
4	To analyse, design, and evaluate Engineering System.
5	To develop the leadership quality.
6	To improve Written and Verbal Communication skills.

Course Outcomes : Upon successful completion of this course, the students will be able to:	
8P2.1	Apply the knowledge of mathematics, science and engineering fundamentals to the solution of complex engineering problems.
8P2.2	Implement practically, ideas/real time industrial problems/current application of respective/multidisciplinary engineering branches.
8P2.3	Apply project management skill to design system/product by taking into consideration different issues such as safety, ethics, social, and health, legal, cultural and cost standards.
8P2.4	Use different modern tools and equipments like EDSA, PSIM, LabView, MATLAB, Keil, Lightpack, Proteus, DipTrace, RSLogix500 Factory Talk View Studio, PLC, Power analyzer etc.
8P2.5	Participate in National/ International paper presentation/ publication/ project competition activities.
8P2.6	Prepare Project Report (proposals) and present their project work in English.

Guidelines:

The student shall complete the remaining part of the project which is an extension of the work carried out in VIIth Semester. For exceptional cases, change of topic has to be approved by Internal Assessment Committee consisting of Guide, Project Coordinator and Head of Department.
Student should incorporate suggestions given by examiner in project I.
The student shall complete the remaining part of the project which consists of design, simulation, fabrication of set up required for the project, analysis and validation of results and conclusions.
The student shall prepare duly certified final report of the project work in the standard format in MS Word / LaTex.
Plagiarism of report should be checked from library. (It should be below 10%)
Student should maintain a Project Work Book.
Student should publish at least one paper at reputed International Journal.
Student should participate at least in one project competitions.

Course Contents:
1. Working model of the project 2. Project Report 3. Presentation and demonstration of project

Marking Scheme (Evaluation and Weightage):

Sr.	Components	Deliverables	Evaluation	Weightage (%)	Rubrics				
					Excellent (100%)	**Good (80%)**	**Fair (60%)**	**Average (40%)**	**Need Improvement (20%)**
1.	Project Synopsis	Synopsis with problem description, objectives, a basic plan (methodology) and initial literature review.	Clear problem statement, Objectives and scope, Feasibility of the plan, and Quality of initial literature review.	10	The synopsis includes a **very clear and innovative problem statement**, **well-defined objectives and scope**, a **highly feasible and structured plan**, and a **comprehensive literature review** with relevant and recent references. Demonstrates deep understanding and originality	The synopsis presents a **clear and relevant problem**, **appropriate objectives**, a **practical and mostly clear plan**, and a **good literature review** with mostly relevant sources. Minor improvements could enhance it.	The synopsis includes a **basic problem statement**, **general objectives**, a **moderately feasible plan**, and a **partial or somewhat shallow literature review**. Adequate, but lacks depth and precision.	The synopsis shows **vague or incomplete elements** across the four areas. The problem may be **unclear**, objectives **underdeveloped**, the plan **lacking structure**, and the literature review **minimal or poorly connected**.	The synopsis is **missing major components** or includes **irrelevant, poorly defined, or incoherent content**. There is little to no evidence of planning, structure, or research effort.
2.	Literature Review	Literature review report with summary of key papers and explanation of research gap.	Depth of research, Relevance and analysis of the papers, and Identification of research gap.	10	Demonstrates **thorough and extensive research** using diverse, high-quality, and up-to-date sources. Papers are **critically analyzed**, with clear understanding of methodologies and findings. The **research gap is well-articulated**, specific, and logically derived from the literature. Shows scholarly insight and originality. A minimum of 25 research papers have been thoroughly reviewed and referenced in the literature survey.	Shows **good coverage** of relevant literature with appropriate sources. Analysis is present but may lack some depth or critical insight. The **research gap is identified** and relevant, though not deeply explored. Solid understanding is evident. A minimum of 20 research papers have been reviewed and referenced in the literature survey.	Literature review includes **some relevant papers**, but lacks variety or depth. Analysis is mostly descriptive, not critical. **Research gap is vaguely stated** or inferred, without strong justification. Adequate effort, but limited in scope. A minimum of 15 research papers have been reviewed and referenced in the literature survey.	**Limited number of sources**, some outdated or not clearly relevant. Minimal or no analysis of papers. Research gap is **unclear, general, or missing context**. Lacks academic rigor. A minimum of 10 research papers have been reviewed and referenced in the literature survey.	**Very few or no relevant papers cited**. No real analysis or synthesis. Research gap is **not mentioned or completely misunderstood**. Indicates lack of understanding or effort. A minimum of 05 research papers have been reviewed and referenced in the literature survey.

Sr.	Components	Deliverables	Evaluation	Weightage (%)	Rubrics				
					Excellent (100%)	**Good (80%)**	**Fair (60%)**	**Average (40%)**	**Need Improvement (20%)**
3.	Methodology & Design	Methodology section with steps, design diagrams (if needed), and test plan.	Selection of proper methodology, Implementation of research or design, Innovation & creativity in approach, Feasibility of the plan.	20	Methodology is **highly appropriate and well-justified**. Implementation is **systematic, complete, and efficient**. The approach shows **strong innovation or creativity** and clear understanding. The plan is **very feasible**, realistic, and considers constraints. Demonstrates deep engagement with the research or design process.	Methodology is **appropriate and mostly clear**. Implementation is **logically executed** with minor gaps. Some evidence of **original thinking or creative problem-solving**. Plan is **feasible with some room for refinement**. Solid, structured approach overall.	Methodology is **partially appropriate**, possibly chosen without strong justification. Implementation is **basic** or partially complete. Shows **limited creativity**, mostly follows standard solutions. Plan is **somewhat feasible**, but lacks detailed support.	Methodology is **vague or misaligned** with objectives. Implementation is **unclear or incomplete**. Minimal creativity in the approach. Plan appears **unrealistic or poorly developed**. Execution lacks coherence.	Methodology is **inappropriate or absent**. No meaningful implementation. No evidence of creativity or innovation. Plan is **not feasible** or not provided. Indicates poor understanding or effort.
4.	Project Implementation/ Experimentation	Working model or prototype, or simulation results	Successful implementation or completion of experiment, Accuracy of results, Problem-solving & overcoming challenges during the project	20	Project/experiment is **successfully and fully implemented** as planned. Results are **highly accurate and validated**. Clear evidence of **effective problem-solving**, with innovative handling of challenges & setbacks. Demonstrates strong technical competence & perseverance.	Project is **mostly completed** with minor issues. Results are **reasonably accurate**, with slight deviations or unaddressed issues. Encountered challenges are **mostly addressed**, showing logical thinking and adaptability	Implementation is **partially complete** or requires revision. Results are **partially accurate** or not well supported. Some challenges are identified but **not fully resolved**. Limited problem-solving effort.	Project is **incomplete or poorly executed**. Results are **inaccurate or inconsistent**. **Little effort shown** in addressing issues; problems may be ignored or misunderstood.	**No meaningful implementation**. Results are **missing or clearly incorrect**. **No evidence of problem-solving**. Student/team shows little to no engagement with the project execution process.

Sr.	Components	Deliverables	Evaluation	Weightage (%)	Rubrics				
					Excellent (100%)	**Good (80%)**	**Fair (60%)**	**Average (40%)**	**Need Improvement (20%)**
5.	Analysis and Interpretation	Data analysis with graphs, tables and an explanation of results.	Accuracy of the analysis, Clarity & insights in the interpretation of results, Comparison with expected, theoretical results or existing work.	10	Analysis is **highly accurate**, methodologically sound, and well-supported. Interpretation of results is **clear, logical, and insightful**, demonstrating deep understanding. Strong **comparison with theoretical or expected results** and/or **existing work**, including meaningful explanations of similarities or deviations.	Analysis is **mostly accurate** with minor flaws or assumptions. Interpretation is **clear and relevant**, though insights may be slightly limited. **Comparison with expected or existing work is present**, with a reasonable discussion of findings.	Analysis is **partially accurate**, with gaps or errors in logic. Interpretation is **basic**, lacking depth or clarity. **Comparison is minimal or superficial**, with limited discussion of relevance.	Analysis shows **major inaccuracies** or unclear reasoning. Interpretation is **unclear or confusing**, offering little insight. **Comparison is weak or missing**, showing lack of engagement with theory or prior work.	Analysis is **incorrect or missing**. No clear interpretation of results. **No comparison** with theoretical or expected outcomes. Lacks analytical thinking or understanding.
6.	Report Writing	Final report with all sections—introduction, literature review, methodology, results, conclusions and future work.	Clear and organized report with plagiarism less than 10%. Presentation of figures, tables, and references. Grammar and writing style.	05	Report is **well-structured, clearly written**, and free from major errors. **Plagiarism is under 10%**. Figures, tables, and references are **consistently formatted**, properly labeled, and highly relevant. Grammar, spelling, and writing style are **flawless**, with professional presentation.	Report is **mostly clear and well-organized**, with **minor formatting or writing issues**. Plagiarism is **within acceptable limits**. Figures/tables are mostly accurate and labeled; references are properly cited with minor inconsistencies. Writing is grammatically correct with few errors. **Plagiarism is under 15%**.	Report shows **basic organization**, but contains **several language or formatting issues**. Plagiarism may approach the limit. Figures, tables, or references are **partially completed**, **inconsistent**, or **not well-integrated**. Writing is understandable but lacks polish. **Plagiarism is under 20%**.	Report is **disorganized** or hard to follow. **Plagiarism may be above threshold** or not clearly addressed. Figures/tables are **poorly presented** or missing; references are **incorrectly cited**. Numerous grammatical or structural problems. **Plagiarism is under 25%**.	Report is **unclear, unstructured**, or shows **high plagiarism**. Figures, tables, and references are **missing, irrelevant, or incorrect**. Writing contains **frequent errors**, poor language usage, and lacks coherence. **Plagiarism is under 30%**.

Sr.	Components	Deliverables	Evaluation	Weightage (%)	Rubrics				
					Excellent (100%)	**Good (80%)**	**Fair (60%)**	**Average (40%)**	**Need Improvement (20%)**
7.	Paper Writing and Publication	A research paper draft (submitted or in the process of submission).	Draft Quality: Structure, clarity, & good presentation of abstract, introduction, methodology, & results. Quality of Journal/ Conference : Higher marks for good-quality peer-reviewed journals or reputed conferences (SCOPUS indexed, IEEE, Springer, Elsevier, etc.).	15	Draft is **well-structured and clearly written**, with strong presentation across **abstract, introduction, methodology, and results**. Logical flow and technical depth are evident. Target journal is **SCIE/ESCI**.	Draft has a **clear structure**, with minor issues in clarity or formatting. Key sections are **well-developed** but could use slight refinement. Target journal/conference is a **high-quality, peer-reviewed, SCOPUS-indexed platform** (e.g., IEEE, Springer, Elsevier).	Draft is **partially organized**, with noticeable gaps in structure or explanation. Some sections are **underdeveloped**. Target journal/conference is an **international conference or UGC-CARE-listed other than WoS/Scopus indexed journal**.	Draft is **poorly structured**, lacking clarity in multiple sections. Content appears rushed or incomplete. Target journal/conference is **relevant but not indexed or peer-reviewed**.	Draft is **disorganized or unclear**, with missing or irrelevant content. Target venue is **non-indexed or informal**, with limited academic rigor.
8	Presentation	PowerPoint presentation and viva voce.	Clear and confident presentation. Depth of understanding shown during the viva.	10	Presentation is **clear, confident, and well-paced**, with excellent use of visuals and engagement. During viva, student demonstrates **in-depth understanding**, answers all questions insightfully, and reflects critical thinking and technical mastery.	Presentation is **clear and reasonably confident**, with good flow and communication. In viva, most questions are **answered accurately**, with signs of good subject knowledge and conceptual clarity.	Presentation is **adequate but may lack polish or confidence**. Some parts are unclear. In viva, student **answers basic questions**, but struggles with deeper or conceptual ones.	Presentation is **unclear or hesitant**, with poor organization or delivery. During viva, student shows **limited understanding** and is unable to respond to several questions effectively.	Presentation is **disorganized or lacking confidence**, with minimal preparation. In viva, student is **unable to answer questions** and shows **poor grasp** of project content.