FABTECH EDUCATION SOCIETY'S

FABTECH TECHNICAL CAMPUS
COLLEGE OF ENGINEERING & RESEARCH, SANGOLA

(An Autonomous Institute)

Affiliated to Dr. Babasaheb Ambedkar Technological University (DBATU), Lonere

In line with the

National Education Policy (NEP) 2020

Compliant Curriculum

For

DEPARTMENT OF ELECTRICAL ENGINEERING

POST GRADUATE PROGRAMME
(ELECTRICAL ENGINEERING)

First & Second Year M. Tech.
(Sem-I, Sem-II, Sem-III &Sem-IV)

(w.e.f. A.Y. 2025-26)

PRINCIPAL
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COLLEGE OF ENGINTEERING
& RESEARCH, SANGOLA

Chairman
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Electrical Engineering Department
FTCCOER, Sangola
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A.C

Vice Principal
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College of Engg.& Research,Sangola

COLLEGE OF ENGINEERING & RESEARCH SANGOLA

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Curriculum for Electrical Engineering M. Tech. with effect from A.Y. 2025-26

Semester I

Course Type	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	In Semester Evaluation Scheme		End Semester Evaluation Scheme		*Total Marks*
			L	*T*	*P*		MSE	ICA	ESE	OE/POE	
							M	M	M	M	
PCC	25PEE11171	Modern Power System Analysis	3	-	-	3	30	10	60	-	100
	25PEE11172	Power System Modelling	3	-	-	3	30	10	60	-	100
	25PEE11173	High Power Converters	3	-	-	3	30	10	60	-	100
	25PEE11174	Modern Power System Analysis Lab			2	1	-	50	-	-	50
PEC	25PEE11271	Professional Elective Courses-I	3	1	-	4	30	10	60	-	100
	25PEE11272										
	25PEE11273										
ELC	25PME11671	Research methodology and IPR	3	1	-	4	30	10	60	-	100
ELC	25PEE11672	Seminar	-	-	2	1	-	50	-	-	50
AEC	25PEE11471	Hands on Research and Analysis Tool	-	-	2	1	-	50	-	-	50
		Total	**15**	**02**	**06**	**20**	**150**	**200**	**300**	**-**	**650**
			Abbreviations: L= Lecture, **T**= Tutorial, **P**= Practical, **M**= Marks								

*Students must complete a student induction program at the start of the first semester to ease their transition into the academic environment.

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In addition to above courses the following Groups are offered as Multidisciplinary Minor by Electrical Engineering Department

Professional Elective Courses-I[PEC]

S.No.	Course Code	Course Name
1	25PEE11271	EHV AC Transmission System
2	25PEE11272	Digital Control Systems
3	25PEE11273	Analysis of Power Converters

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Semester - II

Course Type	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	In Semester Evaluation Scheme		End Semester Evaluation Scheme		*Total Marks*
			L	*T*	*P*		MSE	ICA	ESE	OE/POE	
							M	M	M	M	
PCC	25PEE12175	Digital Protection	3	-	-	3	30	10	60	-	100
	25PEE12176	Power System Dynamics & Stability	3	-	-	3	30	10	60	-	100
	25PEE12177	HVDC and FACTS	3	-	-	3	30	10	60	-	100
	25PEE12178	HVDC and FACTS Lab	-	-	2	1		50	-	-	50
PEC	25PEE12274 25PEE12275 25PEE12276	Professional Elective Course-II	3	1	-	4	30	10	60	-	100
PEC	25PEE12277 25PEE12278 25PEE12279	Professional Elective Course-III	3	1	-	4	30	10	60	-	100
VSE	25PEE12172	Mini Project	-	-	2	1	-	50	-	-	50
ELC	25PET12673	Research Publication and Ethics	-	-	4	2	-	50	-	-	50
		Total	**15**	**02**	**08**	**21**	**150**	**200**	**300**	**-**	**650**

Abbreviations: L= Lecture, **T**= Tutorial, **P**= Practical, **M**= Marks

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In addition to above courses following Groups are offered as Professional Elective Course by Electrical Engineering Department

Professional Elective Course-II [PEC-II]

Sr. No.	Course Code	Name of the Course
1	25PEE12277	Power Quality Issues and Mitigation
2	25PEE12278	Modern optimization techniques in power Systems
3	25PEE12279	Advanced Electric Drives

Professional Elective Course -III [PEC-III]

Sr. No.	Course Code	Name of the Course
1	25PEE12274	Restructured Power System
2	25PEE12275	AI Applications To power systems
3	25PEE12276	Advanced Power Electronics

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Semester - III

Course Type	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	In Semester Evaluation Scheme		End Semester Evaluation Scheme		*Total Marks*
			L	*T*	*P*		MSE	ICA	ESE	OE/POE	
							M	M	M	M	
PCC	26PEE21179	Renewable Energy Systems	3	1	-	4	30	10	60	-	100
ELC	26PEE21674	MOOC's/NPTEL, Self Learning Courses/MKCL@	2	-	-	2	-	50	-		50
OEC	26PEE21571	Open Elective Course -IV	3	1	-	4	30	10	60	-	100
	26PEE21572										
	26PEE21573										
ELC	26PEE21675	Dissertation Phase -I	-	-	12	6	-	100	-	100	200
		Total	**08**	**02**	**12**	**16**	**60**	**170**	**120**	**100**	**450**
			Abbreviations: L= Lecture, T= Tutorial, P= Practical, M= Marks								

@ These subjects are to be studied using SWAYAM/NPTEL (8/12 weeks)) (The list may alter and modify as per the availability of the subjects on the NPTEL/ SWYAM platform and usefulness, every year). Students who fail to satisfy the passing criteria of the course shall be required to appear for an offline examination for the same course and secure the minimum passing marks/grade as prescribed by the Institute.

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NPTEL Courses (ELC -26PEE21674)

Sr.	Title of the course	Instructor Name(s)	Duration (No. of Weeks)	NPTEL URL Link	Click here to Join the course
A	Solar Photovoltaic System Design	Prof. Rhythm Singh IIT Roorkee	8 Weeks	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ph65	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ph65
B	Electric Vehicle: Its Components, Charging Infrastructure and Grid Integration Solution	Prof. Siba Kumar Patro Prof. Narayana Prasad Padhy Prof. Ramkrishna Pasumarthy	12 Weeks	https://nptel.ac.in/courses/108107002	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee103
C	DC Microgrid and Control System	Prof. Avik Bhattacharya	8 Weeks	https://nptel.ac.in/courses/108107143	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee107
D	Introduction To Project Management: Principles & Practices	Dr. Nimisha Singh Quality Council of India	12 Weeks	https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg293	https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg293

Open Elective Course-IV

Sr. No.	Course Code	Name of the Course
1	26PEE21571	Industrial Safety
2	26PEE21572	Operational Research
3	26PEE21573	Entrepreneurship

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Semester - IV

Course Type	*Course Code*	*Name of the Course*	*Engagement Hours*			*Credits*	In Semester Evaluation Scheme		End Semester Evaluation Scheme		*Total Marks*
			L	*T*	*P*		MSE	ICA	ESE	OE/POE	
							M	M	M	M	
ELC	26PEE22676	Dissertation Phase -II	-	-	24	12	-	200	-	200	400
		Total			24	12	-	200	-	200	400
			Abbreviations: L= Lecture, T= Tutorial, P= Practical, M= Marks								

Type of courses	Description
PCC	Programme Core Course
PEC	Programme Elective Course
MDM	Multidisciplinary Minor
OEC	Open Elective Other
ELC	Research Methodology
VSE	Vocational and Skill Enhancement Course
ELC	Dissertation/Project/Internship
AEC	Ability Enhancement Courses

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First & Second Year M.Tech.

(Sem-I, Sem-II, Sem-III &Sem-IV)

(w.e.f. A.Y. 2025-26)

M.Tech Electrical Engineering

Semester- I

Syllabus

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First Year M. Tech.

Semester-I (w.e.f. A.Y. 2025-26)

Modern Power System Analysis(25PEE11171**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	-	-	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	3	3	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Apply Newton-Raphson, Gauss-Seidel, and fast decoupled methods to solve load flow problems incorporating voltage limits, sparsity techniques, and frequency effects.	BL-3: Apply
CO 2	Analyze various types of fault conditions including simultaneous and open conductor faults using a generalized fault analysis method.	BL-4: *Analyze*
CO 3	Evaluate system security under different operating states using contingency analysis, distribution factors, and overload indices.	BL-5: *Evaluate*
CO 4	Analyze the observability of a power system and implement state estimation techniques like WSL and bad data correction using real and pseudo measurements.	BL-4: *Analyze*
CO 5	Evaluate voltage stability through P-V curves, continuation power flow, and voltage collapse indices to predict and mitigate instability in power systems.	BL-5: *Evaluate*

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Load Flow:** Overview of Newton-Raphson, Gauss-Siedel fast decoupled methods, convergence properties, sparsity techniques, handling Q max violations in constant matrix, inclusion in frequency effects AVR in load flow, handling ofdiscrete variable in load flow.	8
2	**Fault Analysis:** Simultaneous faults, open conductors faults, generalized method of fault analysis	8
3	**Security Analysis::** Security state diagram. contingency analysis, generator shift distribution factors, line	8

	outage distribution factor, multiple line outages, overload index ranking	
4	**State Estimation :**Sources of errors in measurement, Virtual and Pseudo measurement, Observability, Tracking state estimation, WSL rnethod, bad data correction	6
5	**Vohage Stability:** Voltage collapse, P-V curve, multiple power flow solution, continuation power flow, optimal multiplies load flow, voltage collapse proximity indices.	6

Text Books:	
1)	L.P. Singh, "Advanced Power System Analysis and Dynamics", New Age Intemational, 2006
2)	A. R. Bergen & Vijay Vittal , "Power System Analysis" ,Pearson , 2000
Reference Books:	
1)	J.J. Grainger &W.D.Stevenson, "Power system analysis ", McGraw Hill ,200f
2)	G.L. Kusic, 'Computer aided power system analysis" ,Prentice Hall lndia 1986
3)	A.J. Wood, " Power generation, operation and Control" , John Wiley, 1994
4)	P.M. Anderson, "Fauhed power system analysis". IEEE Press. 1995

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Semester-I (w.e.f. A.Y. 2025-26)

Power System Modelling (25PEE11172**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	-	-	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	3	3	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze the modeling requirements for various components of a power system, including boilers, turbines, and governors, to support steady-state and dynamic performance studies.	BL-4: *Analyze*
CO 2	Evaluate different transformer models such as auto-transformers, tap-changing, and phase-shifting transformers for their impact on power system operation and control.	BL-5: *Evaluate*
CO 3	Develop mathematical models of synchronous machines using Park's transformation for steady-state and dynamic analysis under different system conditions.	BL-6: *Create*
CO 4	Simulate the performance of a synchronous machine connected to an infinite bus using appropriate models for analyzing steady-state and transient behavior.	BL-3: Apply :
CO 5	Design and evaluate excitation system models—including electro-mechanical and solid-state regulators—and assess their impact on system voltage response and dynamic stability.	BL-6: *Create*

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Modelling of Power System Components:** The need for modelling of power system, different areas of power system analysis. Models of nonelectrical components like boiler, steam & hydro-turbine & governor system. Transformer modelling such as auto-transformer, tap-changing & phase shifting transformer.	8

2	**Synchronous machine modelling** Model required for steady-state analysis. The development of model required for dynamic studies. The current & flux linkage models using Park's transformation leading to simulation as linear model.	8
3	**Analysis of synchronous machine modelling** Synchronous machine connected to an infinite bus, its simulation for steady-state condition.	6
4	**Excitation systems modelling** Simplified view of excitation control. Excitation configuration, primitive systems, Definitions of voltage response ratio & exciter voltage ratings. Excitation control systems using dc generator exciter, alternator-rectifier, alternator SCR, and voltage regulators such as electro-mechanical and solid state. Modelling of excitation systems.	6
5	**Transmission line, SVC and load modelling:** Transmission line modelling, Modelling of static VAR compensators, load modelling	6
Text Books:		
1)	R.Ramunujam," Power System Dynamics Analysis and Simulation, PHI Learning Private Limited, New Delhi, 2009.	
2)	P. Kundur, "Power System Stability and Control", McGraw-Hill, 1993.	
Reference Books:		
1	P. C. Krause, "Analysis of Electric Machinery", McGraw Hill, New York, 1987	
2	Electric Power Systems: B.M. Weddy and B.J. Cory, John Wiely and Sons, Fourth edition(2002).	
3	Power System Analysis and Design:J. Duncan Glover, MulukutlaS. Sarma, ThomsonBrooks/cole/ Third Edition (2003)	
4	CheeMunOng, "Dynamic simulation of Electrical Machinery using Matlab/Simulink" Prentice Hall PTR, 199',7.	
5	P. Vas, "Vector Control of A.C. Machines", Clarendon Press, Oxford 1990.	
6	W. Leonhard. "Control of Electrical Drives", Springer Verlry, I985.	
7	J .M. D. Murphy and F.G. Turnbull, "Power Electronic Control ofAC motors", Pergamum Press, 1988.	

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First Year M. Tech.

Semester-I (w.e.f. A.Y. 2025-26)

High Power converters(25PEE11173**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	-	-	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	3	3	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Apply the principles of multi-pulse rectifiers and voltage source inverters to model and simulate power electronic conversion systems for industrial use.	BL-3: *Apply*
CO 2	Analyze the performance and harmonic characteristics of multilevel and modular converter topologies including SPWM and SVPWM techniques.	BL-4: *Analyze*
CO 3	Evaluate the operation and control of AC voltage controllers such as cyclo-converters and matrix converters in power conditioning applications.	BL-5: *Evaluate*
CO 4	Analyze the design, protection, and integration aspects of high-power converters in renewable energy systems, electric vehicles, and smart grid applications.	BL-4: *Analyze*
CO 5	Evaluate converter applications in FACTS, HVDC systems, and power quality enhancement through case studies on UPFC, STATCOM, and active filters.	BL-5: *Evaluate*

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Introduction to High Power Converters :** Power electronic systems, An overview of PSDs, multi-pulse diode rectifier, multi pulse SCR rectifier	8
2	**Voltage Source Inverters:** Phase shifting transformers, multilevel voltage source inverters: two level voltage source inverter, cascaded, H bridge multilevel inverter.	8

3	**Multilevel and Modular Converter Topologies:** Diode clamped multilevel inverters, Harmonic analysis, switching techniques (SPWM, SVPWM) flying capacitor multilevel inverter, PWM current source inverters, DC to DC switch mode converters, Applications in FACTS, HVDC systems	8
4	**AC voltage controllers:** AC voltage controllers: Cyclo-converters, matrix converter, Power conditioners and UPS.	6
5	**Design aspects of converters & Applications:** Design aspects of converters, protection of devices and circuits,High power converters in renewable energy systems (wind, solar PV),Converters for Electric Vehicles and Traction, Role in Smart Grid and Micro-grid applications, Power quality improvement (active power filters, STATCOM),Case studies: HVDC systems, Unified Power Flow Controllers (UPFC), industrial drives	8
Text Books:		
1)	M.H. Rashid, "Power Electronics", Prentice Hall of India, 1994	
2)	B. K .Bose, "Power Electronics and A.C. Drives", Prentice Hall, 1986	
Reference Books:		
1)	N. Mohan, T. M. Undeland and W. P. Robbins, "Power Electronics: Converter, Applications and Design", John Wiley and Sons, 1989.	
2)	Bin Wu, "High power converters and drives", IEEE press, Wiley Enter science	
3)	Jos Arrillaga, "High Voltage Direct Current Transmission," IET	
4)	L. Umanand, "Power Electronics: Essentials & Applications," Wiley India	

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First Year M. Tech.

Semester-I (w.e.f. A.Y. 2025-26)

Modern Power System Analysis Lab(25PEE11174**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:			**MSE:**	
Tutorials:			**ICA:**	50 Marks
Practical:	2	1	**ESE:**	
Total:	2	1	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Apply theoretical concepts to perform experiments and operate instruments in a controlled laboratory environment for solving real-world engineering problems.	BL-3: *Apply*
CO 2	Analyze experimental data to identify trends, verify theoretical principles, and interpret the behavior of physical systems under test.	BL-4: *Analyze*
CO 3	Evaluate measurement techniques, instrumentation accuracy, and error sources to improve the reliability and precision of experimental results.	BL-5: *Evaluate*
CO 4	Design and set up experimental procedures or test rigs to investigate engineering phenomena or validate simulation models.	BL-6: *Create*
CO 5	Develop technical reports and presentations based on experimental outcomes, integrating data analysis and critical insights to support engineering decisions.	BL-6: *Create*

	List of Experiments	
	1. Study of Convergence Properties and Sparsity Techniques in Load Flow Methods 2. Handling Q-max Violations in PV Buses in Load Flow using Constant Matrix Approach 3. Inclusion of Frequency Effects and AVR Modeling in Load Flow Analysis 4. Load Flow Analysis with Discrete Variables (e.g., transformer taps, switched shunts) 5. Simulation of P-V Curve for Identifying Voltage Collapse Point 6. Study of Voltage Collapse Phenomenon in Weak Buses 7. Implementation of Generalized Method of Fault Analysis for any unbalanced fault	

	OE/POE - The End Semester POE Exam for practical shall be based on performance in one of Experiments and may be followed by sample questions.	

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Semester-I (w.e.f. A.Y. 2025-26)

EHV AC Transmission System(25PEE11271**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze the characteristics, challenges, and electrical parameters of EHVAC transmission systems.	BL-4: Analyze
CO 2	Analyze the electric field distribution and voltage gradients in EHV conductors and bundled configurations.	BL-4: Analyze
CO 3	Evaluate corona effects in EHVAC systems including power loss, audible noise, and radio interference with relevant measurements and standards.	BL-5: Evaluate
CO 4	Apply electrostatic field theory and travelling wave principles to analyze field effects, electromagnetic interference, and wave behaviour in EHVAC transmission lines.	BL-3: Apply
CO 5	Analyze voltage control methods in EHVAC systems using reactive power compensation and their effects on system performance.	BL-4: Analyze

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Fundamentals of EHVAC Transmission:** Necessity of EHV AC transmission – advantages and problems–power handling capacity and line losses- mechanical considerations – resistance of conductors – properties of bundled conductors – bundle spacing and bundle radius- Examples.Line inductance and capacitances – sequence inductances and capacitances – modes of propagation – ground return.	8
2	**Voltage gradients of conductors:** Electrostatics – field of sphere gap – field of line changes and properties – charge – potential relations for multi-conductors – surface voltage gradient on conductors – distribution of voltage gradient on sub-conductors of bundle.	6
3	**Corona effects:** Power loss and audible noise (AN) – corona loss formulae – charge voltage diagram –	7

	generation, characteristics - limits and measurements of AN – relation between 1-phase and 3-phase AN levels – Examples. Radio interference (RI) - corona pulses generation, properties, limits – frequency spectrum – modes of propagation – excitation function – measurement of RI, RIV and excitation functions.	
4	**Electro static field:** Electrostatic field: calculation of electrostatic field of EHV/AC lines – effect on humans, animals and plants – electrostatic induction in un-energized circuit of double-circuit line – electromagnetic interference. **Travelling wave theory:** Travelling wave expression and solution- source of excitation-terminal conditions- open circuited and short-circuited end- reflection and refraction coefficients-Lumped parameters of distributed lines generalized constants-No load voltage conditions and charging current.	8
5	**Voltage control:** Power circle diagram and its use – voltage control using synchronous condensers – cascade connection of shunt and series compensation – sub synchronous resonance in series capacitor – compensated lines – static VAR compensating system.	6
Text Books:		
1)	EHVAC Transmission Engineering by R. D. Begamudre, New Age International (p) Ltd.	
2)	"HVAC and DC Transmission", 3rd edition , Khanna Publishers, 2001 by S. Rao	
Reference Books:		
1)	Rakosh Das Begamudre ,"Extra high voltage AC Transmission Engineering"-Wiley Eastem LTD.	
2)	Edison,"EHV Transmission line"-Electric institution.	
3)	EHV AC & DC Transmission Manoj Nair Balaji publication	
4)	T.J.E.Miller : Reactive Power Control in Electric Systems, John Wiley & Sons, 1986	
5)	A Chakraborti, D.P. Kothari and A.K. Mukhopadyay: Performance, Operation and Control of EHV Power Transmission Systems, T.M.H, 1999.	

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First Year M. Tech.

Semester-I (w.e.f. A.Y. 2025-26)

Digital Control Systems(25PEE11272**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Apply the concepts of Digital control systems.	BL-3: Apply
CO 2	Analyze the time-domain and stability aspects of digital control systems using various mathematical tools.	BL-4: Analyze
CO 3	Formulate and analyze discrete-time state-space models for control system design and evaluation.	BL-4: Analyze
CO 4	Design digital controllers and observers using Z-domain techniques and state-space methods.	BL-6: Create
CO 5	Apply digital control strategies to practical systems using modern tools and address implementation issues.	BL-3: Apply

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Concept & Representation of Discrete time Systems** Block Diagram of typical control system- advantages of sampling in control systems – examples of discrete data and digital systems – data conversion and quantization – sample and hold devices – D/A and A/D conversion – sampling theorem – reconstruction of sampled signals. Z-transform: Definition of Z-transforms – mapping between s-plane and z-plane – inverse z- transform – properties of z-transforms - ROC of z-transforms – pulse transfer function –relation between G(s) and G(z) – signal flow graph method applied to digital control systems.	8
2	**Time-Domain Analysis and Stability** Solution of difference equations, Response of discrete-time systems to standard test signals, Concept of controllability and observability (Kalman criteria), Stability concepts: BIBO, asymptotic, and input-output stability, Lyapunov stability for discrete-time systems, Jury's stability test and Routh stability in z-domain.	8
3	**State Space Analysis:** State Space Representation of discrete time systems, Pulse Transfer Function Matrix	8

	solving discrete time state space equations, State transition matrix and it's Properties, Methods for Computation of State Transition Matrix, Discretization of continuous time state – space equations. Concepts of Controllability and Observability, Tests for controllability and Observability. Duality between Controllability and Observability, Controllability and Observability conditions for Pulse Transfer Function.	
4	**Design of Digital Controllers** Design using transformation techniques (Z-domain and W-domain), Digital PID controller design and tuning methods, Deadbeat and pole-zero cancellation controllers, Root locus and frequency domain design methods in Z-domain, State feedback controller design, Observer-based controller design.	6
5	**Advanced Topics and Applications** Adaptive and predictive control basics, Model Reference Adaptive Control (MRAC), Digital control implementation issues: quantization, overflow, sampling delay, Real-time digital control and embedded implementation overview, Applications in power electronics, robotics, and industrial automation.	6

Text Books:	
1)	K. Ogata, Discrete-Time Control systems, Pearson Education/PHI, 2nd Edition.
2)	B.C.Kuo, "Digital Control Systems", 2nd Edition, Oxford University Press, 2003.
Reference Books:	
1)	M. Gopal, "Modern Control Systems Theory", Wiley Eastern, 1984
2)	M. Gopal, "Digital control engineering", New Age International Publications,2003
3)	M. Gopal, "Digital Control and State Variable Methods", 3rd Edition, TMH, Sep-2008.
4)	V. I. George, C. P. Kurian, Digital Control Systems, Cengage Learning
5)	M. Sami Fadali Antonio Visioli, Digital Control Engineering Analysis and Design, Academic Press
6)	Charles L. Phillips, "Digital Control System: Analysis and Design", Prentice Hall, Englewood Cliffs, New Jersey.
7)	G. F. Franklin, J. D. Powell and M. L. Workman, Digital Control of Dynamic Systems,
8)	Addison Wesley, 1998, Pearson Education, Asia, 3/e, 2000. K. J. Astroms and B. Wittenmark, Computer Controlled Systems - Theory and Design, Prentice Hall, 3/e, 1997.

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First Year M. Tech.

Semester-I (w.e.f. A.Y. 2025-26)

Analysis of Power Converters (25PEE11273**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At The End of This Course, Students Shall Be Able To		***BL Level***
CO 1	Analyze the operation of single-phase and three-phase controlled rectifiers with various loads and assess the impact of conduction modes, source inductance, and power factor on performance.	BL-4: Analyze
CO 2	Evaluate the design and performance characteristics of DC-DC converter topologies such as buck, boost, buck-boost, interleaved, and multi-port converters for different applications.	BL-5: *Evaluate*
CO 3	Design and implement PWM-based single-phase and three-phase voltage source and current source inverters including multilevel inverter systems, and analyze their harmonic spectrum and filtering needs.	BL-6 Create
CO 4	Apply appropriate AC voltage controllers and cycloconverters for specific load types (R, RL) and control ranges, and assess their roles in motor control, reactive power compensation, and HVDC systems.	BL-3: Apply
CO 5	Evaluate the application of power electronic converters in modern technologies including UPS systems, induction heating, renewable energy systems, and electric vehicles, focusing on control, efficiency, and integration challenges.	BL-5: *Evaluate*

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Single Phase Controlled Rectifiers** Single Phase AC to DC controlled converter configurations: Semi-converter and Fully controlled converter with R, RL, RLE load; Continuous and discontinuous conduction mode; Analysis of supply side power factor and power factor improvement techniques; Effect of source inductance; Dual converter; PWM rectifier	7

2	**Three Phase Controlled Rectifiers** Three Phase AC to DC controlled converters configurations: Semi-converter and Fully controlled converter with R, RL, RLE load; Continuous and discontinuous conduction mode; Harmonic analysis; Effect of source inductance; Multi-quadrant converter; Multi-pulse converter	8
3	**DC-DC Converters** Configurations: Buck, Boost, Buck-Boost; Multi-port and interleaved converters; Synchronous converters; Design and control of DC-DC converter; Multi-quadrant choppers and applications	7
4	**DC-AC Inverters** Single phase Voltage Source Inverter (VSI) and Current Source Inverter (CSI); Three phase VSI and CSI: 120° and 180° modes of operation; PWM techniques: Sine PWM, space vector PWM; Multilevel Inverters: Types, voltage control and applications; Harmonic spectrum: THD analysis and Harmonic mitigation techniques; Filter design; Device selections	9
5	**AC Voltage Controllers &Power Converters Applications** Single phase and three phase voltage regulators; R and RL load, range of control; Single phase cycloconverters: Types and operating principle. HVDC applications; Front end rectifier design; Motor control applications; Reactive power compensation; UPS; Induction heating; Power converters in renewable energy and electric vehicles	9
Text Books:		
1)	Rashid M.H., "Power Electronics-Circuits, Devices and Applications", Prentice Hall India, New Delhi, 2017	
2)	Ned Mohan, Tore M. Undeland, "Power Electronics – Converters, Applications and Design", John Wiley & Sons, 2008.	
Reference Books:		
1)	Joseph Vithayathil, "Power Electronics – Principles and Applications", Tata McGraw-Hill edition, 2010.	
2)	Bin Wu, Mehdi Narimani, "High-Power Converters and AC Drives", John Wiley & Sons, 2017.	
3)	William Shepherd and Li Zhang, "Power Converter Circuits", Marcel Dekker Inc, New York, 2004.	
4)	VSen P.C., "Modern Power Electronics", Wheeler Publishing Co, Third edition, New Delhi, 2008.	

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First Year M. Tech.

Semester-I (w.e.f. A.Y. 2025-26)

Research Methodology & IPR(25PME11671**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10 Marks
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Discuss research methodology and the technique of defining researchproblem.	BL-II: Understand
CO 2	Explain the functions of the literature review in research, carrying out a Literature search developing theoretical and conceptual frameworks and writing a review.	BL-II: Understand
CO 3	Explain various research designs, sampling designs, measurement and scaling Techniques and different methods of data collections.	BL-II: Understand
CO 4	Explain several parametric tests of hypotheses, Chi-square test, art of interpretation	BL-II: Understand
CO 5	Discuss various forms of intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.	BL-II: Understand

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Research Methodology:** Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems	8

	Encountered by Researchers in India.	
2	**Defining the Research Problem:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining aProblem, An Illustration, Resources for Literature Survey, How to Read a Scientific Paper, White Paper, and Patent, Research Reports, Recording and Summarizing the Findings of Literature Survey, Formulation of the Problem Statement, Scope and Significance of the Research Problem.	8
3	**Research Design:** Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Design, Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Surveyvers us Census Survey, Types of Sampling Designs.	8
4	**Data Collection:** Types of data, Data Collection, Scaling, Experimental Setup, Data Analysis: Introduction, Regression Analysis, Parameter Estimation, Inferential Statistics, Univariate, Bivariate, and Multivariate Data Analysis, Principal Component Analysis, State Vector Machines.	6
5	**Intellectual Property:** Introduction, Significance of Intellectual Property Rights, Forms of IPR, Importance of IPR in Global Economy, Role of Intellectual Property in Technology Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, CopyrightAct,1957.	8

Text Books:

1)	Research Methodology: C. R. Kothari,ViswaPrakasamPublication,2014.
2)	Research Methodology: Vinayak Bairagi, CRC Press, Taylor & Francis Group, 2019.

Reference Books:

1)	Research Methodology: Ranjit Kumar, SAGE Publications Ltd, 2014.
2)	Conducting Research Literature Reviews: From the Internet to Paper, FinkA, Sage Publications, 2009.

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First Year M. Tech.

Semester-I (w.e.f. A.Y. 2025-26)

Seminar (25PEE11672**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	-	-	**MSE:**	-
Tutorials:	-	-	**ICA:**	50 Marks
Practical:	2	1	**ESE:**	-
Total:	2	1	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze current trends, challenges, and advancements in the chosen topic to establish its relevance and impact within the broader field of study.	BL-4: Analyze
CO 2	Evaluate technical literature from journals, conference proceedings, and standards to identify research gaps and formulate informed perspectives.	BL-5: Evaluate
CO 3	Apply appropriate research methodology and tools to organize, interpret, and present technical data effectively.	BL-3: *Apply*
CO 4	Develop well-structured presentations and technical reports using effective written and verbal communication tailored to academic and professional audiences.	BL-6: Create
CO 5	Defend the presented work with logical reasoning and evidence-based responses during discussions and Q&A sessions.	BL-5: Evaluate

Seminar:

Phase – 1:
In this phase, students select a suitable seminar topic related to recent technologies, engineering developments, or research trends. They collect basic information, study literature, and prepare an introductory presentation. Students are expected to explain the importance of the topic, objectives, and scope of study.

Phase – 2:
This is the second stage of assessment where students present deeper technical details of the selected seminar topic. Students are expected to perform detailed study, analyze concepts, gather recent developments, and improve the quality of their presentation. They should be able to explain technical aspects with clarity and logical flow.

Phase 3:
The final stage of seminar assessment is the End Semester Examination (ESE). In this phase, students give a

complete and final presentation of their seminar topic before the examiners. They also submit a detailed seminar report and face

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First Year M. Tech.

Semester-I (w.e.f. A.Y. 2025-26)

Hands on Research & Analysis Tool (25PEE11471**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	-	-	**MSE:**	-
Tutorials:	-	-	**ICA:**	50 Marks
Practical:	2	1	**ESE:**	-
Total:	2	1	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Apply analytical and numerical methods using tools like MATLAB, SCILAB, and simulation software to model and solve basic engineering and research problems.	BL- 3,4
CO 2	Demonstrate proficiency in using modern research tools, including LaTeX, reference managers, optimization platforms, and AI-based tools for effective technical documentation and research exploration.	BL-3,6

Course Description- This course offers hands-on experience through small, assignment-based activities usingvarious research and analysis tools. The content is organized into modules, each requiring specific prerequisiteknowledge to effectively complete the associated practical sessions. Students will be introduced to widely usedresearch tools and their applications, enabling them to explore the field of research with the foundationalknowledge gained from this course.

Ex.	**Experiment Details**	**No. of Ex. Sessions(hrs.)**
Ex. 1	Assignment on analytical modelling using MATLAB or any equivalent software	04
Ex. 2	Implementation of any one numerical method using MATLAB/ SCILAB	02
Ex. 3	A case study on basic simulations using any one analysis Software	06
Ex. 4	Hands on with LATEX word processing software	04
Ex. 5	Hands on reference manager Tools	02
Ex. 6	Assignment on AI research Tools	02

M.Tech Electrical Engineering

Semester- II

Syllabus

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First Year M. Tech.

Semester-II (w.e.f. A.Y. 2025-26)

Subject: Digital Protection (25PEE12175**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	-	-	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	3	3	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze the evolution, architecture, and operational characteristics of microprocessor and DSP-based digital relays to assess their advantages over conventional relays.	BL-4: *Analyze*
CO 2	Apply mathematical techniques such as finite difference methods, interpolation, least squares, and Fourier analysis to develop and implement protection algorithms.	BL-3: Apply
CO 3	Evaluate signal conditioning and conversion subsystems including sampling, filtering, and ADC processes to ensure reliable digital protection performance.	BL-5: *Evaluate*
CO 4	Design and implement various digital relay algorithms—such as Mann and Morrison, Fourier, Walsh, and least squares-based methods—for accurate fault detection and discrimination.	BL-6: Create
CO 5	Assess the application of modern digital protection techniques such as synchrophasor-based protection, WAMS, AI/ML algorithms, and cybersecurity measures in enhancing power system security and reliability.	BL-5: *Evaluate*

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Introduction to Digital Protection:** Evolution of digital relays from electromechanical relays, Performance and operational characteristics of digital protection, Advantages of digital protection, Block diagram of digital relay, Basic architecture of microprocessor and DSP-based relays.	8

2	**Mathematical Tools for digital protection:** Mathematical background to protection algorithms, Finite difference techniques Interpolation formulae, Forward, backward and central difference interpolation, Numerical differentiation, Curve fitting and smoothing, Least squares method, Fourier analysis, Fourier series and Fourier transform, Walsh function analysis.	8
3	**Signal Processing for digital protection:** Basic elements of digital protection, Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers, Conversion subsystem: the sampling theorem, signal aliasing, Error,sample and hold circuits, multiplexers, analog to digital conversion, Digital filtering concepts, The digital relay as a unit consisting of hardware and software.	8
4	**Algorithms for Digital Relays:** Sinusoidal wave based algorithms, Sample and first derivative (Mann and Morrison) algorithm. Fourier and Walsh based algorithms, Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm. Walsh function based algorithm. Least Squares based algorithms. Differential equation based algorithms.	6
5	**Protection of Power System Components & Modern Trends in Digital Protection:** Digital Differential Protection of Transformers. Digital Line Differential Protection. Recent Advances in Digital Protection of Power Systems. Synchrophasor-based protection (PMUs), Wide Area Protection Systems (WAMS), Artificial Intelligence and Machine Learning in protection, Cybersecurity in digital protection systems.	8
Text Books:		
1)	**Badri Ram & D.N. Vishwakarma**, *Power System Protection and Switchgear*, TMH	
2)	**T.S. MadhavRao**, *Power System Protection: Static Relays*, TMH	
Reference Books:		
1)	**A.G. Phadke and J.S. Thorp**, *Computer Relaying for Power Systems*, Wiley	
2)	**RamasamyNatarajan**, *Computer Relaying for Power Systems*, CRC Press	
3)	A.T. Johns and S. K. Salman, "Digital Protection of Power Systems", IEEE Press,1999	
4)	Gerhard Zeigler, "Numerical Distance Protection", Siemens Publicis Corporate Publishing, 2006	
5)	S.R.Bhide "Digital Power System Protection" PHI Learning Pvt.Ltd.2014	

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First Year M. Tech.

Semester-II (w.e.f. A.Y. 2025-26)

Power system Dynamics & Stability (25PEE12176**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	-	-	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	3	3	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze the different types of power system stability (rotor angle, voltage, frequency) and classify stability phenomena based on time frames to assess their impact on system performance.	BL-4: Analyze
CO 2	Model key power system components such as generators, transmission lines, and controllers to perform dynamic stability studies under various disturbance conditions.	BL-3: *Apply*
CO 3	Evaluate small signal stability issues in single and multi-machine systems using eigenvalue analysis, synchronizing and damping torque concepts, and propose suitable mitigation techniques including Power System Stabilizers (PSS).	BL-5: *Evaluate*
CO 4	Design PSS for multi-machine systems to suppress low-frequency and sub-synchronous oscillations and enhance system damping.	BL-6: Create
CO 5	Develop strategies for transient and voltage stability enhancement using digital simulation, energy function methods, and modern control techniques like FACTS and HVDC.	BL-6: Create

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	Basic concepts of dynamical systems and stability, Basic concepts of power system stability: rotor angle, voltage, and frequency stability, Classification of stability phenomena (short-term, mid-term, long-term), Power system dynamic problems: causes and consequences.	8

2	Modelling of power system components for stability studies: generators, transmission lines, excitation and prime mover controllers.	8
3	Analysis of single machine and multi-machine systems, small signal angle instability (low frequency oscillations): damping and synchronizing torque analysis, Eigen value analysis, mitigation using power system stabilizers.	8
4	PSS design for multi-machine systems, small signal angle instability (sub-synchronous frequency oscillations): analysis and counter-measures.	6
5	Transient instability: analysis using digital simulation and energy function method, transient stability controllers. Stability enhancement techniques: FACTS, HVDC, damping controllers, Voltage stability dynamics and reactive power control.	8

Text Books:

1)	K. R. Padiyar, "Power System Dynamics, Stability and Control", Interline Publishers, Bangalore,1996.
2)	P. Kundur, "Power System Stability and Control", McGraw Hill Inc, New York, 1995.

Reference Books:

1)	P. Sauer and M. A. Pai, "Power System Dynamics and Stability", Prentice Hall, 1997.
2)	E.W. Kimbark, "Power systems Stability", Vol. I and III.
3)	Jan Machowski, JanuszBialek, James Bumby, *Power System Dynamics: Stability and Control*, Wiley

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Semester-II (w.e.f. A.Y. 2025-26)

HVDC and FACTS(25PEE12177**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	-	-	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	3	3	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze the differences between HVAC and HVDC transmission systems and evaluate the suitability of HVDC link types and components for modern power transmission applications.	BL-4: Analyze
CO 2	Analyze different converter topologies and control strategies in HVDC systems..	BL-4: Analyze
CO 3	Evaluate the technical benefits and limitations of HVDC over HVAC transmission	BL-5 Evaluate
CO 4	Analyze the modeling, operation, and control of series and shunt FACTS controllers such as TCSC, SSSC, SVC, and STATCOM to assess their steady-state and dynamic performance in the grid.	BL-4: Analyze
CO 5	Design coordinated control strategies using UPFC, IPFC, and GUPFC devices in combination with HVDC systems for enhanced grid performance and integration, supported by case studies.	BL-6 *Create*

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Introduction to HVDC Transmission** Comparison of HVAC and HVDC systems, Types of HVDC links: monopolar, bipolar, homopolar, Components of HVDC system, Modern trends and applications Power flow in HVDC system	6
2	**HVDC Converters and Control**	6

	Converter topologies: 6-pulse, 12-pulse, and MMC, Converter transformer and filters, Control of HVDC systems: Constant current, constant extinction angle Control characteristics: Voltage-current control modes, Protection and commutation failure	
3	**: Introduction to FACTS** Need for FACTS devices in power systems, Classification of FACTS controllers, Power flow control, stability improvement, and voltage regulation ,Reactive power compensation Modelling of FACTS devices in power system studies	6
4	**: Series and Shunt FACTS Controllers** **Series Devices**: TCSC, SSSC – working, modelling, applications **Shunt Devices**: SVC, STATCOM – control strategies, steady-state & dynamic performance, Interaction of FACTS with the power system	6
5	**Unified and Coordinated Control** UPFC: Operation, modelling, and control, IPFC, GUPFC concepts Coordination of FACTS with HVDC, Case studies on system performance improvement ,Grid integration with FACTS & HVDC.	6

Text Books:

1)	**K.R. Padiyar**, *HVDC Power Transmission Systems*, New Age International
2)	**Narain G. Hingorani& L. Gyugyi**, *Understanding FACTS*, IEEE Press
3)	**Erich Uhlmann**, *Power Transmission by Direct Current*, Springer

Reference Books:

1)	Vijay K. Sood, *HVDC and FACTS Controllers*
2)	Ned Mohan, *Power Electronics – Converters, Applications, and Design*
3)	R. Mohan Mathur& Rajiv K. Varma, *Thyristor-Based FACTS Controllers for Electrical Transmission Systems*
4)	Vijay K. Sood, *HVDC and FACTS Controllers*
5)	Ned Mohan, *Power Electronics – Converters, Applications, and Design*
6)	R. Mohan Mathur& Rajiv K. Varma, *Thyristor-Based FACTS Controllers for Electrical Transmission Systems*

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Semester-II (w.e.f. A.Y. 2025-26)

Subject: HVDC and FACTS Lab (25PEE12178**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:			**MSE:**	
Tutorials:			**ICA:**	50 Marks
Practical:	2	1	**ESE:**	
Total:	2	1	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Apply theoretical concepts to perform experiments and operate instruments in a controlled laboratory environment for solving real-world engineering problems.	BL-3: *Apply*
CO 2	Analyze experimental data to identify trends, verify theoretical principles, and interpret the behavior of physical systems under test.	BL-4: *Analyze*
CO 3	Evaluate measurement techniques, instrumentation accuracy, and error sources to improve the reliability and precision of experimental results.	BL-5: *Evaluate*
CO 4	Design and set up experimental procedures or test rigs to investigate engineering phenomena or validate simulation models.	BL-6: *Create*
CO 5	Develop technical reports and presentations based on experimental outcomes, integrating data analysis and critical insights to support engineering decisions.	BL-6: *Create*

Wxp. No.	**Name of Tutorial / Assignment**
1	Study of 6-Pulse HVDC Transmission System
2	Study of 12-Pulse HVDC Transmission System
3	Study of various FACTS Controllers models
4	Application Study of Static VAR Compensator (SVC) in Power System
5	Application Study of Thyristor-Controlled Series Capacitor (TCSC) in Power System

6	Application Study of Distribution Static Synchronous Compensator (DSTATCOM) in Power System
7	Study and simulation of Power Flow control in a five bus system using UPFC
8	Study of Series Compensation of a Three-Phase Transmission Line

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Semester-II (w.e.f. A.Y. 2025-26)

Restructured Power System (25PEE12274**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10 Marks
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze the structure, objectives, and components of restructured power systems to evaluate the roles of market models and key entities like GENCOs, TRANSCOs, DISCOs, ISO, and PX in deregulated electricity markets.	BL-4: Analyze
CO 2	Study electricity market models and pricing mechanisms.	BL-4: Analyze
CO 3	Analyze transmission congestion, ancillary services, and system operation in deregulated environments.	BL-3 : Apply
CO 4	Evaluate the role of regulatory bodies, market players, and policy frameworks.	BL-5: Evaluate
CO 5	Explore trends and challenges in modern electricity markets including smart grid integration.	BL-5 Evaluate

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Introduction to Power System Restructuring** Overview of traditional vs. restructured power systems ,Objectives of restructuring and deregulation, Components of restructured systems, Market models: Pool, bilateral, multilateral markets,Role of various entities: GENCOs, TRANSCOs, DISCOs, ISO, PX	8
2	**Electricity Market Models and Pricing** Market architecture: Day-ahead, real-time, ancillary service markets, Locational Marginal Pricing (LMP), Zonal and nodal pricing ,Power trading and open access, Pricing of transmission services: Postage stamp, contract path, MW-mile methods	8

3	**Congestion Management and Ancillary Services** Causes and impacts of transmission congestion, Congestion management techniques: nodal pricing, re-dispatch, auction, Role and types of ancillary services ,Reactive power management in deregulated systems, Reliability and security assessment in market operation	8
4	**Transmission Rights and System Operation** Available Transfer Capability (ATC), Total Transfer Capability (TTC), Transmission Open Access and congestion rights, Financial Transmission Rights (FTR), Auction Revenue Rights (ARR), Market clearing and settlement procedures, Security-constrained economic dispatch (SCED).	7
5	**Regulatory Issues and Emerging Trends** Role of regulatory commissions: CERC, SERC, FERC, Tariff design and regulatory frameworks, Renewable energy integration and its impact on electricity markets, Demand Response, Smart Grid, and distributed generation, International experiences in power system deregulation (USA, UK, Nordic, etc).	7
Text Books:		
1)	S. S. Rao, "Switchgear and Protection for Restructured Power Systems"	
2)	K. S. Manoj, "Power System Deregulation and Restructuring"	
Reference Books:		
1)	Mohammad Shahidehpour and Muwaffaq Alomoush, *"Restructured Electrical Power Systems: Operation, Trading and Volatility"*	
2)	LorrinPhilipson,H.LeeWillis,“Understandingelectricutilitiesandde- regulation”, Marcel Dekker Pub.,1998.	
3)	Steven Stoft, “Power system economics: designing markets for electricity”, John Wileyand Sons, 2002.	
4)	KankarBhattacharya,JaapE.Daadler,MathH.J.Boolen,“Operationofrestructured power systems”, Kluwer Academic Pub., 2001.	

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First Year M. Tech.

Semester-II (w.e.f. A.Y. 2025-26)

AI Applications To power systems (25PEE12275)

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze various AI components, problem characteristics, and knowledge representation methods such as logic programming, rule-based systems, and control knowledge to model intelligent systems.	BL-4: Analyze
CO 2	Apply statistical reasoning techniques like Bayesian Networks and Dempster-Shafer theory to develop probabilistic and rule-based decision-making systems.	BL-3 *Apply*
CO 3	Evaluate pattern recognition approaches by selecting appropriate features and statistical classifier algorithms to solve classification problems in real-world applications.	BL-5 : *Evaluate*
CO 4	Design neural network models using multilayer perceptron, backpropagation, and Hopfield nets to address supervised and unsupervised learning tasks.	BL-6: *Create*
CO 5	Develop expert systems and apply AI techniques for power system operations such as load forecasting, economic load dispatch, and stability analysis in single and two-area systems.	BL-6: *Create*

Unit	***Course Contents***	***No. of lectures (hrs.)***

1	**Introduction to AI:** Definition, Applications, Components of an AI program; production system. Problem Characteristics. Overview of searching techniques. Knowledge representation: Knowledge representation issues; and overview. Representing knowledge using rules; procedural versus declarative knowledge. Logic programming, forward versus backward reasoning, matching. Control knowledge.	6
2	**Statistical Reasoning:** Probability and Daye's theorem. Certainty factor and rule based systems. Baysian Networks, Dampster Shafer theorem. Semantic nets and frames, Scripts. Examples of knowledge based systems.	6
3	**Pattern Recognition:** Introduction, automatic pattern recognition scheme. Design Concepts, Methodologies, Concepts of Classifier, concept of feature selection. Feature selection based on means and covariances. Statistical classifier design algorithms; increment-correction and LMSE algorithms. Applications.	6
4	**Artificial Neural Networks:** Biological Neuron, Neural Net, use of neural 'nets, applications, Perception, idea of single layer and multilayer neural nets, back propagation, Hopfield nets, supervised and unsupervised learning.	6
5	**Expert Systems & Applications of AI Techniques:** Introduction. Study of some popular expert systems, Expert System building tools and Shells, Design of Expert Systems. Load forecasting – Load flow studies – Economic load dispatch – Load frequency control – Single area system and two area system – Small Signal Stability (Dynamic stability) Reactive power control	6
Text Books:		
1)	Neural Networks, Fuzzy Logic & Genetic Algorithms, S.Rajasekaran and G.A.V.Pai,- PHI, New Delhi, 2003.	
2)	Computing Theory & Practice, P.D.Wasserman, VanNostrand Reinhold, Neural- New York,1989.	
Reference Books:		
1)	Neural Network & Fuzzy System, Bart Kosko, Prentice Hall, 1992.	
2)	Fuzzy sets, Uncertainty and Information, G.J.Klir and T.A. Folger, PHI, Pvt.Ltd,1994.	
3)	Genetic Algorithms, D.E.Goldberg, Addison Wesley 1999.	

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First Year M. Tech.

Semester-II (w.e.f. A.Y. 2025-26)

Advanced Power Electronics(25PEE12276**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:		1	**ICA:**	10 Marks
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Understand the characteristics and applications of advanced power semiconductor devices.	BL-3: Apply
CO 2	Analyze and design advanced DC-DC converter topologies and control strategies.	BL-4: Analyze
CO 3	Comprehend advanced inverter and multilevel converter technologies.	BL4: Analyze
CO 4	Explore AC-AC conversion techniques and modulation strategies.	BL-6: Create
CO 5	Apply advanced power electronics concepts to modern applications like EVs and renewable energy.	BL-3: Apply

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Advanced Power Semiconductor Devices** Characteristics and performance of advanced devices:, IGBT, IGCT, MOSFET, SiC and GaN-based devices ,Static and dynamic characteristics, switching behaviour, Protection mechanisms: dv/dt, di/dt, thermal protection, Gate driver circuits for high-speed switching, Snubber circuits.	8
2	**Advanced DC-DC Converters and Control** Analysis of non-isolated converters: Cuk, SEPIC, Zeta, Buck-Boost, Isolated converters: Flyback, Forward, Push-Pull, Half-Bridge, Full-Bridge, Design of transformers and filter components ,Soft switching: ZVS, ZCS, resonant converters ,Control methods: current-mode, voltage-mode, digital control.	8

3	**Inverters and Multilevel Converters** Single-phase and three-phase inverters ,PWM techniques: Sine PWM, Space Vector PWM (SVPWM), Resonant inverters and high-frequency switching, Multilevel inverter types: Diode-clamped, Flying capacitor, Cascaded H-bridge, Applications in electric drives and grid integration.	8
4	**AC-AC Converters and Matrix Converters** Cycloconverters: single-phase and three-phase, AC voltage controllers: principle and operation, Matrix converter architecture and control, Modulation methods: Scalar, Vector control, DTC ,Bidirectional operation and power factor control.	7
5	**Applications and Emerging Trends** Power electronics in EVs and battery charging, Power converters in renewable energy (solar, wind) ,Smart grid integration, FACTS, HVDC,EMI/EMC mitigation in converter circuits, Digital control using DSP, FPGA, and ARM processors, AI/ML applications in converter control and diagnostics	7
Text Books:		
1)	*Fundamentals of Power Electronics* – Erickson &Maksimović	
2)	*Power Electronics: Devices, Circuits and Applications* – Muhammad H. Rashid	
Reference Books:		
1)	*Modern Power Electronics and AC Drives* – Bimal K. Bose	
2)	*Power Electronics Handbook* – Muhammad H. Rashid	
3)	*Pulse Width Modulation for Power Converters* – Holmes &Lipo	
4)	*High-Power Converters and AC Drives* – Bin Wu	
5)	*Power Electronic Systems: Theory and Design* – V.R. Moorthi	
6)	*Modern Power Electronics* – P.C. Sen	
7)	*Analysis of Thyristor Power-Conditioned Motors* – S.K. Pillai	

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	First Year M. Tech.
	Semester-II (w.e.f. A.Y. 2025-26)
	Power Quality Issues and mitigation (25PEE12277**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze various types of power quality disturbances and interpret relevant standards to assess compliance in industrial power systems.	BL-4: *Analyze*
CO 2	Evaluate the causes, impacts, and indices of voltage sags, swells, and interruptions to propose mitigation strategies in distribution networks.	BL-5: *Evaluate*
CO 3	Differentiate and interpret current and voltage harmonic distortions caused by nonlinear loads and assess their effects on equipment performance and EMI.	BL-4: *Analyze*
CO 4	Design passive and active power filter configurations for harmonic mitigation and power factor correction using control methods like dq control and boost-based APFC.	BL-6 *Create*
CO 5	Develop control strategies for custom power devices like DSTATCOM, DVR, and UPQC, and implement EMI/EMC protection through layout optimization and shielding techniques.	BL-6 *Create*

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Fundamentals & Standards** Overview: Power-quality definitions & monitoring methods, Disturbance types:	6

	transients, sags/swells, interruptions, flicker, unbalance, harmonics, Industry standards: IEEE 519, 1159, 1453; IEC 61000-4-30.	
2	**Voltage Variations & Interruptions** Short/long interruptions: causes, quantification (SAIFI, SAIDI), cost implications, Voltage sags: characterization by magnitude, duration, unbalance, phase jumps	6
3	**Harmonics & Waveform Distortion** Current vs voltage distortion: THD, TDD, inter-harmonics, triplen-harmonics ,Sources: nonlinear devices—SMPS, converters, drives, lighting, Effects: resonance, equipment degradation, EMI; measurement methods.	6
4	**Passive & Active Compensation** Passive filter design: shunt, series, hybrid filters; impedance tuning; resonance risks Active power filters: shunt/series, single-phase & three-phase, dq control, Power factor correction: boost-based APFC, bilateral converters.	6
5	**Custom Power Devices & EMI/EMC** Shunt & series compensators: DSTATCOM, DVR control strategies, Unified Power Quality Conditioner (UPQC): structures, control, topologies, EMI/EMC: types of interference, PCB layout, shielding, transient protection.	6

Text Books:

1)	*Electrical Power Systems Quality* Roger C. Dugan, Mark F. McGranaghan, Surya Santoso, H. Wayne Beaty
2)	Math H. J. Bollen, *Understanding Power Quality Problems*, IEEE Press, 2000.
3)	*Power Quality in Electrical Systems* Alexander Kusko, Marc T. Thompson.

Reference Books:

1)	Bhim Singh, A. Chandra, K. Al-Haddad, *Power Quality Problems & Mitigation Techniques*, Wiley, 2015
2)	*Power Quality Enhancement Using Custom Power Devices* ArindamGhosh& Gerard Ledwich
3)	J. Arrillaga, N. R. Watson, *Power System Quality Assessment*, Wiley, 2000
4)	ArindamGhosh& Gerard Ledwich, *Power Quality Enhancement Using Custom Power Devices*, Springer, 2012
5)	Supplementary: IEEE standards (519, 1159), IEC 61000; EMI/EMC guides

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	First Year M. Tech.
	Semester-II (w.e.f. A.Y. 2025-26)
	Modern Optimization Techniques in Power System s(25PEE12278)

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

	Course Outcomes: At the end of this course, students shall be able to	***BL Level***
CO 1	Apply classical and intelligent optimization techniques such as linear, non-linear, and evolutionary algorithms to solve constrained and unconstrained optimization problems in engineering systems.	BL-3: *Apply*
CO 2	Analyze the working principles, genetic operators, and implementation issues of Genetic Algorithms and demonstrate their application in economic dispatch and unit commitment problems.	BL-4: Analyze
CO 3	Design and implement Particle Swarm Optimization (PSO) techniques for power system applications like optimal power flow, voltage control, and system reliability enhancement.	BL-6: *Create*
CO 4	Evaluate the performance and convergence behavior of advanced optimization methods such as Simulated Annealing, Tabu Search, Ant Colony Optimization, and Bacterial Foraging Optimization in solving power system optimization problems.	BL-5: *Evaluate*
CO 5	Develop multi-objective optimization strategies using Genetic Algorithms and PSO variants to obtain Pareto-optimal solutions for economic-emission dispatch and optimal power flow problems.	BL-6 *Create*

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Fundamentals of Optimization**: Definition-Classification of optimization problems-Unconstrained and Constrained optimization Optimality conditions-Classical Optimization techniques (Linear and non linear programming, Quadratic programming, Mixed integer programming)-Intelligent	8

	Search methods (Optimization neural network, Evolutionary algorithms, Tabu search, Particle swarm optimization, Application of fuzzy set theory).	
2	**Evolutionary Computation Techniques:** Evolution in nature-Fundamentals of Evolutionary algorithms-Working Principles of Genetic Algorithm- Evolutionary Strategy and Evolutionary Programming-Genetic Operators-Selection, Crossover and Mutation-Issues in GA implementation- GA based Economic Dispatch solution Fuzzy Economic Dispatch including losses- Tabu search algorithm for unit commitment problem-GA for unit commitment-GA based Optimal power flow- GA based state estimation.	8
3	**Particle Swarm Optimization**: Fundamental principle-Velocity Updating-Advanced operators-Parameter selection-Hybrid approaches (Hybrid of GA and PSO, Hybrid of EP and PSO) -Binary, discrete and combinatorial PSO-Implementation issues-Convergence issues- PSO based OPF problem and unit commitment-PSO for reactive power and voltage control-PSO for power system reliability and security.	8
4	**Advanced Optimization Methods:** Simulated annealing algorithm-Tabu search algorithm-SA and TS for unit commitment-Ant colony optimization- Bacteria Foraging optimization.	8
5	**Multi Objective Optimization:** Concept of pareto optimality-Conventional approaches for MOOP-Multi objective GA-Fitness assignment-Sharing function-Economic Emission dispatch using MOGA-Multi-objective PSO (Dynamic neighbourhood PSO, Vector evaluated PSO) –Multi-objective OPF problem.	8
Text Books:		
1)	D.P.Kothari and J.S.Dhillon, “Power System Optimization”, 2ndEdition, PHI learning private limited, 2010.	
2)	Kalyanmoy Deb, “Multi objective optimization using Evolutionary Algorithms” , John Wiley and Sons, 2008.	
Reference Books:		
1)	Kalyanmoy Deb, “Optimization for Engineering Design”, Prentice hall of India first edition,1988.	
2)	Carlos A.CoelloCoello, Gary B.Lamont, David A.VanVeldhuizen, “Evolutionary Algorithms for solving Multi Objective Problems”, 2ndEdition, Springer, 2007.	
3)	SolimanAbdelHady,AbdelAal Hassan Mantawy, “Modern optimization techniques with applications in Electric Power Systems” ,Springer,2012.	
4)	Jizhong Zhu,” Optimization of power system operation”,John Wiley and sons Inc publication,2009.	
5)	KwangY.Lee,MohammedA.ElSharkawi, “Modern heuristic optimization techniques”, John Wiley and Sons,2008.	

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First Year M. Tech.

Semester-II (w.e.f. A.Y. 2025-26)

Advanced Electric drives (25PEE12279**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10 Marks
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyze the torque-speed characteristics and dynamic behavior of different types of electrical drives to select suitable drive systems for specific industrial applications..	BL-4: Analyze
CO 2	Analyze and simulate speed and torque control strategies for DC and AC drives.	BL-4: Analyze
CO 3	Design and implement control methods for induction and synchronous motor drives.	BL-6: Create
CO 4	Apply vector control, direct torque control, and modulation techniques in drive systems.	BL-3: Apply
CO 5	Evaluate modern trends in electric drives including sensorless control, intelligent drives, and their role in renewable energy integration.	BL-5: Evaluate

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Fundamentals of Electrical Drives** Introduction to electric drives: types and applications, Dynamics of electric drives: torque-speed characteristics, Multi-quadrant operation and drive classification, Components of electrical drives, Selection of drives for industrial applications.	6
2	**DC Drives and Control** Modeling and performance of DC motors, Single-phase and three-phase converter-fed DC drives, Chopper-controlled DC drives, Closed-loop speed and current control, Simulation of DC drives in MATLAB/Simulink**.**	6

3	**Induction Motor Drives** Stator voltage control, rotor resistance control, Variable Frequency Drives (V/f control), Vector control (field-oriented control) of induction motors, Direct Torque Control (DTC),Performance and stability analysis**.**	6
4	**Synchronous Motor Drives and Special Machines** Synchronous motor drives: self-control and load commutation, Permanent Magnet Synchronous Motor (PMSM) control, Brushless DC Motor (BLDC) control, Switched Reluctance Motor (SRM) control, Space vector modulation (SVM) techniques.	6
5	**Modern Topics and Applications** Sensorless control of AC drives, FPGA/DSP-based drive control, Drives for renewable energy applications (wind, solar), Energy-efficient drive systems, Fault detection and protection in advanced drives.	6
Text Books:		
1)	Bimal K. Bose, *Modern Power Electronics and AC Drives*, Pearson	
2)	Gopal K. Dubey, *Fundamentals of Electrical Drives*, Narosa Publishing	
Reference Books:		
1)	*R. Krishnan*, Electric Motor Drives: Modeling, Analysis, and Control, *PHI*	
2)	*W. Shepherd, L.N. Hulley, D.T. W. Liang*, Power Electronics and Motor Control, *Cambridge University Press*	

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	FirstYearM.Tech.
	Semester-II (w.e.f.A.Y.2025-26)
	Mini Project (25PEE12172**)**

Teaching Scheme:			**EvaluationScheme:**	
	No.of Hrs./week	**No.of Credits**		
Lectures:	-	-	**MSE:**	-
Tutorials:	-	-	**ICA:**	50 Marks
Practical:	2	1	**ESE:**	-
Total:	2	1	**OE/POE:**	-

CourseOutcomes: At the end of this course, students shall be able to		***BL Level***
CO1	Understand a small project based learning on any topic of interest relevant to curriculum.	BL-2:
CO2	Design and develop a functional prototype or simulation model using appropriate tools, techniques, and project management skills while considering ethical and environmental aspects.	BL-3:

Course Description-The Mini Project enables students to apply domain knowledge to solve real-world or research Problems through design, development, and analysis. It emphasizes innovation, teamwork, technical documentation, and presentation skills.

S.No.	***Experiment Details***	***No.ofEx. Sessions (hrs.)***
	Topic Selection **Description:** Students will select a project topic relevant to their domain, preferably addressing real- world or research-based problems. The topic must be approved by the guide or departmental committee.	6
	Report Preparation or Model Development **Description:** Students must prepare a detailed technical report including literature review, problem statement, methodology, system design, results, and conclusion. Based on the project nature, a working model, prototype, or software tool should be developed.	10

Ex. 3	***Presentation or Demonstration*** **Description:** Students will present their project work through a formal presentation and demonstrate the functionality of their model or simulation to the evaluation panel.	6

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(An Autonomous Institute)

First Year M.Tech.

Semester-II (w.e.f.A.Y.2025-26)

Research Publication and Ethics (25PET12673)

Teaching Scheme:			**Evaluation Scheme:**	
	No.of Hrs./week	**No.of Credits**		
Lectures:	-	-	**MSE:**	-
Tutorials:	-	-	**ICA:**	50Marks
Practical:	4	2	**ESE:**	-
Total:	4	2	**OE/POE:**	-

Course Outcomes: At the end of this course, bstudents shall be able to		***BL Level***
CO1	Conduct systematic literature reviews and identify problem	BL-4:
CO2	Develop skills in academic writing and manuscript preparation	BL-3:
CO3	Apply ethical principles in research conduct and publication	BL-3:
CO4	Use reference management tools and citations towards effectively	BL-3:
CO5	Prepare and present research findings in various formats	BL-4:

Course Description- This course introduces MTech students to the principles, practices, and ethics of research publication in engineering and technology. Students will learn the complete research publication lifecycle, from literature review to manuscript submission, while developing a strong foundation in research ethics and integrity.

Ex.	***ExperimentDetails***	***No.ofEx. Sessions (hrs.)***
Ex. 1	Databaseexploration:IEEEXplore,ScienceDirect,SpringerLink,datasetsiteslikeKaggle	4
Ex. 2	Identify scope and Journals election criteria and evaluation	2
Ex. 3	Calculation of Various Indices related to Impact Factor	2
Ex. 4	Systematic Literature review and literature matrix preparation	12
Ex. 5	Research Proposal Development-Synopsis writeup	8
Ex. 6	Manuscript Writeup exercise	8
Ex. 7	Use of Plagiarism detection tools	4
Ex. 8	Final manuscript submission and checklist	4
Ex. 9	Mock peer review exercise and Response to reviewer comments workshop	4
Ex.10	Authorship agreement drafting and Copyright compliance	4

Text Books:	
1)	"The Craft of Research"byWayneC.Booth,GregoryG.Colomb,JosephM.Williams,JosephBizup,
	WilliamT .FitzGerald, University of Chicagopress.
2)	ResearchEthics:APhilosophicalGuidetotheResponsibleConductofResearchbyL.Vaughn,Oxford University Press, 2019
ReferenceBooks:	
1)	**"TheElementsofStyle",byWilliamStrunkJr.,E.B.White,Pearson,2019**
OnlineResources:	
1)	Committeeon Publication Ethics(COPE) -https://publicationethics.org
2)	Office of Research Integrity(ORI)-https://ori.hhs.gov/
3)	IEEE Author Center - https://ieeeauthorcenter.ieee.org/
4)	Springer Nature Author Services- https://authorservices.springernature.com/
5)	Elsevier Author Hub-https://www.elsevier.com/authors
SoftwareandTools	
1)	Reference Management: Mendeley,Zotero, EndNote
2)	Plagiarism Detection:Turnitin, Grammarly, Copyscape
3)	WritingTools:LaTeX, MicrosoftWord,Google Docs
4)	StatisticalAnalysis: R,Python, MATLAB
5)	Data Visualization: Tableau, matplotlib, ggplot2

M.Tech Electrical Engineering

Semester- III

Syllabus

FABTECH EDUCATION SOCIETY'S
FABTECH TECHNICAL CAMPUS COLLEGE OF ENGINEERING & RESEARCH
(An Autonomous Institute)

Second Year M. Tech.

Semester-III (w.e.f. A.Y. 2026-27)

Renewable Energy Systems(26PEE21179**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Provide an in-depth understanding of renewable energy principles and technologies	BL-3: Apply
CO 2	Analyse the design, modelling, and integration of various renewable energy systems.	BL-4: Analyse
CO 3	Formulate and analyse technical, economic, and environmental performance of renewable sources	BL- 4: Analyse
CO 4	Explore current trends, policies, and research opportunities in renewable energy	BL-6: Create
CO 5	Apply knowledge to design and optimize biomass and biogas energy systems considering feedstock availability and conversion efficiency	BL-3: Apply

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Energy and Environment** Global and national energy scenarios, Energy demand and supply forecasting, Environmental impacts of conventional energy sources, Climate change and the role of renewable energy, Sustainable development and energy planning.	8
2	**Solar Energy Conversion Systems** Solar radiation models and measurement techniques, Solar thermal systems: collectors, concentrators, heat storage, and applications, Solar PV systems: advanced materials, module technologies, MPPT, Design of standalone and grid-connected PV systems, Simulation tools and performance analysis (e.g., PVsyst, MATLAB).	8

3	**Wind Energy Conversion Systems** Wind characteristics and site assessment, Aerodynamics of wind turbines, Wind turbine design, control, and performance analysis, Wind energy system modelling and simulation, Grid integration issues: stability, variability, power quality.	8
4	**Bioenergy Systems** Biomass characteristics, resources, and conversion routes, Biogas, biodiesel, bioethanol: production processes and technologies, Design of digesters and bioenergy systems, Life cycle assessment of bioenergy, Applications in rural and industrial sectors.	6
5	**Emerging and Hybrid Renewable Systems** Geothermal, ocean, tidal, and OTEC systems – working principles and limitations, Hydrogen production, storage, and fuel cells, Hybrid energy systems: design, optimization, and control, Smart grid and microgrid integration, Power electronics for renewable interfacing	8
Text Books:		
1)	*S.P. Sukhatme and J.K. Nayak,* Solar Energy – Principles of Thermal Collection and Storage, *McGraw-Hill*	
2)	*D.P. Kothari et al.,* Renewable Energy Sources and Emerging Technologies, *PHI*	
Reference Books:		
1)	*John Twidell and Tony Weir,* Renewable Energy Resources, *CRC Press*	
2)	*Chetan Singh Solanki,* Solar Photovoltaics: Fundamentals, Technologies and Applications, *PHI*	
3)	*IEEE and Elsevier journals on Renewable Energy*	
4)	*MNRE and IRENA Reports*	

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Second Year M. Tech.

Semester-III (w.e.f. A.Y. 2026-27)

A. Solar Photovoltaic System Design (NPTEL COURSE) (26PEE21674)

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	2	2	**MSE:**	
Tutorials:	-	-	**ICA:**	50 Marks
Practical:	-	-	**ESE:**	
Total:	2	2	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Explain the fundamentals of solar radiation and solar energy resource assessment.	BL-2: Apply
CO 2	Analyze the operating principles and characteristics of solar cells..	BL-4: Analyse
CO 3	Evaluate the performance and optimize the design of solar cells.	BL- 5: Analyse
CO 4	Analyze the design, performance, and degradation of solar PV modules.	BL-4: Create
CO5	Design solar PV systems incorporating power converters, inverters, and energy storage.	BL-6: Create

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	History and current status of solar PV, Solar radiation fundamentals: Sun and blackbody radiation, Solar radiation fundamentals: Atmospheric effects, Solar radiation components, Measurement of solar irradiation components and solar insolation, TMY data and its application, Plane-of-Array solar radiation estimation Hands-on exercise: Solar radiation resource assessment	8
2	Solar cell and photodiode basics, Diode-photodiode comparison and equivalent circuit,Photodiode equivalent circuit: Hands-on solution, Detailed working of solar cell, Recombination phenomena in solar cell, Absorption of light in solar cell: Hands-on analysis, Absorption efficiency and Quantum efficiency: Hands-	8

	on estimation	
3	Design of Anti Reflection Coating, Solar cell I-V curve and characteristics, Temperature dependency of solar cells, Electrical description of real solar cells, Standard model of real solar cells: Hands-on solution, Spectral efficiency of solar cell, Theoretical efficiency of solar cell, Design optimization of solar cells	8
4	Design optimization of solar cells – II, Design of solar modules, Properties of solar modules: Hands-on analysis, Bypass diodes in solar modules: Hands-on analysis, Hotspots in solar modules: Hands-on analysis, Degradation phenomena in solar modules, Age related degradation and module operation: Hands-on analysis	8
5	Thin film solar modules, Design of strings of solar PV modules: Hands-on analysis,Solar PV plant structure: Hands-on example, Direct current cabling of solar PV plant: Hands-on design, DC-DC converters for solar PV plants, MPP trackers and grid connected systems, Inverters for solar PV applications, Inverter circuits and configurations, Inverter efficiency, standards and dimensioning, Batteries and hands-on PV system design	8
Text Books:		
1)	Husain, M.A., Ahmad, M.W., Bakhsh, F.I.,Padmanaban, S. and Malik, H. eds., 2024. Photovoltaic systems technology.	
2)	Abou Jieb, Y. and Hossain, E., 2022. *Photovoltaic Systems*. Springer International Publishing. https://doi.org/10.1007/978-3-030-89780-2.	
Reference Books:		
1)	Gorjian, S. and Shukla, A. eds., 2020. *Photovoltaic solar energy conversion: technologies, applications and environmental impacts*. Academic Press.	
2)	Mertens, K., 2018. *Photovoltaics: fundamentals, technology, and practice*. John Wiley & Sons.	

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Second Year M. Tech.

Semester-III (w.e.f. A.Y. 2026-27)

B. Electric Vehicle: Its Components, Charging Infrastructure and Grid Integration Solution (NPTEL COURSE) (26PEE21674)

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	2	2	**MSE:**	
Tutorials:	-	-	**ICA:**	50 Marks
Practical:	-	-	**ESE:**	
Total:	2	2	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Explain the fundamentals of electric vehicles, charging infrastructure, and power electronic converters.	BL-2: Apply
CO 2	Apply EV charging technologies, battery management systems, and electric drive systems in EV applications..	BL-3: Analyse
CO 3	Analyze the modelling and control of electric vehicles and charging infrastructure.	BL- 4: Analyse
CO 4	Evaluate the stability, grid integration, and techno-economic aspects of EV charging infrastructure.	BL-5: Create
CO 5	Design sustainable EV charging stations with optimal load management and smart grid integration.	BL-6: Apply

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	Introduction to History of Electric Vehicles, Power Train and its Components, Power electronics Devices,Charging infrastructure, DC-DC Converter and AC-DC Converters, Closed loop control of Converters,Charger and its Components, Power factor correction circuit	8
2	Dual Active Bridge, V2G and G2V control, Wireless Charging, DC fast charging, Public charging station, Modular Converters, Solid State Transformers and Renewable Integration, Battery, Battery management systems, EV motors: Induction Motor, PMSM, BLDC and Switched Reluctance	8

	motor and their characteristics	
3	Control Systems for EV and Charging infrastructure, Study of control architecture in EV, Systems models and their classifications, principles used in modelling of systems, Fundamental studies of Modelling of vehicle dynamics and control, Modelling of Charging infrastructure,State Space Representation,	8
4	Stability aspects of control systems in EV and its Charging infrastructure, Design of charging stations with sustainable energy sources and battery storage systems, Ancillary Services by charging stations, Cost benefit analysis of renewable energy and battery storage-based Charging infrastructure, Effect of EV charging stations on Grid: power quality, voltage profile, fault level, and stability, Smart grid	8
5	Urban planning of EV charging stations, safety and Grid issues, Optimal operation of charging stations.Load management with EV and Energy pricing models, Real-time monitoring of load demand, public advisory and assistance systems for EV charging	8
Text Books:		
1)	Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, 2015	
2)	Iqbal Husain, "Electric and Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press. 2011	
Reference Books:		
1)	W. Leonard, "Control of Electric Drives", Springer Press, 2007	
2)	R Krishnan, "Permanent Magnet Synchronous and Brushless DC Motor Drives", CRC Press, 2010	
3)	Berker B., James W. J. & A. Emadi, "Switched Reluctance Motor Drives", CRC Press, 2019	

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Semester-III (w.e.f. A.Y. 2026-27)

C. DC Microgrid and Control System (NPTEL COURSE) (26PEE21674)

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	2	2	**MSE:**	
Tutorials:	-	-	**ICA:**	50 Marks
Practical:	-	-	**ESE:**	
Total:	2	2	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Explain the concepts, architecture, and types of microgrid systems.	BL-2: Apply
CO 2	Compare AC and DC microgrids with conventional power systems..	BL-2: Analyse
CO 3	Apply power electronic converters and DC microgrid topologies in microgrid applications.	BL- 3: Analyse
CO 4	Analyze the operation, applications, and standards of DC microgrids.	BL-4: Create
CO 5	Evaluate control methods and stability of DC microgrid systems.	BL-5: Apply

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	Brief introduction and Concepts of Microgrid,Types of Microgrid system	8
2	Microgrids vs Central Conventional power system, AC and DC Microgrids, comparison between AC and DC Microgrids	8
3	Power Electronic Converters in Microgrid application, DC Microgrid Topologies, DC Power source components	8
4	application of DC Microgrids, DC Microgrid operations, Some Standards related with DC Power Circuit.	8
5	Control methods in DC Microgrid, Linear and nonlinear Stability system in DC	8

	Microgrid	
Text Books:		
1)	Fusheng Li, Ruisheng Li, Fengquan Zhou, Microgrid Technology and Engineering Application, Elsevier, 2015	
2)	S. Chowdhury, P. Crossley, Microgrids and Active Distribution Networks, Institution of Engineering and Technology, 200	
Reference Books:		
1)	Nikos Hatziargyriou, Microgrids Architectures and Control John Wiley Sons, 2014	
2)	Manuela Sechilariu, Fabrice Locment, Urban DC Microgrid: Intelligent Control and Power Flow Optimization, Butterworth-Heinemann, 2016	
3)	Hassan Bevrani, BrunoFrançois, Toshifumi Ise, Microgrid Dynamics and Control John Wiley Sons, 2017	

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Semester-III (w.e.f. A.Y. 2026-27)

D. Introduction To Project Management: Principles &Practices (NPTEL COURSE) (26PEE21674)

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	2	2	**MSE:**	
Tutorials:	-	-	**ICA:**	50 Marks
Practical:	-	-	**ESE:**	
Total:	2	2	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Explain the fundamentals of project management, project initiation, and project planning.	BL-2: Apply
CO 2	Apply project planning, scheduling, and monitoring techniques for effective project execution..	BL-3: Analyse
CO 3	Analyze project risks, monitoring processes, and project closure activities.	BL- 4: Analyse
CO 4	Evaluate project communication strategies and the leadership qualities of a project manager.	BL-5: Create
CO 5	Apply Scrum principles, team-building practices, and agile approaches to manage IT projects.	BL-3: Apply

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	Project Management, Project Initiation	8
2	Project Planning, Project Monitoring	8
3	Project Risk Management, Project Monitoring, Project Termination	8
4	Project Communication Management, Traits of Project Manager	8
5	Project Team Building, IT Projects, Future of Project Management, SCRUM	8

	Process and Leadership in Distributed Agile Teams	
Text Books:		
1)	Project Management: A Systems Approach to Planning, Scheduling, and Controlling – Harold Kerzner	
2)	Project Management: The Managerial Process – Erik W. Larson and Clifford F. Gray	
Reference Books:		
1)	A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Project Management Institute	
2)	Successful Project Management – Jack Gido and Joseph P. Clements	
3)	Fundamentals of Project Management – Joseph Heagney	

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Semester-III (w.e.f. A.Y. 2026-27)

Subject: Industrial Safety(26PEE21571**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Evaluate different accident theories and models along with legal safety frameworks to identify root causes of industrial hazards and recommend preventive safety measures.	BL-5: *Evaluate*
CO 2	Identify, evaluate, and mitigate workplace hazards effectively	BL-4: Analyse
CO 3	Analyze fire, explosion, electrical, and mechanical risks	BL- 4: Analyse
CO 4	Implement national and international safety standards and practices	BL-3: Apply
CO 5	Design and manage a comprehensive industrial safety program	BL-6: Create

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Introduction to Industrial Safety** Evolution and importance of industrial safety, Accident theories and models (Domino theory, Heinrich's theory, Bird's triangle), Types of hazards and accidents in industries, Safety legislations in India (Factories Act, 1948; The Environment (Protection) Act, 1986), Roles and responsibilities of safety professionals, Cost of accidents: Direct and indirect.	**7**
2	**Hazard Identification and Risk Assessment (HIRA)** HAZOP (Hazard and Operability Study)**,** Fault Tree Analysis (FTA) and Event Tree Analysis (ETA)**,** Failure Mode and Effect Analysis (FMEA)**,** Job Safety Analysis (JSA)**,** Risk assessment matrix**,** Risk mitigation hierarchy (Elimination, Substitution, Engineering Controls, Administrative Controls, PPE).	**7**

3	**Fire and Explosion Safety** Fire triangle and tetrahedron, Types and classification of fires, Fire detection and suppression systems, Explosion types (BLEVE, Dust, VCE), Safety in storage and handling of flammable materials, Standards: NFPA, IS codes relevant to fire safety.	**7**
4	**Electrical and Mechanical Safety** Electrical hazards: shock, arc flash, short circuit, Safety practices in electrical installations (IS 3043, IEEE standards), Lockout-Tagout (LOTO) procedures, Mechanical hazards: moving machinery, pinch points, crushing hazards, Machine guarding principles, Pressure vessel and boiler safety.	**7**
5	**Safety Management and Audit** Safety Management Systems (OHSMS, ISO 45001), Incident investigation and reporting, Behaviour-Based Safety (BBS), Safety performance metrics (TRIR, LTIFR, DART rate), Safety training and awareness programs, Audits and inspections (internal, external, compliance).	**7**
Text Books:		
1)	Nicholas J. Bahr. System Safety Engineering and Risk Assessment – A Practical Approach: Taylor & Francis, 1997.	
2)	Industrial Safety Management– L.M. Deshmukh	
Reference Books:		
1)	Fundamentals of Industrial Safety and Health – K.U. Mistry	
2)	System Safety Engineering and Risk Assessment: A Practical Approach – Nicholas J. Bahr	
3)	Industrial Fire Protection Engineering – Robert G. Zalosh	
4)	Electrical Safety Handbook – John Cadick et al.	
5)	Jeremy Stanks. The Manager's Guide to Health & Safety at Work, 8th Edition, Kogan Page Ltd., UK, 2006.	
6)	National Safety Council, USA (2009). Accident Prevention Manual for Business and Industry, Vol. I (13th ed)	

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Semester-III (w.e.f. A.Y. 2026-27)

Operational Research (26PEE21572**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At The End Of This Course, Students Shall Be Able To		***BL Level***
CO 1	Apply The Methodology Of OR Problem Solving And Formulate Linear Programming Problem	BL-3: Apply
CO 2	Analyse The Formulation Skills In Transportation Models And Finding Solutions.	BL-4: Analyse
CO 3	Formulate And Analyse Basics In The Field Of Game Theory And Assignment Problems	BL4: Analyse
CO 4	Design Project Management Techniques Help In Planning And Scheduling A Project	BL-6: Create
CO 5	Apply Basics of Dynamic Programming and Simulation.	BL-3: Apply

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Linear Programming** Definition and Scope of Operations Research, Mathematical formulation of the problem, graphical method, Simplex method, artificial basis technique, dual Simplex method. Degeneracy, alternative optima, unbounded solution, infeasible solution.	**8**
2	**Transportation Problem** Introduction to the problem, LP formulation of a transportation problem. Basic feasible solution by north-west corner method, Vogel's approximation method, least cost method. Finding optimal solution by MODI method, degeneracy, unbalanced transportation problem and Maximization in transportation model.	**8**
3	**Assignment Problem** One to one assignment problem, optimal solutions, unbalanced assignment matrix, travelling sales man problem, maximization in A.P. **Theory of Games :** Introduction, rectangular two person zero sum games, solution of	**8**

	rectangular games in terms of mixed strategies, solution of 2x2 games without saddle point, concept of dominance to reduce the given matrix, Graphical method for 2xn and nx2 games.	
4	**Project Planning through Networks** Introduction, Basic steps in PERT/CPM techniques, Network diagram representation, Rules of drawing network diagram, Fulkerson's rule, Time estimates and Critical path in network analysis, floats, Project evaluation and review technique, Application areas of PERT/CPM techniques.	**6**
5	**Dynamic Programming** Introduction, Characteristics of D.P. model, the recursive equation approach, Computational Procedure in dynamic Programming, solution of an L.P. by D.P. Simulation: Introduction, Monte-Carlo Simulation, Application to Inventory Control, Application to Queuing Problems.	**6**
Text Books:		
1)	Operations Research - S.D. Sharma, Kedarnath Ram nath& Co, 2008.	
2)	Operations Research - Theory and Applications, J.K Sharma, Macmillan Publications India Ltd, 2013.	
Reference Books:		
1)	Operations Research - H.A. Taha, Pearson, 7th Edition, June 2002.	
2)	Introduction to Operations Research - Hiller and Liberman, MGH, 7th Edition, 2002.	
3)	Operations Research- KantiSwarup, P.K. Gupta & Man Mohan, Sultan Chand & Sons	
4)	Operations Research: Theory and Applications", J.K. Sharma, Macmillan India	
5)	Quantitative Techniques in Management", N.D. Vohra, Tata McGraw Hill	
6)	Optimization in Operations Research", Ronald L. Rardin, Pearson	

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Semester-III (w.e.f. A.Y. 2026-27)

Entrepreneurship (26PEE21573**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	3	3	**MSE:**	30 Marks
Tutorials:	1	1	**ICA:**	10
Practical:	-	-	**ESE:**	60 Marks
Total:	4	4	**OE/POE:**	-

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Analyse the characteristics, roles, and challenges of various types of entrepreneurs to assess their impact on innovation, economic growth, and job creation in a dynamic business environment.	BL-4: Analyse
CO 2	Analyse the process of identifying opportunities and evaluating risks in entrepreneurship.	BL-4: Analyse
CO 3	Develop business models using various entrepreneurial frameworks.	BL-5: Evaluate
CO 4	Design a business plan for a new startup.	BL-6:Create
CO 5	Implement entrepreneurial strategies and manage innovation for business success.	BL-3:Apply

Unit	***Course Contents***	***No. of lectures (hrs.)***
1	**Introduction to Entrepreneurship** Definition and characteristics of an entrepreneur, Types of entrepreneurs: Intrapreneur vs. Entrepreneur, Importance of entrepreneurship in economic growth and job creation, Role of innovation and creativity in business, Challenges faced by entrepreneurs in the modern business landscape Entrepreneurial mindset and behaviour.	**8**
2	**Opportunity Identification and Evaluation Solution** Process of identifying business opportunities, Market research methods: SWOT, PEST, Porter's Five Forces, understanding consumer needs and market gaps, Feasibility analysis and risk evaluation, Methods for evaluating the potential of business ideas.	**8**

3	**Business Models and Plan Development:** Introduction to business models (e.g., BMC, Lean Canvas), Key components of a business model: Value proposition, customer segment, revenue model, etc.**,** Developing a comprehensive business plan, financial projections, marketing strategies, and operational planning, Legal structures of businesses (e.g., sole proprietorship, partnership, LLC, etc.)**,** Pitching a business idea to investors.	**8**
4	**Funding and Scaling the Business** Types of funding: Bootstrapping, Angel investors, Venture capital, Crowdfunding**,** **Steps** to secure financing for a start-up**,** developing investor pitches and negotiating terms**,** Business growth strategies: Scaling, Diversification, Mergers, and Acquisitions**,** managing business growth while maintaining quality and innovation**.**	**6**
5	**Innovation, Technology, and Sustainability in Entrepreneurship** Role of innovation and technology in modern start-ups, Digital entrepreneurship and tech start-ups, Sustainable entrepreneurship and social innovation, Leveraging technology for business transformation and competitive advantage, Challenges of scaling in a tech-driven environment, Case studies of successful tech entrepreneurs and innovative start-ups.	**6**
Text Books:		
1)	*Hisrich, R.D., Peters, M.P., & Shepherd, D.A.***,** Entrepreneurship *(9th Edition), McGraw-Hill Education.*	
2)	*Bhaduri, S., &Bansal, S.***,** Entrepreneurship & Innovation: Path to Success, *Pearson Education.*	
Reference Books:		
1)	*Timmons, J.A.***,** New Venture Creation: Entrepreneurship for the 21st Century, *McGraw-Hill.*	
2)	*Kuratko, D.F.***,** Entrepreneurship: Theory, Process, and Practice, *Cengage Learning.*	
3)	*Barringer, B.R.***,** Entrepreneurship: An Opportunity-Based Approach, *Pearson.*	
4)	*Schilling, M.A.*, Strategic Management of Technological Innovation, *McGraw-Hill Education.*	
5)	*Drucker, P.*, Innovation and Entrepreneurship: Practice and Principles, *Harper Business.*	

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Semester-III (w.e.f. A.Y. 2026-27)

Dissertation Phase-I (26PEE21675**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	-	-	**MSE:**	-
Tutorials:	-	-	**ICA:**	100 Marks
Practical:	12	6	**ESE:**	-
Total:	12	6	**OE/POE:**	100 Marks

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Identify and define a relevant research problem in the field of electrical power systems through literature review and industry trends.	BL-2 Understand
CO 2	Formulate clear project objectives, scope, and methodology with appropriate planning and resource identification.	BL-3: Apply
CO 3	Demonstrate the ability to review and critically analyse recent advancements, research papers, and standards related to the selected topic.	BL-4 Analyse
CO 4	Develop a preliminary design, model, or simulation framework aligned with the proposed project objectives.	BL- 6: Create
CO 5	Communicate the project proposal effectively through interim reports and presentations, adhering to technical writing standards and ethical practices.	BL-3: Apply

	Course Contents	
	Dissertation Phase-I In phase–I students can do project work in the dept. It is expected that students should complete the following activities in Phase-I: **literature survey, Problem Definition, Motivation for study and objective of the work, tools and techniques, Preliminary design /feasibility / modular approaches.** The Continuous assessments (Design Seminar, Progress Seminar and End Sem Seminar) will be made. In these the Examinations the internal guide, PG	

	Coordinator along with a Departmental Research Committee (DRC) members, will evaluate the work. The marks obtained in these two assessments will be combined to get the final evaluation out of 200 marks. The course grading, like other courses, will be relative in nature.	
	The evaluation will take place based on criteria such as literature survey and well-defined project problem statement, proposed high level system design, concrete plan for implementation and result generation, presentation etc. The panel (external examiner(s) and senior faculty) will provide a report about suggestions/changes to be incorporated during phase-I **Deliverables** 1. A report having the following details: Abstract, Problem statement, Requirements specification, Literature survey, Proposed solution, High-level design description, Plan for implementation and testing in Phase-II 2. A presentation that covers the major points covered in the report. 3. Research Review Paper publication based on the work carried out in Phase-I.	

M.Tech Electrical Engineering

Semester- IV

Syllabus

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Semester-IV (w.e.f. A.Y. 2026-27)

Dissertation Phase –II (26PEE22676**)**

Teaching Scheme:			**Evaluation Scheme:**	
	No. of Hrs./week	**No. of Credits**		
Lectures:	-	-	**MSE:**	-
Tutorials:	-	-	**ICA:**	200 Marks
Practical:	24	12	**ESE:**	-
Total:	24	12	**OE/POE:**	200 Marks

Course Outcomes: At the end of this course, students shall be able to		***BL Level***
CO 1	Formulate and execute a comprehensive research plan to address a complex problem in electrical power systems using appropriate theoretical and practical tools.	BL-6: Create
CO 2	Demonstrate proficiency in simulation, modelling, and design **of** advanced electrical power system components or control strategies using software/hardware tools.	BL-3 Apply
CO 3	Critically analyse research findings, interpret experimental/simulation data, and draw valid conclusions with technical justification.	BL-5: Evaluate
CO 4	Document and present the project work effectively in the form of a detailed technical report and oral presentation, adhering to professional and ethical standards.	BL- 6: Create
CO 5	Collaborate effectively within a team and manage project timelines and resources, demonstrating leadership and project management skills.	BL-5: Evaluate

	Course Contents	
	Dissertation Phase-II In phase–II students can do project work in the dept. It is expected that students should complete the following activities in Phase-II: **Implementation of the proposed approach in the first stage, Testing and verification of the implemented , Writing of a report and presentation Publish the work done at a suitable reputed conference/in a journal.**	

	Evaluation: Evaluation will be done in three steps: Review Seminar, Progress Seminar, Pre-submission seminar and End-Semester Semester evaluation. In Review Seminar, it is convers about work done in Phase-I and Plan for implementation and testing in Phase-II and In the Mid Semester Examination, internal guide, PG Coordinator along with a Departmental Research Committee (DRC) members, will evaluate the work. In the End Semester Examination evaluation, the internal guide, along with an external expert will evaluate the work. The marks obtained in these two assessments will be combined to get the final evaluation out of 200 marks. The course grading, like other courses, will be relative in nature. The assessment is done on the criteria such as concrete system design, implementation status and concrete plan for completion of remaining tasks, presentation etc. The purpose of Mid-Semester evaluation is also to check preparedness of students for the End Semester evaluation. Examiners may give suggestions for changes/corrections to be incorporated before the final evaluation. If the work done till then may not lead to successful completion of the dissertation in the remaining time, the student may be asked to take an extension in time to complete the course. The assessment End-Semester evaluation will be done based on the criteria such as quality of implementation, result analysis, project outcomes (publications, patent, copyright, contribution to open source community, participation in project competition etc.), quality of report, presentation etc. The total assessment of phase-II work is for 200 marks and the grading, like other courses, will be relative. **Deliverables** 1. Proposed system Hard ware/ Software Model presentation. 2. Dissertation report that gives overview of the problem statement, literature survey, design, implementation details, testing strategy and results of testing 3. All the artifacts created throughout the duration of dissertation such as requirements specification, design, project plan, test cases etc 4. Presentation based on the dissertation report