GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

CURRICULUM 2025

M.E. - [POWER ELECTRONICS AND DRIVES]

Academic Year: **2025-2026,** Regulation: **R2025**

Program Overview

Program Duration: 2 Years (4 Semesters)

Total Credits Required: 71 Credits

Affiliated University: Anna University, Chennai

NBA Accreditation Status: NIL

Program Outcomes:

1. **Engineering Knowledge**: Apply math, science, and engineering fundamentals to complex problems.
2. **Problem Analysis**: Identify and analyze complex problems using research and sustainability principles.
3. **Design Solutions:** Design systems and processes considering health, safety, cost, culture, and environment.
4. **Investigations:** Use experiments, modelling, and data analysis to reach valid conclusions.
5. **Engineering Tools:** Apply modern tools for modelling and problem-solving, recognizing their limits.
6. **Society & Environment:** Assess societal, legal, and environmental impacts of engineering solutions.
7. **Ethics:** Commit to ethics, human values, diversity, and legal compliance.
8. **Teamwork:** Work effectively as an individual and in multidisciplinary teams.
9. **Communication:** Communicate clearly in reports, presentations, and documentation across diverse groups.
10. **Management & Finance:** Apply management and economic principles in projects and teamwork.
11. **Lifelong Learning:** Engage in continuous learning, adapt to new technologies, and think critically.

Program Specific Outcome

1. Apply the fundamentals of mathematics, science and engineering knowledge to identify, formulate, design and investigate complex engineering problems of electric circuits, analog and digital electronic circuits, electrical machines and power systems.

2. Apply appropriate techniques and modern Engineering hardware and software tools in power systems to engage in life-long learning and to successfully adapt in multi-disciplinary environments.
3. Ability to understand the recent technological developments in Electrical & Electronics Engineering and develop products to cater the societal & Industrial needs.

Credit Distribution Comparison

Component	Anna University	AICTE Norms	GCE Bargur
Mathematics & Basic Sciences (BS)	**-**	**-**	**-**
Humanities & Social Sciences (HS)	**-**	**-**	**-**
Engineering Sciences (ES)	**-**	**-**	**-**
Professional Core (PC)	**29**	**20**	**29**
Professional Electives (PE)	**15**	**15**	**15**
Open Electives (OE)	**3**	**3**	**3**
Project Work (PR)	**18**	**28**	**21**
Mandatory courses (MC)	**6**	**2**	**3**
Total Credits	**71**	**68**	**71**

Category Abbreviations

BS - Basic Sciences | **ES** - Engineering Sciences | **PC** - Professional Core

PE - Professional Electives | **OE** - Open Electives | **HS** - Humanities & Social Sciences

| **MC** Mandatory courses | **PR** - Project

Notes

- Legend: L - Lecture Hours per Week | T - Tutorial Hours per Week | P - Practical Hours per Week | C - Credits
- Credits are calculated as: L + T + P/2 for theory courses with lab, and based on contact hours for other courses.
- Professional Electives are domain-specific advanced subjects.
- Open Electives can be chosen from any other department to promote interdisciplinary learning.

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Changes from previous curriculum R2022:

1. **Professional Core subjects are modified and changed**
2. **Laboratories are changed and modified**
3. **Relevant Professional Electives are included**

SEMESTER-WISE CURRICULUM STRUCTURE (for 4 semesters)

SEMESTER I

S.No	Subject Code	Subject Name	L	T	P	C	Category
1	25ZMC101	Research Methodology and IPR	3	0	0	3	MC
2	25PEPC102	Power Electronic Converters and Inverters	3	0	0	3	PC
3	25PEPC103	Electric Drives for Conventional Machines	3	0	0	3	PC
4	25PEPC104	Modeling and Analysis of Electrical Machines	3	0	0	3	PC
5		Professional Elective - I	3	0	0	3	PE
6		Professional Elective - II	3	0	0	3	PE
7		Audit Course-I	2	0	0	0	AC
8	25PEPC111	Power Electronic Converters and Inverters Laboratory	0	0	4	2	PC
9	25PEPC112	Electric Drives for Conventional Machines Laboratory	0	0	4	2	PC
Total			**20**	**0**	**8**	**22**	

SEMESTER II

S.No	Subject Code	Subject Name	L	T	P	C	Category
1	25PEPC201	Special Machines and Drives	3	0	0	3	PC
2	25PEPC202	Digital Controllers for Power Electronic Applications	3	0	0	3	PC
3	25PEPC203	Digital Signal Processors for Power Electronics	3	0	0	3	PC

S.No	Subject Code	Subject Name	L	T	P	C	Category
4	25PEPC204	Power Quality	3	0	0	3	PC
5		Professional Elective - III	3	0	0	3	PE
6		Audit Course-II	2	0	0	0	AC
7	25PEPC211	Electrical Drives for Special machines Laboratory	0	0	4	2	PC
8	25PEEE212	Digital Controllers for Power Electronic Applications Laboratory	0	0	4	2	PC
Total			**17**	**0**	**8**	**19**	

SEMESTER III

S.No	Subject Code	Subject Name	L	T	P	C	Category
1		Professional Elective – IV	3	0	0	3	PE
2		Professional Elective – V	3	0	0	3	PE
3		Open Elective	3	0	0	3	OE
4	25PEEE311	Project Phase-I	0	0	18	9	PR
Total			**9**	**0**	**18**	**18**	

SEMESTER IV

S.No	Subject Code	Subject Name	L	T	P	C	Category
1	25PEEE411	Project Phase-II	0	0	24	12	PR
Total			**0**	**0**	**24**	**12**	

TOTAL NO. OF CREDITS: 71

Professional Electives (PE)

Students must choose 5 Professional Electives

	Based on the industrial needs and latest developments in the engineering subjects may be proposed. Numbers not limited to 16						
1	25PEPE01	Power Electronics for Renewable Energy Sources	3	0	0	3	PE
2	25PEPE02	Power Semiconductor Devices	3	0	0	3	PE
3	25PEPE03	Solar and Energy Storage System	3	0	0	3	PE
4	25PEPE04	Wind Energy Conversion System	3	0	0	3	PE
5	25PEPE05	PWM Converter and Applications	3	0	0	3	PE
6	25PEPE06	Switched Mode Power Converters	3	0	0	3	PE
7	25PEPE07	Micro Grid	3	0	0	3	PE
8	25PEPE08	Controller Design for Power Electronic Applications	3	0	0	3	PE
9	25PEPE09	Distributed Power Generation	3	0	0	3	PE
10	25PEPE10	Smart Grid Technologies	3	0	0	3	PE
11	25PEPE11	SCADA Systems and Applications	3	0	0	3	PE
12	25PEPE12	Energy Storage technologies	3	0	0	3	PE
13	25PEPE13	HVDC and FACTS Devices	3	0	0	3	PE
14	25PEPE14	Electromagnetic Interference and Compatibility	3	0	0	3	PE
15	25PEPE15	Electric Vehicles and Power Management	3	0	0	3	PE

16	25PEPE16	Advanced power Converters	3	0	0	3	PE

Open Electives (OE)

Students must choose 1 Open Electives from other departments (3 credits each = 3 credits)

1	22PEOE01	Waste to Energy	3	0	0	3	OE
2	22PEOE02	Machine Learning and Automation	3	0	0	3	OE
3	22PEOE03	Software for Circuit Simulation	3	0	0	3	OE
4	22PEOE04	Power Electronics for Solar Photovoltaic Systems	3	0	0	3	OE
5	22PEOE05	Introduction to Electric Vehicles	3	0	0	3	OE

LIST OF AUDIT COURSES

1	22ZAC001	Disaster Management	2	0	0	0	AC
2	22ZAC002	English for Research Paper Writing	2	0	0	0	AC
3	22ZAC003	Value Education	2	0	0	0	AC
4	22ZAC004	Pedagogy Studies	2	0	0	0	AC
5	22ZAC005	Stress Management by Yoga	2	0	0	0	AC
6	22ZAC006	Constitution of India	2	0	0	0	AC

Signature of HOD

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Department of Electrical and Electronics Engineering

Subject Code	25ZMC101	Subject Title	RESEARCH METHODOLOGY AND IPR
Category	Professional Core	L-P-T-C	3-0-0-3
Regulation	2025	Semester	I
Prerequisites			

Course Objectives:

1. To identify the problems and solutions for research in various areas
2. To prepare literature survey and write thesis report.
3. To prepare research proposal in various agencies like DST, AICTE etc..,
4. To understand the Intellectual property rights and patenting
5. To understand the patent rights and its developments

Course Content:

[RESEARCH PROBLEM AND SOLUTION] (9 Hours)

Meaning of research problem – Sources of research problem – Criteria Characteristics of a good research problem – Errors in selecting a research problem – Scope and objectives of research problem – Approaches of investigation of solutions for research problem– data collection–analysis – interpretation – Necessary instrumentations

[LITERATURE SURVEY AND WRITING] (9 Hours)

Effective literature studies approaches – Analysis – Plagiarism – Research ethics – Effective technical writing

[RESEARCH PROPOSAL] (9 Hours)

How to write report and Paper Developing a Research Proposal – Format ofresearch proposal – a presentation and assessment by a review committee.

[NATURE OF INTELLECTUAL PROPERTY] (9 Hours)

Patents – Designs – Trade and Copyright – Process of Patenting and Development: technological research – innovation – patenting – development – International Scenario: International cooperation on Intellectual Property – Procedure for grants of patents – Patenting under PCT.

[PATENT RIGHTS AND NEW DEVELOPMENTS] (9 Hours)

Scope of Patent Rights – Licensing and transfer of technology – Patent information and databases – Geographical Indications – Administration of Patent System –IPR of Biological Systems –Computer Software etc – Traditional knowledge – Case Studies: IPR and IITs.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom'sLevel
CO1	Understand research problem formulation.	L1
CO2	Analyze research related information	L4
CO3	Understand that tomorrow world will be ruled by ideas, concept, and	L2

	creativity.	
CO4	Understand that IPR would require in growth of individuals & nation.	L2
CO5	Understand the importance of IPR protection.	L2

Text Books:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students“”

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

3.Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

4.Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.

Reference Books:

1. Mayall , “Industrial Design”, McGraw Hill, 1992.

2. Niebel , “Product Design”, McGraw Hill, 1974.

3. Asimov , “Introduction to Design”, Prentice Hall, 1962.

4. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in NewTechnological Age”, 2016.

5. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	2	-	-	-	-	2	-	-	-	-	-	3
CO2	-	-	-	2	-	-	-	-	2	-	-	-	-	-
CO3	-	2	-	-	-	3	-	1	-	-	-	-	2	-
CO4	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	1	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By

Name & Designation

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Department of Electrical and Electronics Engineering

Subject Code	25PEPC102	Subject Title	POWER ELECTRONIC CONVERTERS AND INVERTERS
Category	Professional Core	L-P-T-C	3-0-0-3
Regulation	2025	Semester	I
Prerequisites			

Course Objectives:

1. To determine the operation and characteristics of controlled rectifiers.
2. To apply switching techniques and basic topologies of DC-DC switching regulators.
3. To study and analyze the operation of the converter.
4. To analyze different types of single phase and three phase inverters.
5. To impart knowledge on multilevel inverters and modulation techniques.

Course Content:

[SINGLE PHASE & THREE PHASE CONVERTERS] 9-Hours

Principle of phase controlled converter operation – single-phase full converter and semi- converter (RL, RLE load) – single phase and three phase dual converter – Three phase operation full converter and semi-converter (R, RL, RLE load) – reactive power – power factor improvement techniques – PWM rectifiers.

[DC-DC CONVERTERS] 9-Hours

Limitations of linear power supplies, switched mode power conversion, Non-isolated DC- DC converters: operation and analysis of Buck, Boost, Buck – Boost, Cuk& SEPIC – under continuous and discontinuous operation – Isolated converters: basic operation of Flyback, Forward and Push-pull topologies, Half and Full Bridge Converters.

[SINGLE AND THREE PHASE VOLTAGE SOURCE INVERTERS] 9-Hours

Single phase and three phase voltage source inverters (both 120o mode and180o mode)–Voltage & harmonic control-PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation.

[CURRENT SOURCE INVERTERS] 9-Hours

Operation of six-step thyristor inverter – inverter operation modes – load – commutated inverters – Auto sequential current source inverter (ASCI) – current pulsations – comparison of current source inverter and voltage source inverters – PWM techniques for current source inverters, Grid-tied Inverters.

[MULTILEVEL INVERTERS] 9-Hours

Multilevel concept – diode clamped – flying capacitor – cascade type multilevel inverters - Comparison of multilevel inverters - application of multilevel inverters – PWM techniques for MLI – Single phase &Three phase Impedance source inverters.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom'sLevel
CO1	*Understand the operation of different types of converters, choppers and inverters.*	L2
CO2	*Select a suitable converter/chopper/inverter for specified input and*	L4

	output.	
CO3	*Analysis the performance of converters, choppers and inverters.*	L4
CO4	Identify the suitable PWM technique for single phase voltage source inverter, current source inverter and multilevel inverter.	L4
CO5	Apply converters, choppers and inverters topologies of power circuit for power electronic systems.	L3

Text Books:

1.Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Prentice Hall India, Third Edition, New Delhi, 2004.

2.P.C. Sen, "Modern Power Electronics",Wheeler Publishing Co, First Edition, New Delhi, 1998.

3.P.S.Bimbra, "Power Electronics", Khanna Publishers, Eleventh Edition, 2003

Reference Books:

1.Gopal K Dubey, "Power Semiconductor controlled Drives", Prentice Hall Inc., NewYersy, 1989.

2.Bimal K.Bose "Modern Power Electronics and AC Drives", Pearson Education, Second Edition, 2003.

3.Ned Mohan,T.M Undeland and W.P Robbin, "Power Electronics:

4.R.Krishnan, "Electric Motor Drives – Modelling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, 2003.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	3	3	1	-	-	-	-	-	-	-	3	2
CO2	3	2	3	3	1	-	-	-	-	-	-	-	3	2
CO3	3	2	3	3	1	-	-	-	-	-	-	-	3	2
CO4	3	2	3	3	1	-	-	-	-	-	1	-	3	1
CO5	3	2	3	3	1	-	-	-	-	-	1	-	3	1

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

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GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

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Department of Electrical and Electronics Engineering

Subject Code	25PEPC103	Subject Title	ELECTRIC DRIVES FOR CONVENTIONAL MACHINES
Category	Professional Core	L-P-T-C	3-0-0-3
Regulation	2025	Semester	I
Prerequisites			

Course Objectives:

1.To Summarize the concepts of conventional DC drive

2.To Analyze the performance of various semiconductor controlled DC drives

3.To Identify and enhance uses of dc drive in modern applications

4.To Analyze the performance of AC motors with various control strategies and Implementation of AC drive systems

5.To Identify the suitability of control methods of AC Drives for industrial applications

Course Content:

[CONVENTIONAL AND CONVERTER CONTROL OF DC DRIVES] (9-Hours)

Models and transfer function of series and separately excited dc motor–Multi quadrant operation. Control of dc drives with single phase and three phase converters- Closed loop control- Dual converter fed dc motor- Methods of braking of dc motors.

[**CHOPPER CONTROL OF DC MOTORS] (9-Hours)**

Steady state analysis of chopper controlled dc drives – Continuous and discontinuous current conduction modes–Dynamic state analysis- Control strategies- CLC and TRC strategies – Multi quadrant control – Closed loop control- Traction motors- Traction supply systems.

[**VOLTAGE AND FREQUENCY CONTROLLED INDUCTION MOTOR DRIVES] (9-Hours)**

Introduction - Four quadrant control and closed loop operation of AC drives – Effect of non-sinusoidal supply on performance of induction motor: Stator voltage control using AC voltage controller- VSI and CSI driven induction motors: motoring, regenerative braking and closed loop operation – Constant Volts/Hz control: Constant slip speed control and air gap flux weakening control – Comparison of VSI and CSI fed drives.

[**ROTOR RESISTANCE CONTROL AND SLIP ENERGY RECOVERY SCHEMES] (9-Hours)**

Constant torque operation –static rotor resistance control – Principle of vector control – Direct vector control scheme – Indirect vector control scheme – Speed control of slip ring induction motor by injected emf- Torque slip characteristics – Static Kramer and Scherbius drives- sub synchronous and super synchronous operations- torque equation.

[**SYNCHRONOUS MOTOR DRIVES] (9-Hours)**

Vector controlled PM synchronous motor drives – constant flux and Flux weakening speed control - Power factor control and self-control - closed loop operation- permanent magnet synchronous motor (Brushless excitation)

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom'sLevel
CO1	Summarize the concepts of conventional DC drive	L1
CO2	Analyze the performance of various semiconductor controlled DC	L4

	drives	
CO3	Identify and enhance uses of dc drive in modern applications	L2
CO4	Analyze the performance of AC motors with various control strategies and Implementation of AC drive systems.	L4
CO5	Identify the suitability of control methods of AC Drives for industrial applications	L1

Text Books:

1.Sen, P.C. “Thyristor DC Drives”, John Wiley and Sons, 1991

2. Krishnan.R. “Electric Motor Drives- Modelling, Analysis and Control”, Pearson Education,2010.

3. Dubey,G.K. “Power Semiconductor Controlled Drives”, New York:Prentice Hall

Reference Books:

1. VedamSubramanyam, “Electric drives concepts and applications”, Tata McGraw Hill publishing company Ltd., II Edition,New Delhi, 2011.
2. Murphy, J.M.D, Turnbull, F.G. ‘Thyristor Control of AC Motors’, Pergamon press Oxford,First Edition,1988.

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO1	PSO2	PSO3
CO1	3	2	-	3	-	-	-	-	-	-	-	-	2	2
CO2	-	3	2	2	-	-	-	-	-	-	-	-	2	-
CO3	-	-	-	-	3	-	2	-	2	-	-	-	-	2
CO4	3	3	1	1	2	-	1	-	-	-	2	-	-	2
CO5	-	3	3	-	3	1	2	-	1	-	-	-	2	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

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Department of Electrical and Electronics Engineering

Subject Code	25PEPC104	Subject Title	MODELLING AND ANALYSIS OF ELECTRICAL MACHINES
Category	Professional Core	L-P-T-C	3-0-0-3
Regulation	2025	Semester	I
Prerequisites			

Course Objectives:

1. To provide knowledge about the fundamentals of magnetic circuits, energy, force and torque of multi-excited systems.
2. To study about various reference frame theories and analyze the performance of Rotating.

Course Content:

[PRINCIPLES OF ELECTROMAGNETIC ENERGY CONVERSION] (9-Hours)

General expression of stored magnetic energy – energy and force/Torque Equation – Singly and doubly excited systems – Linear and Non-linear magnetic systems – Analysis of magnetic circuits with air gap and permanent magnets.

[REFERENCE FRAME THEORY] (9-Hours)

Static and rotating reference frames – Stationary circuit variables transformed to the arbitrary reference frame – Commonly used reference frame -Transformation of variables Transformation between reference frames – Transformation of a balanced set – Balanced steady state phasor and voltage equations – Variables observed from several frames of reference.

[DC MACHINES] (9-HOURS)

Voltage and Torque Equations – Dynamic characteristics of permanent magnet and shunt DC motors -Time- domain block diagrams -State equations –Solution of dynamic characteristic by Laplace transformation.

[INDUCTION MACHINES] (9-HOURS)

Voltage and Torque Equations – Transformation for rotor circuits – Voltage and torque Equations in reference frame variables – Analysis of steady state operation – Free acceleration characteristics – Dynamic performance for load and torque variations – Dynamic performance for three phase fault.

UNTI-V [SYNCHRONOUS MACHINES](9-HOURS)

Voltage and Torque Equation – Voltage Equation in arbitrary reference frame and rotor reference frame – Park equations –Rotor angle and angle between rotor – Steady state analysis – Dynamic performances for torque variations–Dynamic performance for three phase fault – Transient stability limit – Critical clearing time.

Total Hours: 45

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Understand the various electrical parameters in mathematical form.	L2
CO2	Understand the different types of reference frame theories and transformation relationships.	L2

CO3	Find the electrical machine equivalent circuit parameters.	L3
CO4	Model of Induction machines.	L4
CO5	Model of Synchronous Machines	L4

Text Books:

1. Paul C.Krause, Oleg Wasyzczuk, Scott S, Sudhoff, “Analysis of Electric Machinery and DriveSystems”,JohnWiley&Sons,2013.
2. Krishnan.R, “Electric Motor Drives, Modeling, Analysis and Control”, Prentice Hall of India

References Books:

1. Samuel Seely, “Eletromechanical Energy Conversion”, Tata McGraw Hill Publishing Co, 1962
2. Fitzgerald.A.E, Charles Kingsley, Jr, and Stephan D, Umanx, “Electric Machinery”, Tata McGrawHill, 7th Edition, 2014.
3. P S Bimbhra, “Generalized Theory of Electrical Machines”, Khanna Publishers, 2008.

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1	3	2	–	–	–	-	-	-	-	-	-	3	2	2
CO2	3	3	2	–	2	-	-	-	-	-	-	3	2	-
CO3	3	3	2	–	3	-	-	-	-	-	-	3	-	2
CO4	3	3	2	2	3	-	-	-	-	-	-	3	-	2
CO5	3	3	2	2	3	1	2	-	-	-	-	3	2	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

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Department of Electrical and Electronics Engineering

Subject Code	25PEPC111	Subject Title	POWER ELECTRONIC CONVERTERS AND INVERTERS LABORATORY
Category	Professional Core	L-P-T-C	0-0-4-2
Regulation	2025	Semester	I
Prerequisites			

COURSE OBJECTIVES:

1. To design and analyses the various DC drives.
2. To Implement closed loop system using hardware simulation.

LIST OF EXPERIMENTS:

1. Modeling and system simulation of basic electric circuits using MATLAB – SIMULINK / SCILAB

a) DC source fed resistive load and Resistive – inductive load

b) DC source fed RLC load for different damping conditions c) DC source fed DC motor load

2. Modeling and System simulation of basic power electronic circuits using MATLAB-SIMULINK / SCILAB

a) AC Source with Single Diode fed Resistive and Resistive-Inductive Load

b) AC source with Single SCR fed Resistive and Resistive-Inductive Load

3. Modeling and System Simulation of SCR based full converter with different types of load using MATLAB-Simulink / SCILAB

a) Full converter fed resistive load.

b) Full converter fed Resistive-Back Emf (RE) load at different firing angles.

c) Full Converter fed Resistive-Inductive Load at different firing angles.

d) Full converter fed DC motor load at different firing angles.

4. Circuit Simulation of Voltage Source Inverter and study of spectrum analysis with and without filter using MATLAB / SCILAB.

a) Single phase square wave inverter.

b) Three phase sine PWM inverter.

c) Hybrid solar and wind based single phase power generation.

d) Analysis of grid tied inverter.

5. Performance characteristics of multilevel inverter.
6. Performance evaluation of buck converter.
7. Performance evaluation of boost converter.
8. Performance evaluation of buck-boost converter.

Total Hours: 60

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Select right tools and equipment for carrying out minor works /repair electrical wiring and plumbing.	L5
CO2	Do electrical wiring for household applications.	L5
CO3	Do soldering and testing of PCB connections.	L6

COURSE ARTICULATION MATRIX:

CO1	2	3	1	1	3	-	-	-	1	1	3	2	2	3	3
CO2	2	3	1	1	3	-	-	-	1	1	3	2	2	3	3
CO3	2	3	1	1	3	-	-	-	1	1	3	2	2	3	3

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

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GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPC112	Subject Title	ELECTRIC DRIVES FOR CONVENTIONAL MACHINES LABORATORY
Category	Professional Core	L-P-T-C	0-0-4-2
Regulation	2025	Semester	I
Prerequisites			

COURSE OBJECTIVES:

1. To design and analyses the various DC drives.
2. To Implement closed loop system using hardware simulation.

LIST OF EXPERIMENTS:

1. Speed control of converter fed DC motor
2. Speed control of chopper fed DC motor
3. Regenerative / Dynamic braking operation of DC motor
4. Closed loop speed control of DC motor using Step/Ramp/Parabolic input and PID controller
5. Four quadrant operation of dual converter-based DC drive
6. Speed control of single-phase induction motor using TRIAC
7. Determination of output voltage and characteristics of 1-phase dual converter with RL
8. VSI fed induction motor drive analysis using MATLAB/PSPICE/PSIM Software.
9. PWM Inverter fed three phase induction motor drive control using MATLAB/PSPICE/PSIM Software.
10. Single phase Multi Level Inverter based induction motor drive.
11. Regenerative/ Dynamic braking operation of AC motor.
12. Speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper MOSFET

Total Hours: 60

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Select right tools and equipment for carrying out minor works /repair electrical wiring and plumbing.	L5
CO2	Do electrical wiring for household applications	L6
CO3	Do soldering and testing of PCB connections.	L6

COURSE ARTICULATION MATRIX:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	3	1	1	3	-	-	-	1	1	3	2	2	3	3
CO2	2	3	1	1	3	-	-	-	1	1	3	2	2	3	3
CO3	2	3	1	1	3	-	-	-	1	1	3	2	2	3	3

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By
Name & Designation

BOS Approval
Date: DD/MM/YYYY

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPC201	Subject Title	SPECIAL MACHINES AND DRIVES
Category	Professional Core	L-P-T-C	3-0-0-3
Regulation	2025	Semester	II
Prerequisites	Principles of Electric Machine, Power Electronics, Analog Electronics, Digital Electronics		

COURSE OBJECTIVES:

1.To impart knowledge on the construction, modeling, control, and performance analysis of special electrical machines such as BLDC, PMSM, and SRM.

2. To enable students to design and implement appropriate converter and sensor interfaces for special machine drives using control strategies and microcontroller integration.

COURSE CONTENT:

[DRIVE FOR BLDC MOTOR] (9-Hours)

BLDC Construction - Driving Principle (Electronic Commutation) - Modelling - Voltage and Torque Equations - Torque ripple - Position Sensors - Position Sensing and Control - Commutation with QE -Position Alignment - Switching schemes in control - Speed Control - Current Control - PWM Schemes - BSM and USM methods - Startup and reversal.

[DRIVE FOR PMSM] (9-Hours)

Structure and Categories of PMSM - Modelling of PMSM - d-q axis model of PMSM - Voltage, Flux and Torque Equations - Vector control of SPMSM and IPMSM - d-q axis current regulators - PI gains for PMSM- Feed forward control - Speed estimation using encoder - Flux weakening control - Basics of Sensor-less control of PMSM.

[DRIVE FOR SWITCHED RELUCTANCE MOTOR] (9-Hours)

Switched Reluctance Motor - Principle of operation - Equivalent Circuit - Power and Torque equation -operational characteristic - Phase excitation sequence - Control overview of SRM (Control Principle) - Current Control.

[POWER CONVERTERS FOR SPECIAL MACHINE DRIVES] (9-Hours)

Converters for BLDC, PMSM - Switching schemes - PWM schemes - Dead Time, Effects and Compensation - SRM - Asymmetric Bridge converter - (N+1) switch converter - C-Dump converter – Nswitch converter.

[SENSING ELEMENTS FOR SPECIAL ELECTRIC MACHINE DRIVES] (9-Hours)

Current Sensors, their position in circuit and interface with microcontroller - Voltage Sensors and interface with microcontroller - Position/Speed Sensors and interface with microcontroller - Quadrature Encoder Interface.

Total Hours: 45

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Explain the construction, operating principles, and modeling of BLDC motor drives.	L1
CO2	Develop and analyze the d–q axis model and control strategies for PMSM drives.	L2

CO3	Describe and analyze the torque production, characteristics, and control of Switched Reluctance Motors.	L2
CO4	Select and design suitable power converters for various special electrical machine drives**.**	L4
CO5	Identify and interface sensing elements with controllers for special machine drives.	L4

REFERENCE BOOK:

1. Ned Mohan and Siddharth Raju, “Analysis and Control of Electric Drives” 1st Edition, Wiley, 2021.
2. Kwang Hee Nam, “AC Motor Control and Electrical Vehicle Applications”, 2nd Edition, CRC Press, 2019.

TEXT BOOK:

1. Sang-Hoon Kim, “Electric Motor Control - DC, AC, and BLDC Motors”, Elsevier, 2017.
2. PiotrWach, “Dynamics and Control of Electrical Drives”, Springer-Verlag Berlin Heidelberg, 2011.
3. R. Krishnan, “Switched Reluctance Motor Drives: Modeling,Simulation, Analysis, Design, and Applications”, CRC Press, 2001

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1	3	2	–	–	1	–	-	-	-	-	-	3	2	2
CO2	3	3	2	–	2	–	-	-	-	-	-	3	2	-
CO3	3	3	2	–	2	–	-	-	-	-	-	3	-	2
CO4	3	3	3	2	3	–	-	-	-	-	-	3	-	2
CO5	2	2	3	2	3	–	2	-	-	-	-	3	2	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By

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GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPC202	Subject Title	DIGITAL CONTROLS FOR POWER ELECTRONIC APPLICATIONS
Category	Professional Core	L-P-T-C	3-0-0-3
Regulation	2025	Semester	II
Prerequisites	Difference Equation, Z Transforms, Control systems, LinearIntegrated Circuits		

COURSE OBJECTIVES:

To impart knowledge on digital control techniques applicable to power electronic converters and electrical drives.

To develop skills for designing, analyzing, and implementing digital control algorithms for various converter and motor drive applications.

COURSE CONTENT:

[DIGITAL CURRENT MODE CONTROL] (9-Hours)

Introduction to Digital control – Structure - Requirements of the Digital Controller - Basic Digital Current Control Implementations – Discretization strategies – Effects of computational delay – Minimization of computational delay – Predictive controller

[MULTI-SAMPLED CURRENT CONTROLLERS] (9-Hours)

Over-sampled PI current controller – Over-sampled Predictive controller – Fixed frequency hysteresis current controller

[SPACE VECTOR MODULATION BASED CONTROLLERS] (9-Hours)

Aβ Transformation – Space Vector modulation – Rotating reference frame current controller – Park's Transformation – Rotating reference PI current controller – Implementation of rotating reference frame PI current controller.

[EXTERNAL CONTROL LOOPS] (9-Hours)

Modelling of internal current loop – Large bandwidth controllers – PI controller – predictive controller- Narrow bandwidth controllers – DFT filter based voltage controller

[NEW DIGITAL CONTROL PARADIGMS] (9-Hours)

Flexibility and Performance – Distributed generation control architectures – Control system organization and implementation – Controller validation.

Total Hours: 45

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Explain the principles and structure of digital current mode control and its implementation issues.	L3
CO2	Analyze and design multi-sampled digital current controllers for power converter systems.	L4
CO3	Apply space vector modulation and reference frame transformation for digital current control.	L3
CO4	Develop external voltage control loops and predictive controllers for power electronic applications.	L4
CO5	Evaluate and implement advanced digital control paradigms for distributed and flexible power electronic systems.	L5

Reference Book:

1. Simone Buso and Paolo Mattavelli, “Digital Control in Power Electronics”, 2nd Edition, Morgan and Claypool, 2015.
2. RyszardKoziolet. al., “Digital Control of Electric Drives”, Elsevier, 1992.

TEXT BOOK:

1. M. Sami Fadali and Antonio Visioli, “Digital Control Engineering Analysis and Design”, 2ndEdition, Elsevier, 2013.
2. Gregory Starr,“Introduction to Applied Digital Controls”, Springer Nature, 2020.

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1	3	2	–	–	1	–	-	-	-	-	-	3	2	-
CO2	3	3	2	–	2	–	-	-	-	-	-	3	2	-
CO3	3	3	3	2	3	–	-	-	-	-	-	3	-	2
CO4	3	3	3	3	3	–	-	-	-	-	-	3	-	2
CO5	2	3	3	3	3	–	-	-	-	-	-	3	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By
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GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPC203	Subject Title	DIGITAL SIGNAL PROCESSORS FOR POWER ELECTRONICS
Category	Professional Core	L-P-T-C	3-0-0-3
Regulation	2025	Semester	II
Prerequisites	Microcontroller, Power Electronics, Analog Electronics, Digital Electronics and C Programming		

COURSE OBJECTIVES:

To apply the resources of TMS320F28379D DSP Architecture for Power conditioning, Power flow control and motor drive controls.

COURSE CONTENT:

[TMS320F28379D DSP ARCHITECTURE] (9-Hours)

Overview of C28x DSP - Architecture Overview of TMS320F28379D- C28x family: CPU system control - FPU and CLA - Memory Architecture - Dedicated Memory - Global Shared memory - Local shared memory - Message passing Memory - Math Accelerator - VCU - TMU - Fast Interrupt response manager -Code Security manager.

[ANALOG SYSTEMS] (9-Hours)

ADC - Triggering and conversion sequencing - ADC SOC functional diagram and operation - Examples for ADC implementation - Comparator sub system - Functional diagram and operation - Examples for implementation - DAC - functional diagram and application.

[CONTROL PERIPHERALS] (9-Hours)

ePWM - ePWM signals and connections - ePWM block diagram - study of individual sub-moduled of ePWM - Typical application configurations of ePWM for dc-dc converter and inverters - HRPWM - eCAP- modes of operations - eQEP - functional block diagram and connections.

[CLA AND IPC FOR DUAL CORE PROCESSORS] (9-Hours)

CLA - purpose and operation - CLA overview and functional block diagram - operation - CLA memory and register access - CLA Tasks - IPC features - Messaging with flags and interrupts - IPC data transfer.

[APPLICATIONS TO POWER CONVERTERS] (9-Hours)

Introduction to CCS Compiler - Configuring and closed loop control of basic DC-DC converters - Configuring and closed loop control of single-phase inverter - Configuring and closed loop control of three phase inverters - Configuring and closed loop control of Electric Motors.

Total Hours: 45

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Apply the resources of TMS320F28379D DSP Architecture for Power Electronic Control Applications	L3
CO2	Configure the modules and manage control applications	L4
CO3	Share the computational burdens among different resources effectively for deriving optimal control.	L1
CO4	Manage the special features of modules and memory resources to effectively reduce the execution timings	L2

CO5	Able to realise the designed controller in the suitable form through sharing of resources.	L5

Reference Documents:

1. Texas320F28379D Manuals
2. Texas320F28379D Datasheet
3. Texas320F28379DMicrocontrollerWorkshop Manual
4. C2000DelfinoWorkshopManual
5. C2000CLASoftware DevelopmentGuide

COURSE ARTICULATION MATRIX:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1	3	3	–	–	2	–	-	-	-	-	-	2	2	–
CO2	3	3	2	–	3	–	-	-	-	-	-	3	3	2
CO3	3	3	3	–	3	–	-	-	-	-	-	3	3	3
CO4	3	3	3	2	3	–	-	-	-	-	-	3	3	3
CO5	3	3	3	2	3	–	-	-	-	-	-	3	3	3

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By
Name & Designation

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GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPC204	Subject Title	POWER QUALITY
Category	Professional Core	L-P-T-C	3-0-0-3
Regulation	2025	Semester	II
Prerequisites			

COURSE OBJECTIVES:

1.To understand the different power quality issues to be addressed.

2.To understand the recommended practices by various standard bodies like IEEE, IEC, etc. on voltage & frequency, harmonics.

3.To understanding STATIC VAR Compensators.

COURSE CONTENT:

[INTRODUCTION] (9-Hours)

Power quality – Voltage quality – Overview of power quality phenomena – Classification of power quality issues – Power quality measures and standards – THD – TIF – DIN – C – message weights – Flicker factor – Transient phenomena – Occurrence of power quality problems – Power acceptability curves – IEEE guides – Standards and recommended practices.

[POWER ANALYSIS FOR AC SYSTEMS] (9-Hours)

Single phase sinusoidal, non-sinusoidal source supplying linear and nonlinear loads –Three phase Balance system – Three phase unbalanced system – Three phase unbalanced and distorted source supplying on linear loads – Concept of PF – Three phase three wire – Three phase four wire system.

[HARMONICS] (9-Hours)

Harmonics – individual and total harmonic distortion – RMS value of a harmonic waveform – Triplex harmonics – Important harmonic introducing devices. – SMPS – Three phase powerconverters – Arcing devices – Saturable devices – Harmonic distortion of fluorescent lamps – Effect of power system harmonics on power system equipment and loads.

[MODELING OF NETWORKS AND COMPONENTS UNDER NON-SINUSOIDAL CONDITIONS] (9-Hours)

Transmission and distribution systems – Shunt capacitors – transformers –.Electric machines – Ground systems – loads that cause power quality problems – Power quality problems created by drives and its impact on drive.

[POWER FACTOR IMPROVEMENT] (9-Hours)

Power Factor Improvement Introduction – Passive Compensation – Passive Filtering – Harmonic Resonance –Impedance Scan Analysis – Active Power Factor Corrected Single Phase Front End – Control Methods for Single Phase APFC – Three Phase APFC and Control Techniques – PFC based on Bilateral Single Phase and Three Phase Converter.

Total Hours: 45

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Acquire knowledge about the harmonics, harmonic introducing	L3

	devices and effect of harmonics on system equipment and loads	
CO2	AnalysePolyphase AC systems with linear and nonlinear loads for power factor and harmonic analysis.	L4
CO3	Develop analytical modeling skills needed for modeling and analysis of harmonics in networks and components	L3
CO4	Understand active power factor correction based on static VAR compensators and its control techniques	L2
CO5	Understand series and shunt active power filtering techniques for harmonics.	L2

Reference Book:

1. G.T. Heydt, “Electric power quality”, McGraw-Hill Professional, 2007
2. Math H. Bollen, “Understanding Power Quality Problems”, IEEE Press, 2000
3. J. Arrillaga, “Power System Quality Assessment”, John wiley, 2000

Text Book:

1. J.Arrillaga, B.C. Smith, N.R. Watson & A. R.Wood ,”Power system Harmonic Analysis”,Wiley, 1997.
2. E.Aeha and M.Madrigal, “Power System Harmonics, Computer Modelling and Analysis, “ WileyIndia,2012.

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1	3	3	–	-	-	-	-	-	1	-	-	2	-	–
CO2	3	3	2	-	-	2	-	-	-	-	1	3	1	2
CO3	3	3	3	-	-	-	-	-	1	-	-	3	-	3
CO4	3	3	3	-	-	-	-	-	1	-	-	3	-	3
CO5	3	3	3	-	-	2	-	-	-	-	-	3	-	3

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By
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GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPC211	Subject Title	ELECTRICAL DRIVES FOR SPECIAL MACHINES LABORATORY
Category	Professional Core	L-P-T-C	0-0-4-2
Regulation	2025	Semester	II
Prerequisites			

COURSE OBJECTIVES:

1. To design and implement speed control systems for BLDC, PMDC, and PMSM motors.
2. To develop microcontroller and DSP-based speed control for stepper and SRM motors.
3. To simulate motor drives, including PMSM and PMDC, using PWM inverters.
4. To analyze and evaluate the performance of various motor drives through simulations.

LIST OF EXPERIMENTS:

1. Speed control of BLDCmotor.
2. Micro controller based speed control of stepper motor
3. DSP based speed control of SRM Motor
4. Speed control of PMDC motor.
5. Speed control of PMSM motor.
6. Simulation of permanent Magnet Synchronous Motor drive fed by PWM Inverter using software.
7. Simulation of PMDC drives by using software. **Total Hours: 60**

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Develop a suitable power electronic circuit for speed control of BLDC motor, PMDC motor and PMSmotor.	L5
CO2	Program the DSP and Microcontroller for speed control of SRM and Stepper motor res.Control Analyze a suitable power electronic circuit for speed control DSP based speed control of SRM Motor Micro controller based speed control of stepper motor	L6
CO3	Simulate PMDC drive and permanent Magnet Synchronous Motor drive fed by PWM Inverter..	L5
CO4	Generate PWM using FPGA for inverters.	L5
CO5	Analyze and evaluate power electronic circuits for motor speed control systems and optimize theirperformance.	L4

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	–	3	-	2	-	-	-	-	3	2	-
CO2	3	3	3	–	3	-	-	-	-	2	-	2	3	-
CO3	3	3	3	–	3	-	-	-	-	2	-	2	5	-
CO4	3	3	3	2	3	-	-	-	-	2	-	2	3	-
CO5	3	3	3	2	3	-	-	-	-	-	-	3	2	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By

Name & Designation

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Date: DD/MM/YYYY

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEEE212	Subject Title	DIGITAL CONTROLS FOR POWER ELECTRONIC APPLICATIONS LABORATORY
Category	Professional Core	L-P-T-C	0-0-4-2
Regulation	2025	Semester	II
Prerequisites			

Course objectives:

1. To understand PWM generation of AC-DC converter.
2. To understand PWM generation of DC-DC converter.
3. To understand PWM generation of AC-AC converter.
4. To understand PWM generation of DC-AC converter.

LIST OF EXPERIMENTS

1. PWM generation for Chopper Circuit using DSP
2. PWM generation for Four Quadrant Chopper Circuit using DSP
3. Triggering Circuit design for Half converter using digital controller
4. Triggering Circuit design for Full converter using digital controller
5. Pulse Generation scheme for cycloconverter using DSP
6. PWM Generation for Single phase inverter using PIC controller
7. PWM Generation for Three phase inverter using PIC controller
8. Sine PWM generation for Three phase Inverter using PIC controller
9. PWM generation using FPGA for Multilevel inverter.
10. 10.PLC based controller design for DC chopper.

Total Hours:60

COURSE OUTCOMES:

CO	Course Outcome	Bloom's Level
CO1	Generate PWM for chopper circuits. and Generate PWM using FPGA for inverters.	L5
CO2	Generate PWM for inverter circuits.	L5
CO3	Generate PWM for Rectifier circuits.	L6
CO4	Generate PWM using FPGA for inverters.	L5
CO5	Generate PWM for Cycloconverter circuits.	L6

COURSE ARTICULATION MATRIX:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1	1	2	3	-	-	-	2	-	-	-	-	-	-	-
CO2	1	2	3	-	-	-	-	-	-	2	-	-	-	-
CO3	1	2	3	-	-	-	-	-	-	2	-	-	-	-
CO4	1	2	3	-	-	-	-	-	-	2	-	-	-	-
CO5	1	2	3	-	-	-	-	-	-	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By
Name & Designation

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Date: DD/MM/YYYY

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE01	Subject Title	POWER ELECTRONICS FOR RENEWABLE ENERGY SOURCES
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To provide knowledge about different types of renewable energy systems.
2. To analyze the various electrical Generators used for the Wind Energy Conversion Systems.
3. To design a power converter used in renewable energy systems such as AC-DC, DC-DC,and AC-AC converters
4. To understand the importance of standalone, grid-connected, and hybrid operation Renewable energy systems.
5. To analyse various maximum power point tracking algorithms

Course Content:

[INTRODUCTION TO RENEWABLE ENERGY SOURCES] (09 Hours)

Classification of Energy Sources – Importance of Non-conventional energy sources– Advantages and disadvantages of conventional energy sources Environmental aspects of energy–Impacts of renewable energy generation on the environment – Qualitative study of renewable energy resources: Ocean energy, Biomass energy, Hydrogen energy, - Solar Photovoltaic (PV), Fuel cells: Operating principles and characteristics, Wind Energy: Nature of wind, Types, control strategy, operating area.

[FUEL CELL POWER ELECTRONICS FOR DISTRIBUTED GENERATION] (09 Hours)

Fuel cell - Working Principle - Distributed generation - Fuel cell based energy system for DG Power electronics topologies for residential stationary fuel cell energy systems - Issues in fuel cell power conditioning system - Energy management system issues - Auxiliary Storage Modelling of fuel cells, Power extraction for fuel cell, Stand alone fuel cell system with consumer/load .

[POWER CONVERTERS AND ANALYSIS OF SOLAR PV SOURCES] (09 Hours)

Power Converters: Line commutated converters (inversion-mode) – Boost and buck-boost converters- selection of inverter, battery sizing, array sizing. Analysis: Block diagram of the solar PV systems – Types of Solar PV systems: Stand-alone PV systems, Grid integrated solar PV Systems–Grid connection Issues.

[POWER CONVERTERS AND ANALYSIS OF WIND SOURCES] (09 Hours)

Power Converters: Three-phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid-Interactive Inverters – Matrix converter.

Analysis: Stand-alone operation of fixed and variable speed WECS-Grid integrated SCIG and PMSG based WECS**.**

[HYBRID RENEWABLE ENERGY SOURCES] (09 Hours)

Need for Hybrid Systems – Range and type of Hybrid systems – Case studies of Diesel - PV, Wind- PV, Micro hydel - PV, Biomass – Diesel systems–Maximum Power Point Tracking (MPPT).

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Analyze the impacts of renewable energy technologies on the environment and demonstrate them to harness electrical power.	L2
CO2	Select a suitable Electrical machine for Wind Energy Conversion Systems.	L3
CO3	Design the power converters such as AC-DC, DC DC and AC-AC converters for Solar energy systems.	L4
CO4	Design the power converters such as AC-DC, DC-DC, and AC-AC converters for Wind energy systems.	L5
CO5	Interpret the stand-alone, grid connected, and hybrid renewable energy systems with MPPT.	L3

Text Books:

1. S.N.Bhadra, D.Kastha,& S.Banerjee"WindElectricalSystems", Oxford University Press, 2009
2. Rashid. M.H"Power electronics Handbook", Academicpress,2ndEdition, 2006.

Reference Books:

1. Gray, L.Johnson,"Windenergysystem",prenticehallofindia,1995.
2. B.H.Khan"Non-conventional Energy sources", Tata McGraw-hill Publishing Company, New Delhi, 2017.
3. Rai.G.D,"Solar energy utilization", Kanna publishers, 5thEdition,2008.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	–	3	-	2	-	-	-	-	3	-	-
CO2	3	3	3	1	3	-	-	-	-	2	-	2	-	-
CO3	3	3	3	1	3	-	-	-	-	2	-	2	-	-
CO4	3	3	3	2	3	-	-	-	-	2	-	2	3	-
CO5	3	3	3	2	3	-	-	-	-	-	-	3	2	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlated

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE02	Subject Title	POWER SEMICONDUCTOR DEVICES
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To improve power semiconductor device structures for adjustable speed motor control

   Applications.

2. To understand the static and dynamic characteristics of current controlled power

   Semiconductor devices

3. To understand the static and dynamic characteristics of voltage controlled power

4. To enable the students for the selection of devices for different power electronics

5. To understand the control and firing circuit for different devices

Course Content:

[INTRODUCTION] (09 Hours)

Power switching devices overview – Attributes of an ideal switch ,application requirements, circuit symbols ; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching-Power diodes - Types, forward and reverse characteristics , switching characteristics – rating.

[CURRENT CONTROLLED DEVICES] (09 Hours)

BJT's – Construction, static characteristics, switching characteristics; Negative temperature coefficient and second breakdown; Thyristors – Physical and electrical principle under lying operating mode, Two transistor analogy – concept of latching; Gate and switching characteristics; converter grade and inverter grade and other types; series and parallel operation;comparisonofBJTandThyristor–steadystateanddynamicmodelsofBJT&Thyristor- Basics of GTO, MCT,FCT,RCT

[VOLTAGE CONTROLLED DEVICES] (09 Hours)

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - and IGCT. New semiconductor materials for devices – Intelligent power modules – Integrated gate commutated thyristor (IGCT) - GAN, SiC, IEGT- Comparison of all power devices.

[OTHER GATE CONTROLLED DEVICES] (09 Hours)

Necessity of isolation, pulse transformer, opto coupler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT- Overvoltage, over current and gate protections; Designof snubbers, GTO, MCT and other thyristors.

[THERMAL PROTECTION] (09 Hours)

Heat transfer – conduction, convection and radiation ; Cooling – liquid cooling ,vapour – phase cooling; Guidance for hear sink selection–Thermal resistance and impedance - Electrical analogy of thermal components ,heat sink types and design–Mounting types -switching loss calculation for power device**.**

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Determine the suitable device for the application.	L2
CO2	Design of semiconductor device and its parameters.	L5
CO3	Design of protection circuits.	L5
CO4	Design of firing and control circuit.	L5
CO5	Determine the reliability of the system.	L3

Text Books:

1. *B.W.Williams, "Power Electronics Circuit Devices and Applications".*
2. *Rashid M.H., "Power Electronics Circuits ,Devices and Applications", Prentice Hall India, Third Edition, New Delhi, 2004*
3. *MD Singhand K.B Khanchandani, "Power Electronics", Tata McGraw Hill, 2001.*

Reference Books:

1. *Mohan, Undeland and Robins, "Power Electronics–Concepts, applications and Design John Wiley and Sons, Singapore, 2000.*
2. *Joseph Vithayathil, "Power Electronics: Principles and Applications", Delhi, Tata McGraw - Hill, 2010.*
3. *Donald A.Neamen, "Semiconductor Physics and Devices", Tata McGraw Hill, New Delhi, Fourth Edition, 2012.*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	3	-	-	-	-	-	1	-	-	-	-	2	2
CO2	-	3	-	-	-	-	2					-	2	-
CO3	-	3	-	-		-	-	-	-	2	-	-	-	2
CO4	-	3	-	-	-	-	-	-	-	2	-	-	-	2
CO5	-	3	-	-	-	-	-	-	2	-	-	-	2	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE03	Subject Title	SOLAR AND ENERGY STORAGE SYSTEMS
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	01
Prerequisites			

Course Objectives:

1. To Study about solar modules and PV system design and their applications.
2. To Deal with Standalone PV System
3. To Deal with grid connected PV systems.
4. To Discuss about different energy storage systems.

Course Content:

[INTRODUCTION] (09 Hours)

Characteristics of sunlight–semiconductors and P-N junctions–behavior of solar cells–cell properties PV cell interconnection

[STANDALONE PV SYSTEM] (09 Hours)

Solar modules–storage systems–power conditioning and regulation-MPPT-protection– Standalone PV systems design–sizing

[GRID CONNECTED PV SYSTEMS] (09 Hours)

PV systems in buildings–design issues for central power stations–safety–Economic aspect – Efficiency and performance- International PV programs – Synchronization issues

[ENERGY STORAGE SYSTEMS] (09 Hours)

Impact of intermittent generation–Battery energy storage–solar thermal energy storage–Pumped hydro electric energy storage

[APPLICATIONS] (09 Hours)

Water pumping – battery chargers – solar car – direct-drive applications –Space Telecommunications

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Develop more knowledge on solar energy storage systems	L3
CO2	Develop basic knowledge on standalone PV system	L5
CO3	Understand the issues in grid connected PV systems	L2
CO4	Modeling of different energy storage systems and their performances	L4
CO5	Attain more knowledge on different applications of solar energy.	L2

Text Books:

1. *Solanki C.S., "Solar Photovoltaics: Fundamentals, Technologies And Applications", PHI Learning Pvt. Ltd., 2015.*

2. *Stuart R.Wenham, Martin A. Green, Muriel E. Watt and Richard Corkish, "Applied Photovoltaics", 2007, Earthscan, UK.*

3. *Eduardo Lorenzo G. Araujo, "Solar electricity engineering of photovoltaic systems", Progensa, 1994.*

Reference Books:

1. *Frank S. Barnes& Jonah G. Levine, "Large Energy storage Systems Handbook", CRC Press, 2011.*

2. *McNeils, Frenkel, Desai, "Solar & Wind Energy Technologies", Wiley Eastern, 1990*

3. *S.P.Sukhatme, "Solar Energy", Tata McGraw Hill, 1987*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	-	-	-	-	-	2	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	2	-	-	-	-
CO3	3	3	3	-	-	-	3	2	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	2	-	2	-
CO5	3	3	3	-	-	-	-	-	-	-	2	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE04	Subject Title	WIND ENERGY CONVERSION SYSTEMS
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To learn the design and control principles of Wind turbine.
2. To understand the concepts of fixed speed and variable speed, wind energy conversion
3. To analyze the grid integration issues.

Course Content:

[INTRODUCTION] (09 Hours)

Components of WECS - WECS schemes - Power obtained from wind - simple momentum theory- Power coefficient - Sabinin's theory - Aerodynamics of Wind turbine.

[WIND TURBINES] (09 Hours)

HAWT – VAWT - Power developed – Thrust – Efficiency - Rotor selection - Rotor design considerations - Tip speed ratio - No of Blades - Blade profile - Power Regulation - yaw control- Pitch angle control - stall control - Schemes for maximum power extraction.

[FIXED SPEED SYSTEMS] (09 Hours)

Generating Systems - Constant speed constant frequency systems - Choice of Generators - Deciding factors - Synchronous Generator - Squirrel Cage Induction Generator - Model of Wind Speed - Model wind turbine rotor - Drive Train model - Generator model for Steady state and Transient stability analysis.

[VARIABLE SPEED SYSTEMS] (09 Hours)

Need of variable speed systems – Power - wind speed characteristics - Variable speed constant frequency systems synchronous generator – DFIG – PMSG - Variable speed generators modelling - Variable speed variable frequency schemes**.**

[GRID CONNECTED SYSTEMS] (09 Hours)

Wind interconnection requirements – low-voltage ride through (LVRT) – ramp rate limitations, and supply of ancillary services for frequency and voltage control – current practices andindustry trends wind inter connection impact on steady-state and dynamic performance of the power system including modelling issue.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Acquire knowledge on the basic concepts of Wind energy conversion system.	L3
CO2	Understand the mathematical modelling and control of the Wind turbine	L2

CO3	Develop more understanding on the design of Fixed speed system	L5
CO4	Develop more understanding on the design of Variable speed system	L5
CO5	Learn about Grid integration issues and current practices of wind interconnections with power system.	L1

.**Reference Books:**

1. *L.L. Freris "Wind Energy conversion Systems", Prentice Hall,1990*
2. S.N.Bhadra*, D.Kastha, S.Banerjee, "Wind Electrical Sytems", Oxford University Press, 2010.*
3. *Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006*
4. *E.W.Golding "The generation of Electricity by wind power", Red wood bum Ltd., Trowbridge, 1976.*
5. N.Jenkins, "Wind Energy Technology" John Wiley & Sons, 1997.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	-	-	-	-	-	2	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	2	-	-	-	-
CO3	3	3	3	-	-	-	3	2	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	2	-	2	-
CO5	3	3	3	-	-	-	-	-	-	-	2	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	**25PEPE05**	**Subject Title**	**PWM CONVERTER AND APPLICATIONS**
Category	Professional Elective	**L-P-T-C**	3-0-0-3
Regulation	2025	**Semester**	
Prerequisites			

Course Objectives:

1. To understand the concepts and basic operation of PWM converters, including basic circuit Operation and design
2. To understand the steady-state and dynamic analysis of PWM converters along with the Applications like solid state drives and power quality.

Course Content:

[FUNDAMENTALS OF CONVERTERS] (09 Hours)

AC/DC and DC/AC power conversion – Overview of applications of voltage source converters and current source converters – Practical devices in converter – Calculation of switching and conduction power losses

[PWM TECHNIQUES] (09 Hours)

Pulse width modulation techniques for bridge converters–Bus clamping PWM–Space vector based PWM – Advanced PWM techniques.

[MODEL OF PWM CONVERTER] (09 Hours)

Compensation for dead time and DC voltage regulation - Dynamic model of PWM converter - Multilevel converters - Constant V/F induction motor drives.

[POWER FACTOR COMPENSATION] (09 Hours)

Estimation of current ripple and torque ripple in inverter fed drives – Line-side converters with power factor compensation.

[REACTIVE POWER AND HARMONICS COMPENSATION] (09 Hours)

Active power filtering – Reactive power compensation - Harmonic current compensation – Selective harmonic elimination – PWM technique for high power electric drives

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	**Course Outcome**	**Bloom's Level**
CO1	Design PWM converters.	L5
CO2	Analyse the PWM converters in steady-state conditions.	L4
CO3	Analyse the PWM converters in dynamic conditions.	L4
CO4	Analyse power converters with various PWM techniques for Steady-State.	L4

CO5	Analyse power converters with various PWM techniques for transient.	L4

.**Reference Books:**

1. *Mohan, Undeland and Robbins, "Power Electronics: Converters, Applications and Design", John"s Wiley and Sons*

.2. *Erickson RW, "Fundamentals of Power Electronics", Chapman and Hall.*

3. *Vithyathil. J, "Power Electronics: Principles and Applications", McGraw Hill.*

4. *Edison Roberto Cabral Da Silva,"Advanced Power Electronics Converter",Wiley.*

5. D.GrahameHolmesThomasA.Lipo,„PulseWidthModulationforPowerConverters"Wiley IEEE Press.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	-	-	-	-	-	2	-	-	-	-	3	-	-
CO2	-	-	-	-	-	-	-	-	2	-	-	-	2	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	2	-
CO4	-	-	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	-	-	-	2	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE06	Subject Title	SWITCHED MODE POWER CONVERTERS
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To understand different types of converters
2. To understand different switch mode topologies & control methods
3. To understand different resonant converter topologies.

Course Content:

[SMPS TOPOLOGIES] (09 Hours)

Buck, Boost, Buck-Boost SMPS Topologies – Basic Operation – Waveforms – modes of operation – switching stresses – Switching and conduction losses – Optimum switching frequency – Practical voltage, current and power limits – design relations – Voltage mode controlprinciples–Push-PullandForwardConverterTopologies–BasicOperation,Waveforms–Flux Imbalance Problem and Solutions

[FERRITE TRANSFORMERS] (09 Hours)

Transformer Design – Output Filter Design – Switching Stresses and Losses – Forward Converter Magnetics – Voltage Mode Control – Half and Full Bridge Converters – Basic Operation and Waveforms – Magnetics – Output Filter – Flux Imbalance – Switching Stresses and Losses – Power Limits – Voltage Mode Control.

[RESONANT CONVERTERS] (09 Hours)

Classification of Resonant Converters – Basic Resonant Circuit Concepts – Load Resonant Converter – Resonant Switch Converter – Zero Voltage Switching – Clamped Voltage Topologies – Resonant DC Link Inverters with Zero Voltage Switching – High Frequency Link Integral Half Cycle Converter – Fly back Converter – discontinuous mode operation, waveforms,control–Magnetics–SwitchingStressesandLosses,–Disadvantages–Continuous Mode Operation, waveforms, control, design relations**.**

[CONTROL OF SMPS] (09 Hours)

Voltage Mode Control of SMPS – Loop Gain and Stability Considerations – Error Amp– frequency Response and Transfer Function – Trans-conductance Current Mode Control of SMPS – Current Mode Control Advantages, Current Mode Vs Voltage Mode – Current Mode Deficiencies – Slope Compensation – Study of a typical Current Mode PWM Control IC - UC3842 – Modeling of SMPS – Small Signal Approximation – General Second Order Linear Equivalent Circuits – Study of popular PWM Control ICs (SG 3525,TL 494,MC34060 etc.)

[DC TRANSFORMER] (09 Hours)

DC Transformer – Voltage Mode SMPS Transfer Function – General Control Law Consideration - EMI Generation and Filtering in SMPS – Conducted and Radiated Emission Mechanisms in SMPS – Techniques to reduce Emissions – Control of Switching Loci –Shielding and Grounding Power Circuit Layout for minimum EMI – EMI Filtering at Input and Output – Effect of EMI Filter on SMPS Control Dynamics.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Acquire knowledge about the principles of operation of non-isolated hard-switched DC-DC converters.	L5
CO2	Acquire knowledge about the principles of operation of isolated hard-switched DC-DC converters.	L4
CO3	Acquire knowledge on various loss components in a switched mode converter	L4
CO4	Acquire knowledge on choice of switching frequency with a view towards design of such converters.	L4
CO5	Acquire knowledge about the principles of operation of DC Transformer.	L4

.**Reference Books:**

1. *Abraham I Pressman, "Switching Power Supply Design," McGraw Hill Publishing Company, 2001.*

2. *Daniel M Mitchell, "DC-DC Switching Regulator Analysis," McGraw Hill Publishing Company-1988.*

3. *Ned Mohan et.al, "Power Electronics," John Wiley and Sons 2006.*

4. *Marian K.Kazimierczuk Dariusz Czarkowski, "Resonant ower converters",Wiley.*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	-	-	-	2	-	-	-	-	3	-	-
CO2	3	2	-	-	-	-	-	2	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	2	-	3	-	-
CO4	3	-	2	-	-	-	-	-	-	2	-	3	-	-
CO5	3	-	2	-	-	-	-	2	-	-	-	3	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE07	Subject Title	MICRO GRID
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To illustrate the concept of distributed generation and its topologies.
2. To analyze the impact of grid integration
3. To study concept of micro grid and its configuration.
4. To understand various modes of operation and control of micro grid**.**

Course Content:

[INTRODUCTION] (09 Hours)

Conventional power generation: advantages and disadvantages, Energy crises, Non–conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro–turbines, biomass, and tidal sources.

[DISTRIBUTED GENERATIONS (DG)] (09 Hours)

Concept of distributed generations, topologies, selection of sources, regulatory standards/framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra–capacitors, flywheels. Captive power plants.

[IMPACT OF GRID INTEGRATION] (09 Hours)

Requirements for grid interconnection, limits on operational parameters: voltage, frequency,THD, response to grid abnormal operating conditions, islanding issues, Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues

[BASICS OF A MICROGRID] (09 Hours)

Concept and definition of Micro grid, Micro grid drivers and benefits, review of sources of Micro grids, typical structure and configuration of a Micro grid, AC and DC micro grids, Power Electronics interfaces in DC and AC Micro grids.

[CONTROL AND OPERATION OF MICROGRID] (09 Hours)

Modes of operation and control of Micro grid: grid connected and islanded mode, Active and reactive power control, protection issues, anti–islanding schemes: passive, active and communication–based techniques, Micro grid communication infrastructure, Power quality issues in Micro grids, regulatory standards, Micro grid economics, Introduction to smart Micro grids.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Understand the various conventional and non-conventional sources of electrical energy.	L5

CO2	Understand the various topologies, standards and energy storage elements of the distributed generations.	L2
CO3	Understand the grid integration, stability and power quality issues of distributed generations.	L3
CO4	Understand the different configurations and interfaces of the Microgrid.	L3
CO5	Understand the control of Microgrids and the concept of smart Microgrids	L2

Reference Books:

1. Amirnaser Yezdani, and Reza Iravani, 'Voltage Source Converters in Power Systems: Modeling, Control and Applications', IEEE John Wiley Publications, 2010.

2. Dorin Neacsu, 'Power Switching Converters: Medium and High Power', CRC Press, Taylor& Francis, 2006

3. Chetan Singh Solanki, 'Solar Photo Voltaics', PHI learning Pvt. Ltd., NewDelhi,2009

4. J.F. Manwell, J.G. McGowan, 'Wind Energy Explained, theory design and applications',Wiley publication2010.

5. D. D. Hall and R. P. Grover, 'Biomass Regenerable Energy', John Wiley, New York, 1987.

6. John Twidell and Tony Weir, 'Renewable Energy Resources' Taylor and Francis Publications, Second edition 2006.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	1	1	-	-	-	-	-	-	-	-	3	-
CO2	3	3	1	1	-	-	-	-	-	-	-	-	3	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	3	-
CO4	3	3	1	1	-	-	-	-	-	-	-	-	3	-
CO5	3	3	1	1	-	-	-	-	-	-	-	-	3	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE08	Subject Title	CONTROLLER DESIGN FOR POWER ELECTRONIC APPLICATIONS
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites	Microcontroller, Power Electronics, Analog Electronics, Digital Electronics and C Programming, Control Systems		

Course Objectives:

1. To enable students to design, implement and analyze controllers for power electronic systems

Course Content:

[POWER SUPPLY CONTROLLERS] (09 Hours)

Control loop stability – Small Signal Analysis – Circuit Transfer function – Type 1, Type 2, Type 3 compensator – Selection of compensator – Design using k-factor method – Pole zero placement method.

[CONTROLLER DESIGN USING TRANSFER FUNCTION] (09 Hours)

PI, PID control structures – Parameter Tuning - The Ziegler–Nichols Method - The Cohen–Coon Method - The Chien–Hrones–Reswick Method - Comparison of the PI, and PID Controllers -Lag–Lead Controller Structure - Lag–Lead Controller–PR Controller - Controller Design using software tools

[DISCRETIZATION PROCESS FOR DIGITAL SYNTHESIS] (09 Hours)

Interest of discretization - Discretization by invariance methods - Impulse invariance method - Step invariance method - Discretization by transformation methods - first-order Euler transformation - second-order Euler transformation – Tustin's transformation - Discretization by the transformation of pole(s) and zero(s) - z-Transfer functions of simple controllers.

[SYNTHESIS OF CONTROLLER IN C PROGRAM] (09 Hours)

z-domain to difference equation transformation - Implementation of controllers in difference equation form – Writing 'C' codes to implement controllers.

[APPLICATIONS TO POWER CONVERTERS] (09 Hours)

Introduction to C Compilers – XC and CCS - Design and closed loop control ofbasic DC-DC converters - Design and closed loop control of inverters - Design and closed loop control BLDC, PMSM.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Choose the correct controller for a specific application	L5
CO2	Design the controller parameters through an appropriate method	L2
CO3	Discretize the designed controller for digital implementation	L3

CO4	Develop the code for the chosen controller through mathematical process	L3
CO5	Apply the controller design process to control different converter and drives	L2

Reference Books:

1. D. Venable, “The K Factor: A New Mathematical Tool for Stability Analysis and Synthesis,” Proceedings Powercon 10, 1983.
2. Daniel Hart, “Power Electronics”, Tata-McGraw Hill,
3. Cem Ünsalan, Duygun E. Barkana and H. Deniz Gürhan, “Embedded Digital Control with Microcontrollers Implementation with C and Python”, Wiley, 2021.
4. Jean Mbihi, “Analog Automation and Digital Feedback Control Techniques”, Wiley, 2018.
5. Biswanath Samanta, “Introduction to Digital Control - An Integrated Approach”, Springer 2024.
6. Simone Buso and Paolo Mattavelli, “Digital Control in Power Electronics”, 2nd Edition, Morgan and Claypool, 2015.
7. Gregory Starr,“Introduction to Applied Digital Controls”, Springer Nature, 2020.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	-	1	1	-	-	-	-	1	-	-	-
CO2	3	2	3	-	2	1	-	-	-	-	1	-	-	-
CO3	2	1	3	-	3	1	-	-	-	-	1	-	-	-
CO4	1	1	2	3	3	2	-	-	-	-	1	-	-	-
CO5	2	3	3	-	2	2	-	-	-	-	1	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE09	Subject Title	DISTRIBUTED POWER GENERATION
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To illustrate the concept of distributed generation
2. To analyze the impact of grid integration.
3. To study concept of Micro grid and its configuration
4. To Understand and analyse of micro grid operations.

Course Content:

[MICROGRIDS] (09 Hours)

Introduction to micro-grids – Types of micro-grids: autonomous and non-autonomous grids Sizing of micro-grids – Modeling & analysis of Micro-grids with multiple DGs.

[GRID INTEGRATION OF DGS] (09 Hours)

Need for Distributed generation – Renewable sources in distributed generation and current scenario in Distributed Generation – Planning of DGs – Sitting and sizing of DGs optimal placement of DG sources in distribution systems – Grid integration of DGs – Different types of interfaces – Inverter based DGs and rotating machine based interfaces. – Aggregation of multiple DG units

[IMPACTS OF DGS IN POWER SYSTEM] (09 Hours)

Technical impacts of DGs – Transmission systems – Distribution Systems – De-regulation Impact of DGs upon protective relaying – Impact of DGs upon transient and dynamic stability of existing distribution systems – Steady-state and Dynamic analysis.

[ECONOMICS OF DG OPERATION] (09 Hours)

Economic and control aspects of DGs Market facts – Issues and challenges – Limitations of DGs, Voltage control techniques – Reactive power control – Harmonics – Power quality issues– Reliability of DG based systems.

[PROTECTION OF MICROGRID] (09 Hours)

Micro-grids with power electronic interfacing units – Transients in micro-grids – Protection of micro-grids – Case studies – Recent Trends in Micro grid.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Understand the planning and operational issues related to Distributed Generation.	L5
CO2	Understand integration related to Distributed Generation.	L2
CO3	Understand the impact of Distributed Generation in Power system.	L3

CO4	Understand economic operation related to Distributed Generation.	L3
CO5	Acquire Knowledge about Distributed Generation Learn Micro-Grids	L2

.**Reference Books:**

1. *H. Lee Willis, Walter G. Scott, "Distributed Power Generation – Planning and Evaluation", Marcel Decker Press.*
2. *M.GodoySimoes, Felix A.Farret, "Renewable Energy Systems – Design and Analysis with Induction Generators", CRC press.*
3. *Stuart Borlase. "Smart Grid: Infrastructure Technology Solutions" CRC Press*
4. *H.Lee WIillis Walter G.Scott," Distributed Power Generation", CRC Press.*
5. *Farhad Shahnia Ali Arefi Gerard Ledwidh Editors,"Electic Distribution Network*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	-	1	-	-	-	-	3
CO2	3	3	-	-	-	1	-	-	-	2	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	2	-	-	-
CO5	3	3	-	-	-	-	-	-	3	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE10	Subject Title	SMART GRID TECHNOLOGIES
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To understand concept of smart grid and its advantages over conventional grid.
2. To know smart metering techniques.
3. To learn wide area measurement techniques.
4. To understand the problems associated with integration of distributed generation & its Solution through smart grid.

Course Content:

[INTRODUCTION TO SMART GRID] (09 Hours)

Introduction to Smart Grid – Evolution of Electric Grid Concept of Smart Grid – Definitions, Need of Smart Grid Concept of Robust &Self-Healing Grid – Present development & International policies in Smart Grid

[SMART GRID AUTOMATION] (09 Hours)

Introduction to Smart Meters – Real Time Prizing – Smart Appliances – Automatic Meter Reading (AMR) – Outage Management System (OMS) – Plug in Hybrid Electric Vehicles(PHEV) – Vehicle to Grid – Smart Sensors – Home & Building Automation – Smart substations – Substation Automation – Feeder Automation

[SMART GRID TECHNOLOGIES] (09 Hours)

Geographic Information System (GIS) – Intelligent Electronic Devices (IED) & their application for monitoring & protection – Smart storage like Battery, SMES, Pumped Hydro – Compressed Air Energy Storage – Wide Area Measurement System (WAMS) – Phase Measurement Unit(PMU).

[POWER QUALITY IN SMART GRID] (09 Hours)

Power Quality & EMC in Smart Grid – Power Quality issues of Grid connected Renewable Energy

Sources – Power Quality Conditioners for Smart Grid – Web based Power Quality monitoring – Power Quality Audit

[COMMUNICATION IN SMART GRID] (09 Hours)

Advanced Metering Infrastructure (AMI) – Home Area Network (HAN) – Neighbourhood Area Network (NAN) – Wide Area Network (WAN) – Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication – Wireless Mesh Network. Basics of CLOUD Computing & Cyber Security for Smart Grid – Broadband over Power line (BPL) – IP based protocols

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Appreciate the difference between smart grid & conventional grid.	L2
CO2	Apply smart metering concepts to industrial and commercial installations.	L3
CO3	Formulate solutions in the areas of smart substations, distributed generation and wide area measurements.	L4
CO4	Analyze Power quality solutions in the areas of smart substations, distributed generation and wide area measurements	L3
CO5	Come up with smart grid solutions using modern communication technologies	L2

.**Reference Books:**

1. Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE,2011

2. Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press, 2009

3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, “Smart Grid: Technology and Applications”, Wiley 2012.

4. Stuart Borlas"e, “Smart Grid:Infrastructure, Technology and solutions “CRC Press.

5. A.G.Phadke , “Synchronized Phasor Measurement and their Applications”,Springer.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	1	-	-	-	2	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	2	-	-	-	-
CO3	3	3	1	1	-	-	-	-	-	-	2	-	-	-
CO4	3	3	1	-	-	-	-	-	-	-	1	-	2	-
CO5	3	3	1	-	-	-	-	1	-	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE11	Subject Title	SCADA SYSTEMS AND APPLICATIONS
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To understand what is meant by SCADA and its functions.
2. To know SCADA communication
3. To get an insight into its application.

Course Content:

[INTRODUCTION TO SCADA] (09 Hours)

Data acquisition systems, Evolution of SCADA, Communication technologies – Monitoring and supervisory functions – SCADA applications in Utility Automation – Industries SCADA

[INDUSTRIES SCADA SYSTEM COMPONENTS] (09 Hours)

Schemes – Remote Terminal Unit (RTU) – Intelligent Electronic Devices (IED) – Programmable Logic Controller (PLC) – Communication Network – SCADA Server – SCADA/HMI Systems

[SCADA ARCHITECTURE] (09 Hours)

Various SCADA architectures – advantages and disadvantages of each system – single unified standard architecture – IEC 61850.

[SCADA COMMUNICATION] (09 Hours)

Various industrial communication technologies – wired and wireless methods and fiber optics – Open standard communication protocols.

[SCADA APPLICATIONS] (09 Hours)

Utility applications – Transmission and Distribution sector – Operations, monitoring, analysis and improvement – Industries: Oil, gas and water – Case studies, Implementation, Simulation Exercises

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Describe the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications.	L2
CO2	Acquire knowledge about SCADA architecture, various advantages and disadvantages of each system.	L3
CO3	Knowledge about single unified standard architecture IEC 61850.	L4
CO4	To learn about SCADA system components: remote terminal units,	L3

	PLCs, intelligent electronic devices, HMI systems, SCADA server.	
CO5	Learn and understand about SCADA applications in transmission and distribution sector, industries etc.	L2

.**Reference Books:**

1. *Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, 2004.*
2. *Gordon Clarke, Deon Reynders: "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK,2004.*
3. *William T. Shaw, "Cybersecurity for SCADA systems", PennWell Books, 2006*
4. *David Bailey, Edwin Wright, "Practical SCADA for industry", Newnes, 2003.*
5. *Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", Penn Well 1999.*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	2	-	-	-	-	2	-	-	-	3	3	-
CO2	3	3	2	-	1	-	-	2	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	2	-	2	1	-
CO4	3	3	1	-	-	-	-	-	-		2	2	1	1
CO5	2	2	1	-	-	-	-	1	-	-	-	2	1	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	**25PEPE12**	**Subject Title**	**ENERGY STORAGE TECHNOLOGIES**
Category	Professional Elective	**L-P-T-C**	3-0-0-3
Regulation	2025	**Semester**	
Prerequisites			

Course Objectives:

1. To understand the various types of energy storage technologies and its applications.
2. To study the various modeling techniques of energy storage systems.
3. To learn working concepts and types of batteries.
4. To make the students to get understand the concepts of Hydrogen and Biogas storage.
5. To provide the insights on super capacitor, Fly wheel and compressed energy storage system

Course Content:

[INTRODUCTION] (09 Hours)

Necessity of energy storage– Scope of energy storage- types of energy storage–comparison of energy storage technologies– Applications.- Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles,

[THERMAL STORAGE SYSTEM] (09 Hours)

Thermal storage–Types–Modeling of thermal storage units–Simple water and rock bed storage system–pressurized water storage system– Phase change storage system – Modeling - organic and inorganic materials, efficiencies, –Packed bed storage units – Modeling using porous medium approach..

[ELECTROCHEMICAL ENERGY STORAGE] (09 Hours)

Fundamental concept of batteries–measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel– Cadmium, Zinc Manganese di oxide and modern batteries - zinc-Air, Nickel Hydride, Lithium Battery.

[HYDROGEN AND BIOGAS STORAGE] (09 Hours)

Hydrogen storage options–compressed gas–liquid hydrogen–Metal Hydrides, chemical Storage, Biogas storage - comparisons. Safety and management of hydrogen and Biogas storage - Applications

[ALTERNATE ENERGY STORAGE TECHNOLOGIES] (09 Hours)

Flywheel, Pumped hydro storage - Super capacitors, Superconducting magnetic energy storage (SMES)- Principles & Methods–Applications, Compressed air Energy storage, Fuel cell, Concept of Hybrid Storage – Applications.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Identify the energy storage technologies for suitable applications.	L2
CO2	Analyze the energy storage systems.	L3
CO3	Summarise the concepts and types of batteries.	L4
CO4	Examine the principle of operation of Hydrogen and Biogas storage systems.	L3
CO5	Explain the working of super capacitor, Flywheel and compressed energy storage systems	L2

.**Reference Books:**

1. *R Robert A. Huggins, Energy storage, Springer Science & Business Media (2010)*

2. *Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2010.*

3. *Luisa F.Cabeza, Advances in Thermal Energy Storage Systems: Methods and Applications, Elsevier Wood head Publishing, 2015.*

4. *Robert Huggins, Energy Storage: Fundamentals, Materials andApplications,2ndedition, Springer,2015.*

5. *Ru-shiliu, Leizhang, Xueliang sun, Electrochemical technologies for energy storage and conversion,,Wiley publications,2012*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	-	1	2	-	1	-	-	-	-	-	-	-	-
CO2	2	-	3	3	-	1	-	-	-	-	-	-	-	-
CO3	2	-	1	2	-	1	-	-	-	-	-	-	-	-
CO4	2	-	1	2	-	1	-	-	-	-	-	-	-	-
CO5	2	-	1	2	-	1	-	-	-	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE13	Subject Title	HVDC AND FACTS DEVICES
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To Summarize the different types of HVDC Transmission systems.
2. To Examine the control schemes for HVDC transmission systems.
3. To illustrate the power flow analysis of AC and DC systems
4. To classify different types of FACTS devices which are used in compensation of reactive power.
5. To Analyze the Static series and combined compensators.

Course Content:

[INTRODUCTION] (09 Hours)

Comparison of AC-DC transmission systems, application of DC transmission, types of DC links, typical layout of HVDC converter station. HVDC converters, pulse number, analysis of Gratez circuit with and without overlap, converter bridge characteristics, equivalent circuits or rectifier and inverter configurations of twelve pulse converters

[CONVERTER & HVDC SYSTEM CONTROL] (09 Hours)

Principles of DC Link control, converter control characteristics, system control hierarchy, firing angle control, current and excitation angle control, starting and stopping of DC Link.

[HARMONICS AND POWER FLOW ANALYSIS IN AC/DC SYSTEMS] (09 Hours)

Harmonics, Filters and Reactive power control: Introduction, generation of harmonics, AC and DC Filters, Reactive power Requirements in steady state, sources of reactive power, static VAR systems. Power flow analysis in AC/DC systems: Modeling of DC/AC converters, controller equations, solutions of AC/DC load flow, simultaneous method, Sequential method.

[INTRODUCTION TO FACTS] (09 Hours)

Introduction to FACTS: Flow of power in AC Parallel paths and meshed systems, basic types of FACTS controllers, brief description and definitions of FACTS controllers. Static shunt compensators: Objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators, SVC and STATCOM, comparison between SVC and STATCOM.

[STATIC AND COMBINED COMPENSATORS] (09 Hours)

Static Compensators: Objectives of Series compensation, Variable impedance type and thyristors switched series capacitors (TCSC), and switching converter type series compensators, static series synchronous compensator (SSSC), power angle characteristics, basic operating control schemes.

Combined Compensators: Introduction, unified power flow controller (UPFC), basic operating principle, independent real and reactive power flow controller, control structure.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Illustrate the layout of HVDC converter stations.	L3
CO2	Demonstrate the rectifier and inverter configurations of 12 pulse HVDC converter.	L2
CO3	Classify different FACTS controllers and their operation.	L3
CO4	Analyze the power flow in HVDC systems.	L4
CO5	Describe the converter control characteristics of HVDC systems.	L1

. **TEXTBOOKS:**

1. HVDC Transmission systems, S Kamakshaiah, V. Kamaraju, The Mc Graw Hill Companies.

2. Understanding FACTS, Concepts and Technology of Flexible AC Transmission systems, Narain. G.

Hingorani, Laszlo Gyugyi, IEEE press, Wiley India.

Reference Books:

1. HVDC and FACTS Controllers applications of static converters in power systems, Vijay K. sood,

Kluwer Accademic Publishers. 2015

2. HVDC Power transmission systems, K R Padiyar, New Age International.2020

3. Thyristor Basd Controllers for Electrical Transmission Systems, R. Mohan Mathur, Rajiv K. Varma.

Wiley India 2016.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	1	-	-	-	2	-	-	-	2	3	-
CO2	3	3	2	1	1	-	-	2	-	-	-	2	3	-
CO3	3	3	2	1	1	-	-	-	-	2	-	2	1	-
CO4	3	3	1	1	-	-	-	-	-		2	2	1	1
CO5	2	2	1	1	-	-	-	1	-	-	-	2	1	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE14	Subject Title	ELECTRO MAGNETIC INTERFERENCE AND COMPATIBILITY
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To define EMI Environment, Coupling principles, Different sources Mitigation Techniques
2. To describe the Electromagnetic emissions and distinguish EMI radiation and conduction coupling
3. To impart knowledge on the Grounding, Cabling, Shielding, Bonding mechanisms for EMC
4. To describe the Characteristics of EMI filters and components for EMI/EMC standards

Course Content:

[INTRODUCTION] (09 Hours)

Introduction to EMI and EMC, Sources of EMI, Conducted and Radiated EMI emission and susceptibility, Radiation hazards to humans, EMC Testing categories, Practical experiences and concerns, frequency spectrum conservations, Mechanisms of EMI generation, EMI Testing and Measurement, Methods of mitigation of EMI and Biological effects of EMI.

[EMI FROM APPARATUS / CIRCUITS] (09 Hours)

Introduction, Electromagnetic Emissions, Noise from relays and Switches, Nonlinearities in Circuits, Passive Inter modulation, Cross-Talk in Transmission lines, Transients in Power Supply Lines calculation of induced Voltages and Currents, Surges on Mains Power Supply,EMI- Radiation coupling, Conduction coupling, Combination of both Radiation and Conduction coupling**.**

[CONDUCTED INTERFERENCE MEASUREMENTS] (09 Hours)

Introduction, Characterization of Currents / Voltages, Common-Mode and Differential-Mode Interferences-examples, Conducted EMI Noise on Power Supply Lines-Transients on power Supply Lines, Propagation of surges in Low Voltage AC lines, Conducted EMI from equipment and Apparatus-Instrumentation for Measuring the Conducted EMI, Measurement of CM and DM Interferences, Immunity to Conducted EMI. Power Supplies - Linear Power Supplies - Switched-Mode Power Supplies (SMPS)- Effect of Power Supply Components on Conducted Emissions- Power Supply and Filter Placement-Conducted Susceptibility**.**

[GROUNDING, CABLING, SHIELDING AND BONDING] (09 Hours)

Safety and signal grounds, low and high frequency grounding methods, grounding of amplifiers and cable shields, isolation, neutralizing transformers, shield grounding at high frequencies, digital grounding. Types of cables, Mechanism of EMI emission / Coupling in cables. Shielding Effectiveness, near and far fields / impedances sources, methods of analysis, total loss due to absorption and reflection effects, composite absorption and reflection losses for electric fields / magnetic fields, Low frequency magnetic shielding, Effect of Apertures. Electrical Characteristics of good bonds.

[EMI FILTERS AND EMI/EMC STANDARDS] (09 Hours)

Introduction, Characteristics of various filters – Impedance Mismatch Effects-Lumped Element Low-Pass Filters, High-Pass Filters, Band-Pass Filters, Band-reject Filters, PowerLine Filter design-Common-Mode Filter, Differential-Mode filter, Combined CM and DM filter. Components for EMC and EMC Standards - Choice of capacitors, inductors, transformers and resistors, EMC design components, National / International EMC standards

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Analyse the transients in power supply lines	L4
CO2	Describe the Conducted Interference measurements.	L2
CO3	Describe the Grounding, Cabling, Shielding, Bonding mechanisms for EMC	L2
CO4	Analyse the effect of power supply components on Conducted emissions.	L4
CO5	Design various EMI filters	L4

. **TEXTBOOKS:**

1. Dr. V.P. Kodaly, Engineering Electromagnetic Compatibility, IEEE Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.

2. Henry W. Ott, Electromagnetic Compatibility Engineering, John Wiley & Sons Inc, New York, 2009

3. Clayton R.Paul, Introduction to electromagnetic compatibility, John Wiley and Sons, Inc. 1991.

Reference Books:

1. *Daryl Gerke and William Kimmel, EDN's Designer's Guide to Electromagnetic Compatibility, Elsevier Science & Technology Books, 2002.*

2. *Dr Kenneth L Kaiser, The Electromagnetic Compatibility Handbook, CRC Press, 2005.*

3. Bernhard Keiser, Principles of Electromagnetic Compatibility, 3rd Edition, Artech house, 1986

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	3	2	1	-	-	-	2	-	-	-	2	3	-
CO2	3	3	2	1	1	-	-	2	-	-	-	2	3	-
CO3	3	3	2	1	1	-	-	-	-	2	-	2	1	-
CO4	3	3	1	1	-	-	-	-	-		2	2	1	1
CO5	2	2	1	1	-	-	-	1	-	-	-	2	1	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE15	Subject Title	ELECTRIC VEHICLES AND POWER MANAGEMENT
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To define EMI Environment, Coupling principles, Different sources Mitigation Techniques
2. To describe the Electromagnetic emissions and distinguish EMI radiation and conduction coupling
3. To impart knowledge on the Grounding, Cabling, Shielding, Bonding mechanisms for EMC
4. To describe the Characteristics of EMI filters and components for EMI/EMC standards

Course Content:

[ELECTRIC VEHICLES AND VEHICLE MECHANICS] (09 Hours)

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings, Comparisons of EV with Internal combustion Engine vehicles, Fundamentals of vehicle mechanics

[ARCHITECTURE OF EV's AND POWER TRAIN COMPONENT] (09 Hours)

Architecture of EV's and HEV's – Plug-n Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears,Clutches,Transmission and Brakes**.**

[CONTROL OF DC AND AC DRIVES] (09 Hours)

DC/DC chopper based four quadrant operations of DC drives– Inverter based V/f Operation (motoring and braking) of induction motor drive system–Induction motor and permanent motor based vector control operation– Switched reluctance motor (SRM) drives.

[BATTERY ENERGY STORAGE SYSTEM] (09 Hours)

Battery Basics,Different types, Battery Parameters, Battery modelling, Traction Batteries.

[ALTERNATIVE ENERGY STORAGE SYSTEMS] (09 Hours)

Fuel cell–Characteristics-Types–hydrogen Storage Systems and Fuel cell EV–Ultra capacitors.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Study the Fundamentals of vehicle mechanics and architect of electric vehicles.	L3
CO2	To provide knowledge about various possible battery energy storage technologies that can be used in electric vehicles	L1
CO3	understand the usage of various alternative energy storage system	L2

. **Reference Books:**

1. *Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Second Edition"CRC Press,Taylor& Francis Group,Second Edition(2011).*

2. *Ali Emadi,Mehrdad Ehsani,JohnM.Miller,"VehicularElectric PowerSystems",Special Indian Edition, Marcel dekker, Inc2010.*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	2	2	1	-	-	-	2	-	-	-	3	2	-
CO2	3	2	2	1	=	-	-	2	-	-	-	3	3	-
CO3	3	2	2	1	-	-	-	-	-	2	-	2	1	-
CO4	3	3	1	1	-	-	-	-	-		2	2	1	1
CO5	2	2	1	1	-	-	-	1	-	-	-	2	1	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25PEPE16	Subject Title	ADVANCED POWER CONVERTERS
Category	Professional Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To study the operation of voltage lift circuits
2. To impart knowledge on the working of super lift circuits
3. To learn the operation of ultra lift converters and multiple quadrant converters.
4. To provide knowledge on the principle of bidirectional dual active bridge converters
5. To educate on the working principle of Impedance source converter

Course Content:

[VOLTAGE-LIFT CONVERTERS] (09 Hours)

Introduction- Self-lift and reverse self-lift circuits- Cuk converter, Luo converter and SEPIC converter- continuous and discontinuous conduction mode.-Applications

[POSITIVE OUTPUT &NEGATIVE OUTPUT SUPER-LIFT LUO CONVERTERS] (09 Hours)

Main series, -Elementary Circuit, Re-Lift Circuit, Triple-Lift Circuit, Higher-Order Lift Circuit-. Continuous and discontinuous conduction modes- Applications

[ULTRA LIFT CONVERTERS AND MULTIPLE-QUADRANT OPERATING LUO-CONVERTERS] (09 Hours)

Ultra-Lift Luo - Converter- Operation – Continuous and discontinuous conduction Modes of Ultra Lift Luo-Converter-Instantaneous Values- Multiple quadrant operating Luo Converters - Circuit explanations-Modes of operation- Applications

[BIDIRECTIONAL DUAL ACTIVE BRIDGE DC–DC CONVERTERS] (09 Hours)

Application of Bidirectional DC–DC Converter- Classification of Bidirectional DC–DC Converter – Working Principle of Hybrid-Bridge-Based Dual active bridge (DAB) converter- Performance Voltage mode control- Principle of Dual-Transformer based DAB converter- Three-Level bidirectional DC–DC converter- Applications

[IMPEDANCE SOURCE CONVERTER] (09 Hours)

Voltage Fed Z-source inverters – Topologies –Steady state and dynamic model- Current fed Z-source inverter –Topology –Modification and operational principles. Modulation Methods- Sine PWM-SVPWM and Pulse width Amplitude Modulation- Applications

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Understand the working of voltage lift circuits	L2
CO2	Design the super lift converters	L4
CO3	Understand the working and applications of ultra-lift converters	L2
CO4	*Acquire knowledge on working and design of bi-directional DC-DC converters*	L1
CO5	Understand the concepts related with impedance source converter	L2

TEXT BOOKS:

1. *Fang Lin Luo, Hong Ye "Advanced DC/DC Converters", Second Edition, CRC press,2018*

2. Yushan Liu , Haitham Abu- Rub , BaomingGe , Dr. FredeBlaabjerg , Omar Ellabban , Poh Chiang Loh, "Impedance source power electronic converters", Wiley IEEE Press, 2016

3. DeshangSha,GuoXu, "High-Frequency Isolated Bidirectional Dual Active Bridge DC–DC Converters with Wide Voltage Gain", Springer 2019.

Reference Books:

1. *Fang Lin Luo, Hong Ye, "Essential DC/DC Converters", First Edition, CRC,2005*

2. Fang Lin Luo, Hong Ye, "Power Electronics Advanced Conversion Technologies", Second Edition,

2018 CRC press .

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	-	2	3	2	1	-	-	-	-	-	-	-	-
CO2	2	-	2	3	2	1	-	-	-	-	-	-	-	-
CO3	2	-	2	3	2	1	-	-	-	-	-	-	-	-
CO4	2	-	2	3	2	1	-	-	-	-	-	-	-	-
CO5	2	-	2	3	2	1	-	-	-	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlatio

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	22PEOE01	Subject Title	WASTE TO ENERGY
Category	Open Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To study the various types of wastes
2. To study the pyrolysis, gasification and combustion process of biomass
3. To study the properties, features, and applications of biogas.

Course Content:

[INTRODUCTION TO ENERGY FROM WASTE] (09 Hours)

Classification of waste as fuel – Agro based, Forest residue, Industrial waste – MSW – Conversion devices – Incinerators, gasifiers, digestors

[BIOMASS PYROLYSIS] (09 Hours)

Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gases, yields and applications**.**

[BIOMASS GASIFICATION] (09 Hours)

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation **–** Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

[BIOMASS COMBUSTION] (09 Hours)

Biomass stoves – Improved chullahs, types, some exotic designs – Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, – Design, construction and operation Operation of all the above biomass combustors.

[BIOGAS] (09 Hours)

Properties of biogas (Calorific value and composition) – Biogas plant technology and status – Bio energy system – Design and constructional features – Biomass resources and their classification – Biomass conversion processes – Thermo chemical conversion – Direct combustion – biomass gasification – Pyrolysis and liquefaction – biochemical conversion – anaerobic digestion – Types of biogas Plants–Applications–Alcohol production from biomass–Biodiesel production–Urban waste to energy conversion – Biomass energy programme in India.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Explain the types of wastes and its applications in energy conversion	L2
CO2	Apply pyrolysis, combustion, gasification process of biomass to produce energy	L4

CO3	Apply the biogases to produce energy and other manufacturing process.	L2

Reference Books:

1. *Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.*

2. *Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.*

3. *Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991*

4. *Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.*

5. Stehik,Petr, "up-to-date-waste to Energy Approach "Springer.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	2	-	-	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	2	-	-	1	-	-
CO3	-	2	-	-	-	-	-	1	-	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	22PEOE02	Subject Title	MACHINE LEARNING AND AUTOMATION
Category	Open Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To understand the need for machine learning for various problem solving
2. To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
3. To understand the latest trends in machine learning
4. To design appropriate machine learning algorithms for problem solving.

Course Content:

[INTRODUCTION] (09 Hours)

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

[NEURAL NETWORKS AND GENETIC ALGORITHMS] (09 Hours)

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

[BAYESIAN AND COMPUTATIONAL LEARNING] (09 Hours)

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model

[INSTANT BASED LEARNING] (09 Hours)

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – CaseBased Learning.

[ADVANCED LEARNING] (09 Hours)

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Differentiate between supervised, unsupervised, semi-supervised machine learning approaches	L2
CO2	Discuss the decision tree algorithm and indentity and overcome the problem of overfitting	L2
CO3	Discuss and apply the back propagation algorithm and genetic algorithms to various problems	L2
CO4	Apply the Bayesian concepts to machine learning	L3
CO5	Analyse and suggest appropriate machine learning approaches for various types of problems	L4

Reference Books:

1. *Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.*
2. *Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.*
3. *Stephen Marsland, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.*
4. *Carlos Puerto – Santana, "Industrial Applications of Machine Learning", CRC Press.*
5. *Tom M.Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	2	-	2	1	2	-	2	-	-	3	-
CO2	-	3	2	-	-	-	-	2	2	-	-	3	-	-
CO3	-	2	-	-	-	-	-	1	2	-	-	3	-	-
CO4	-	-	-	-	3	-	-	-	-	2	-	3	-	-
CO5	3	2	-	-	-	-	-	-	-	2	-	-	-	3

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	22PEOE03	Subject Title	SOFTWARE FOR CIRCUIT SIMULATION
Category	Open Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To provide Knowledge about power electronic components.
2. To analyse various algorithms in power electronics systems
3. To analyse DC and AC circuits
4. To provide student hand-on experience on MATLAB to implement various strategies.

Course Content:

[INTRODUCTION] (09 Hours)

Importance of simulation – General purpose circuit analysis – programs – Method of analysis of power electronic systems– Review of modeling of power electronic components and systems.

[ADVANCED TECHNIQUES IN SIMULATION] (09 Hours)

Analysis of power electronic systems in a sequential manner coupled and decoupled systems– Various algorithms for computing steady state solution in power electronic systems–Future trends in computer simulation

[PSPICE] (09 Hours)

Introduction – Pspice overview – DC circuit Analysis – AC circuit analysis – Transient and the time domain – Fourier Series and Harmonic components – An introduction to Pspice device**s** BJT,FET, MOSFET and is model–Amplifiers and Oscillators–Nor linear Devices.

[MATLAB] (09 Hours)

Introduction – function description – Data types–Tool boxes–Graphical Display: Import and Export of data– Programs for solution of state equations

[SIMULINK] (09 Hours)

Introduction–Graphical user Interface–Selection of objects–Blocks–lines Simulation- Application programs.

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Acquire Knowledge about the simulation of Power Electronics Devices.	L1
CO2	Learn Various advance techniques in Simulation.	L2
CO3	Learn about DC and AC circuits analysis using Pspice.	L2

CO4	Learn about DC and AC circuits analysis using Matlab.	L4
CO5	Acquire Knowledge about Graphical user Interface	L1

Reference Books:

1. *Rajagopalan .V „Computer aided analysis of power electronic systems" Marcell Dekker1987.*
2. *John Keown „Microsim Pspice and circuit analysis" Prentice hall Inc, 1998.*
3.*Orcad Pspice User manual,Orcad Corporation, 2006.*
4. *Matlab /Simulinkmanual,MathsWork2007.*
5. *Adrian Loinovici, "Computer Aided analysis of Active circuits".*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	2	-	-	-	2	-	1	2	3	-	-
CO2	3	3	-	2	-	-	-	-	2	1	2	3	-	-
CO3	3	3	3	2	-	-	-	3	-	2	2	3	-	-
CO4	3	3	3	2	-	-	-	3	-	2	2	3	-	-
CO5	3	3	-	2	-	-	-	-	-	2	2	3	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	22PEOE04	Subject Title	POWER ELECTRONICS FOR SOLAR PHOTOVOLTAIC SYSTEMS
Category	Professional Core/Elective/Open elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To understand PV cell and its characteristics.
2. To estimate Sun's Solar Energy
3. To understand Battery and its Application for PV.
4. To study different Power converters for Solar PV.
5. To know the applications of solar PV

Course Content:

[THE PV CELL AND CHARACTERISTICS] (09 Hours)

A historical perspective, PV cell characteristics and equivalent circuit, Model of PV cell, Short Circuit, Open Circuit and peak power parameters, Datasheet study, Cell efficiency, Effect of temperature, Temperature effect calculation example, Fill factor, PV cell simulation. Identical cells in series, Load line, Non-identical cells in series, protecting cells in series, interconnecting modules in series, Simulation of cells in series, identical cells in parallel, Non-identical cells in parallel, protecting cells in parallel, interconnecting modules in parallel, Simulation of cells in parallel, Measuring I-V characteristics.

[SUN INCIDENT ENERGY ESTIMATION] (09 Hours)

Insolation and irradiance, Insolation variation with time of day, Earth centric viewpoint and declination, solar geometry, Insolation on a horizontal flat plate, Energy on a horizontal flat plate, Sunrise and sunset hour angles. Energy on a tilted flat pla**te,** Atmospheric effects, Air Mass, Energy with atmospheric effects, Clearness index.

[BATTERY FOR PV] (09 Hours)

Sizing PV for applications without batteries, Batteries - Capacity, C-rate, Efficiency, Energy and power densities, Battery selection, other energy storage methods, Direct PV-battery connection, Charge controller, Battery charger - Understanding current control, slope compensation, Batteries in series - charge equalization, Batteries in parallel

[POWER ELECTRONICS IN PV] (09 Hours)

PV system design, Load profile, Days of autonomy and recharge, Battery size, PV array size.MPPT concept, Input impedance of DC-DC converters -Boost converter, Buck converter,

Buck-Boost converter - PV and DC-DC interface.Impedance control methods, Reference cell, Sampling method, Power slope methods, Hill climbing method.

[PV APPLICATIONS] (09 Hours)

Solar home lighting systems – Solar street lighting systems - Solar lanterns – Applications - Rural electrification process -Water pumping principle, Hydraulic energy and power, Total dynamic

head, Numerical solution - Colebrook formula, Centrifugal pump, Reciprocating pump, PV power, Pumped hydro application

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level
CO1	Learn about the solar PV systems.	L3
CO2	Analyze of the estimation of solar energy from Sun.	L4
CO3	Learn about Batteries for PV systems.	L2
CO4	Acquire knowledge about the power electronics in PV system.	L3
CO5	Acquire knowledge about PV Applications.	L1

Reference Books:

1. Chenming, H. *and White, R.M., Solar Cells from B to Advanced Systems, McGraw Hill Book Co, 1983*
2. *Ruschenbach, HS, Solar Cell Array Design Hand Varmostrand, Reinhold, NY, 1980.*
3. *HP Garg and J Prakash: Solar Energy: Fundamentals and Applications, Tata McGraw Hill, 2010*
4. *Martin A. Green, Solar Cells Operating Principles, Technology, and System Applications Prentice- Hall, 2008.*
5. *Rai, G.D., Solar Energy Utilization, Khanna Publishers,Delhi, 2010.*
6. *Rashid .M. H "power electronics Hand book", Academic press, 2007.*
7. *Electrochemical technologies for energy storage and conversion, Ru-shiliu, Leizhang, Xueliang sun, Wiley publications, 2012.*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	-	2	-	-	-	2	-	-	2	3	3	-
CO2	3	2	-	2	-	-	-	1	-	-	-	3	3	-
CO3	-	2	-	-	-	-	-	1	-	-	-	3	3	-
CO4	3	1	-	-	-	-	-	1	-	-	2	3	3	-

CO5	3	1	-	-	-	-	-	2	-	-	3	3	3	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	22PEOE05	Subject Title	INTRODUCTION TO ELECTRIC VEHICLES
Category	Open Elective	L-P-T-C	3-0-0-3
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To Understand basics of Electric Vehicles
2. To Understand different Electric drive motors.
3. To Know about Energy storage methods.
4. To design drive system
5. To understand management of electrical energy in Electric vehicles

Course Content:

[INTRODUCTION] (09 Hours)

History electric vehicles, social and environmental importance of electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

[ELECTRIC DRIVES] (09 Hours)

Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

[ENERGY STORAGE] (09 Hours)

Introduction to Energy Storage Requirements in Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Fly wheel based energy storage and its analysis, Hybridization of different energy storage devices.

[DESIGN OF ELECTRIC DRIVE] (**09 Hours**)

Matching the electric machine, Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems.

[ENERGY MANAGEMENT AND STRATEGIES] (09 Hours)

Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies.

Case Studies: Design of a Battery Electric Vehicle (BEV).

Total Hours: 45

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom's Level

CO1	Understand the operation of Electric Vehicles	L2
CO2	Acquire Knowledge on various Energy storage technologies for Electric Vehicles	L1
CO3	Learn about the need for energy vehicles.	L3
CO4	Understand energy storage systems in EV	L2
CO5	Understand the concept of Energy Management.	L2

Reference Books:

1. *Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.*
2. *Electric and Hybrid Vehicles" by Tom Denton Taylor and Francis , 2016..*
3. *MehrdadEhsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.*
4. *James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.*
5. *"Build Your Own Electric Vehicle" by Seth Leitman and Bob Brant Mccraw Hills – MCGRA 2nd Edition, 2013*
6. *"Introduction to Hybrid Vehicle System Modeling and Control" by Wei Liu John Willy & Sons.*
7. *"Advanced Electric Drive Vehicles (Energy, Power Electronics, and Machines)" by Ali Emadi CRC Press, 2015.*

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO1	3	3	-	2	-	-	- 3	2	-	2	-	-	3	-
CO2	3	2	-	-	-	-	-	-	2	2	-	1	3	2
CO3	3	2	-	-	-	-	3	1	-	2	-	-	3	-
CO4	3	2	-	-	-	-	-	-	-	1	-	-	3	2
CO5	3	3	-	-	-	-	2	-	-	2	-	-	3	1

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

lSubject Code	25ZAC001	Subject Title	DISASTER MANAGEMENT
Category	Audit Course	**L-P-T-C**	2-0-0-0
Regulation	2025	**Semester**	I
Prerequisites			

Course Objectives:

1. To understand various disasters, hazards and its effects.
2. To monitor and manage the disasters.
3. To prepare risk assessment report.
4. To understand the various methods to mitigate the disasters.

Course Content:

[INTRODUCTION TO DISASTERS] (6 Hours)

Disaster: Definition, factors and significance – Difference between hazard and disaster Natural and manmade disasters: Difference, nature, types and magnitude – Study of seismic zones – Areas prone to floods and droughts – Landslides and avalanches – Areas prone to cyclonic and coastal hazards with special reference to tsunami – Post-disaster diseases and epidemics

[REPERCUSSIONS OF DISASTERS AND HAZARDS] (6 Hours)

Economic damage – Loss of human and animal life – Destruction of ecosystem – Natural disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches – Man-made disaster: Nuclear reactor meltdown, Industrial accidents, Oil slicks and spills, Outbreaks of disease and Epidemics, War and conflicts.

[DISASTER PREPAREDNESS AND MANAGEMENT] (6 Hours)

Preparedness – Monitoring of phenomena triggering a disaster or hazard – Evaluation of risk: application of remote sensing – Data from Meteorological and other agencies – Media reports: Governmental and Community preparedness.

[RISK ASSESSMENT](6 Hours)

Disaster risk: Concept and elements – Disaster risk reduction – Global and National disaster risk situation – Techniques of risk assessment – Global co- operation in risk assessment and warning – People's participation in risk assessment – Strategies for survival.

[DISASTER MITIGATION] (6 Hours)

Meaning – Concept and strategies of disaster mitigation – Emerging trends in mitigation – Structural mitigation and Non-structural mitigation –Programs of disaster mitigation in India.

Total Hours: 30

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom'sLevel
CO 1	Demonstrateacriticalunderstandingofkeyconceptsindisasterriskreductionand humanitarian response.	L1
CO 2	Evaluatedisasterriskreductionandhumanitarianresponsepolicyandpractic e from multiple perspectives.	L5

CO 3	Developanunderstandingofstandardsofhumanitarianresponseandpracticalrelevance in specific types of disasters and conflict situations.	L2
CO 4	Understandthestrengthsandweaknessesofdisastermanagementapproaches,planningand programming in different countries, particularly their home country or the countries they work in	L2

Text Books:

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies” New Royal book Company.

2. Sahni, PardeepEt.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.

3.Goel S. L. , Disaster Administration And Management Text And Case Studies” ,Deep &Deep Publication Pvt. Ltd., New Delhi.

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	-	-	2	-	-	-	2	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	2	-	-	-	-	-
CO3	-	2	-	-	-	-	-	1	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By

Name & Designation

BOS Approval

Date: DD/MM/YYYY

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25ZAC002	Subject Title	ENGLISH FOR RESEARCH PAPER WRITING
Category	Audit Course	L-P-T-C	2-0-0-0
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1.Understand that how to improve your writing skills and level of readability.

2.Learn about what to write in each section

3.Understand the skills needed when writing a Title

4.Ensure the good quality of paper at very first-time submission.

Course Content:

[PLANNING AND PREPARATION] (6-Hours)

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

[RESEARCH FINDINGS] (6-Hours)

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising,Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

[LITERATURE REVIEW] (6-Hours)

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

[PAPER WRITING SKILLS-I] (6-Hours)

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

[PAPER WRITING SKILLS-II] (6-Hours)

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions usefulphrases, how to ensure paper is as good as it could possibly be the first- time submission

Total Hours: 30

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom'sLevel
CO1	Write the technical report, research proposal without grammatical errors,.	*L1*
CO2	Write the literature review on specific research topic	*L2*
CO3	Write the research paper for the proposal	*L2*

Text Books:

1.Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2.Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3.*HighmanN(1998),HandbookofWritingfortheMathematicalSciences,SIAM.Highman"s book .*

4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011Reference Books:

Course Articulation matrix:

CO	Program Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	1	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By

Name & Designation

BOS Approval

Date: DD/MM/YYYY

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25ZAC003	Subject Title	VALUE EDUCATION
Category		L-P-T-C	2-0-0-0
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

1. To understand value of education and self- development
2. To Imbibe good values in students
3. To know about the importance of character

Course Content:

[ETHICS] (6-Hours)

Values and self-development – Social values and individual attitudes. Work ethics, Indian vision of humanism.Moral and non- moral valuation. Standards and principles. Value judgments

[ELEMENTS OF VALUE EDUCATION] (6-Hours)

Importance of cultivation of values.Sense of duty. Devotion, Self-reliance. Confidence, Concentration.Truthfulness, Cleanliness.Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature.

[PERSONALITY DEVELOPMENT] (6-Hours)

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking.Integrity and discipline.

[DIFFERENT VALUES] (6-Hours)

Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour.Universal brotherhood and religious tolerance.True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits.Association and Cooperation. Doing best for saving nature

[CHARACTER AND COMPETENCE] (6-Hours)

Character and Competence –Holy books vs Blind faith.Self-management and Good health.Science of reincarnation. Equality, Nonviolence, Humility, Role of Women.All religions andsame message. Mind your Mind, Self-control. Honesty, Studying effectively

Total Hours: 30

Upon successful completion of this course, students will be able to:

CO	Course Outcome	Bloom'sLevel
CO1	Acquire the knowledge of self-development	L1
CO2	Learn the importance of Human values	L1
CO3	Develop the overall personality	L5

Text Books:

1.Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By

Name & Designation

BOS Approval

Date: DD/MM/YYYY

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25ZAC004	Subject Title	PEDAGOGY STUDIES
Category		L-P-T-C	2-0-0-0
Regulation	2025	Semester	
Prerequisites			

Course Objectives:

3. To Review existing evidence on the review topic to inform programme design and policy making undertaken by the HRD, other agencies and researchers.
4. To identify critical evidence gaps to guide the development.

Course Content:

[INTRODUCTION AND METHODOLOGY](6-Hours)

Aims and rationale – Policy background – Conceptual framework and terminology – Theories of learning, Curriculum, Teacher education – Conceptual framework – Research questions. –Overview of methodology and Searching

[THEMATIC OVERVIEW] (6-Hours)

Pedagogi calpracticesarebeing used by teacher's informal and informal class rooms in developing countries. – Curriculum – Teacher education.

[EVIDENCE ON THE EFFECTIVENESS OFPEDAGOGICAL PRACTICES] (6-Hours)

Evidence on the effectiveness of pedagogical practices – Methodology for the in depth stage: quality assessment of included studies – How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? – Theory of change – Strength and nature of the body of evidence for effective pedagogical practices –Pedagogic theory and pedagogical approaches –Teachers' attitudes and beliefs and Pedagogic strategies.

[PROFESSIONAL DEVELOPMENT] (6-Hours)

Alignment with classroom practices and followsup support – Peer support – Support from the head teacher and the community – Curriculum and assessment – Barriers to learning: limitedresources and large class sizes

[RESEARCH GAPS AND FUTURE DIRECTIONS] (6-Hours)

Research design – Contexts – Pedagogy – Teacher education – Curriculum and assessment – Dissemination and research impact.

Total Hours: 30

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Understand the pedagogical practices are being used by teachers in formal and informal classrooms in developing countries	L2
CO2	Understand the evidence on the effectiveness of pedagogical practices.	L2
CO3	Understand the teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.	L2

Text Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learningof basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, „learning to read" campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	1	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By
Name & Designation

BOS Approval
Date: DD/MM/YYYY

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25ZAC005	Subject Title	STRESS MANAGEMENT BY YOGA
Category		L-P-T-C	2-0-0-0
Regulation	2025	Semester	
Prerequisites			

COURSE OBJECTIVES:

3. To achieve overall health of body and mind .
4. To overcome stress

COURSE CONTENT:

[ASHTANGA] (6-Hours)

Definitions of Eight parts of yoga.

[YAM] (6-Hours)

Do`s and Don't's in life: Ahinsa, satya, astheya, bramhacharya and aparigraha.

[**NIYAM] (6-Hours)**

Do`s and Don't's in life: Shaucha, santosh, tapa, swadhyay, Ishwarpranidhan.

[**ASAN] (6-Hours)**

Various yoga poses and their benefits for mind & body

[PRANAYAM] (6-Hours)

Regularization of breathing techniques and its effects-Types of pranayam

Total Hours: 30

COURSE OUTCOMES:

CO	Course Outcome	Bloom'sLevel
CO1	Develop healthy mind in a healthy body thus improving social health also	5
CO2	Improve efficiency	2

Reference Book:

1. Janardan Swami Yogabhyasi Mandal, "Yogic Asanas for Group Tarining-Part-I", Nagpur
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature" Advaita Ashrama (Publication Department), Kolkata.

COURSE ARTICULATION MATRIX:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-

Correlation Levels: 3 - Strong, 2 - Medium, 1 - Low, - (dash) - No correlation

Course Designed By

Name & Designation

BOS Approval

Date: DD/MM/YYYY

GOVERNMENT COLLEGE OF ENGINEERING, BARGUR- 635104

(Autonomous institute affiliated to Anna University, Chennai)

Department of Electrical and Electronics Engineering

Subject Code	25ZAC006	Subject Title	CONSTITUTION OF INDIA
Category		L-P-T-C	1-0-0-0
Regulation	2025	Semester	
Prerequisites			

COURSE OBJECTIVES:

To provide understanding of basic concepts of Indian Constitution and various organs created by the constitution including their functions.

COURSE CONTENT:

[INTRODUCTION] (6-Hours)

Constitution' Definition and Classification -Constitutional Organs - Indian Constitution: Sources and constitutional history, Salient features of Indian Constitution - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State PolicyRule of Law - Separation of powers Constitution - Doctrine of Basic Structure.

[UNION GOVERNMENT & STATE GOVERNMENT AND THEIR ADMINISTRATION] (6-Hour)

Distribution of Powers between Center and States Structure of the Indian Union: Federalism, Centre- State -relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha. Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

[LOCAL ADMINISTRATION] (6-Hours)

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayatiraj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy Emergency Provisions

[ELECTION COMMISSION] (6-Hours)

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Total Hours: 30

Recommended References:

1. V.N. Shukla, Constitution of India
2. M.P. Jain – Indian Constitutional Law.
3. H.M.Seervai : Constitution of India
4. D.D.Basu: Shorter Constitution of India
5. Kagzi : Indian Constitution
6. Pylee : The History of Indian Constitution

Course Designed By

Name & Designation

BOS Approval

Date: DD/MM/YYYY