Electrical Engineering Department
Government College of Engineering, Karad

Curriculum for TY Electrical from Academic Year 2021-22

Institute Vision
To emerge as a technical Institute of national repute driven by excellence in imparting value based education and innovation in research to face the Global needs of profession
Institute Mission
To *create* professionally competent engineers *driven* with the sense of responsibility towards *nature and society*
Department Vision
To produce Electrical Engineers to meet the requirements of Industry with *professional, ethical* and *social* responsibility
Department Mission
To impart *quality* education in Electrical Engineering To *upgrade* curriculum continuously to meet the industrial requirements To develop ability to research, *innovation* and entrepreneurship To promote *awareness* about social and ethical responsibility

Program Educational Objectives

PEO 1	Student will have a sound foundation of mathematical, scientific and engineering *fundamentals* necessary to *formulate, solve* and *analyse* engineering problems and to *prepare* them for *graduate studies* as well as *research* and *innovation*
PEO 2	Student will have an excellent *academic ambience* of collaborative learning which will help them to *assimilate* difficult theoretical concepts through modelling, simulation, well designed laboratory sessions, industrial training etc. by using modern tools.
PEO 3	*Employability* of students will be enhanced by continually *upgrading* the curricula to *satisfy* dynamic *industry* requirements in tune with the state-of-the-art *scientific and technological developments* and *entrepreneurship skills* will be inculcated
PEO 4	Students will demonstrate professional, *ethical* attitude and ability to relate engineering issues to broader *environmental and social* context through life-long learning

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOME (PSO)

Design solution for power system problems using appropriate tool and design power apparatus that meet specific needs with appropriate consideration to its social impact

Government College of Engineering, Karad

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering

Scheme of Instructions: Third Year B. Tech. in Electrical Engineering

Semester – V

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	OEC	EE2501	Microcontroller	3	-	-	3	3	15	15	10	60	100
2	PCC	EE2502	Electrical Machines II	3	-	-	3	3	15	15	10	60	100
3	PCC	EE2503	Power Systems II	3	-	-	3	3	15	15	10	60	100
4	PCC	EE2504	Control Systems	3	-	-	3	3	15	15	10	60	100
5	PEC	EE25*5	Elective – I	3	-	-	3	3	15	15	10	60	100
6	OEC	EE2506	Microcontroller Lab	-	-	2	2	1	-	-	25	25	50
7	PCC	EE2507	Electrical Machines II Lab	-	-	2	2	1	-	-	25	25	50
8	PCC	EE2508	Power Systems II Lab	-	-	2	2	1	-	-	25	25	50
9	PCC	EE2509	Software Lab-II	-	-	2	2	1			25	25	50
10	P/S/IT	EE2510	Mini Project	-	-	2	2	1	-	-	25	25	50
11	P/S/IT	EE2511	Technical Training & Technical Presentation	-	1	-	1	1			25	25	50
			Total	**15**	**01**	**10**	**26**	**21**	**75**	**75**	**200**	**450**	**800**

L- Lecture T-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2 ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	MCC (Mandatory Courses)	Project / Seminar / Industrial Training
Credits	--	--	--	12	03	04	--	02
Cumulative Sum	06	22	27	29	03	08	Yes	03

PROGRESSIVE TOTAL CREDITS :77+21= 98

Government College of Engineering, Karad

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering

Scheme of Instructions: Third Year B. Tech. in Electrical Engineering

Semester – VI

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs / Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	HSMC	EE2601	Economics for Engineers	3	-	-	3	3	15	15	10	60	100
2	OEC	EE2602	Internet of Things	3	-	-	3	3	15	15	10	60	100
3	PEC	EE26*3	Elective – II	3	-	-	3	3	15	15	10	60	100
4	PCC	EE2604	Power Electronics	3	-	-	3	3	15	15	10	60	100
5	PCC	EE2605	Electrical Machine Design	3	-	-	3	3	15	15	10	60	100
6	OEC	EE2606	Internet of Things Lab	-	-	2	2	1	-	-	25	25	50
7	PCC	EE2607	Power Electronics Lab	-	-	2	2	1	-	-	25	25	50
8	PCC	EE2608	Electrical Machine Design Lab	-	-	2	2	1	-	-	50	50	100
9	PCC	EE2609	Electrical Workshop Lab	-	-	2	2	1			25	25	50
10	HSMC	EE2610	Technical Presentation		1		1	1	-	-	25	25	50
			Total	**15**	**01**	**08**	**24**	**20**	**75**	**75**	**200**	**450**	**800**

L- Lecture T-Tutorial P-Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2 ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	MCC (Mandatory Courses)	Project / Seminar / Industrial Training
Credits	04	--	--	9	03	04	--	--
Cumulative Sum	10	22	27	38	06	12	Yes	03

PROGRESSIVE TOTAL CREDITS :98+20=118

List of Electives to be offered for V and VI Semester

Elective – I		Elective – II	
EE2505	**EHVAC Transmission**	**EE2603**	**HVDC Transmission**
EE2515	**Electromagnetics**	**EE2613**	**Electrical Utilization and Traction**
EE2525	**Optimization Techniques**	**EE2623**	**Special Electrical Machines**

Government College of Engineering, Karad

Third Year (Sem. – V) B. Tech. Electrical Engineering

EE2501: Microcontroller

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Develop algorithm to perform the task
2.	Select appropriate peripherals to develop digital system
3.	Select suitable microcontroller for given application and program it
4.	Design and develop suitable microcontroller based system for given application

	Course Contents	Hours
Unit 1	**Overview of Microcomputer systems**: Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, instruction sets of microprocessors (with examples of 8085 and 8086);	**(8)**
Unit 2	**Interfacing with peripherals**: timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic Coprocessors; System level interfacing design	**(8)**
Unit 3	**Memory:** Concepts of virtual memory, Cache memory, Advanced coprocessor Architectures- 286, 486, Pentium; Microcontrollers: 8051 systems	**(4)**
Unit 4	**RISC processors:** Introduction to RISC processors PIC;	**(7)**
Unit 5	**Programmable Logic Controllers (PLCs):** ARM microcontrollers interface designs	**(6)**
Unit 6	**Arduino:** Programming and architecture. Interfacing with sensors and network. Applications to electrical measurements and control.	**(7)**

Text Books

1.	R. S. Gaonkar, “Microprocessor Architecture: Programming and Applications with the 8085/8080A”, Penram International Publishing, 1996
2.	Douglas Hall, “Microprocessors Interfacing”, Tata McGraw Hill, 1991.
3.	D A Patterson and J H Hennessy, "Computer Organization and Design The hardware and software interface” Morgan Kaufman Publishers

Reference Books

1.	Satish Shah, “8051 Microcontrollers: MCS51 family and its variants”, Oxford University Press.
2.	Subrata Ghoshal, “8051 Microcontroller: Internals, Instructions, Programming and Interfacing”, Pearson Education.
3.	K Uma Rao, Andhe Pallavi, “The 8051 Microcontrollers: Architecture, Programming and Applications”, Pearson Education

Useful Links

1.	http://nptel.ac.in/courses/Webcourse-contents/IITKANPUR/microcontrollers/ micro/ui/TOC.htm
2.	http://freevideolectures.com/Course/3018/Microprocessors-andMicrocontrollers

EE2501

Government College of Engineering, Karad
Third Year (Sem. – V) B. Tech. Electrical Engineering
EE2501: Microcontroller

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Develop algorithm to perform the task
2.	Select appropriate peripherals to develop digital system
3.	Select suitable microcontroller for given application and program it
4.	Design and develop suitable microcontroller based system for given application

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	3	1	2	3	1					2	3
CO 3	3	2	2	2	3	2	1					2	3
CO 4	3	2	3	1	2	3	1					2	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	20
Evaluate				
Create	5	5	4	20
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem. – V) B. Tech. Electrical Engineering

EE 2502 : Electrical Machines-II

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	To familiarize students with the concept of AC machines and their industrial applications
2.	To set a firm and solid foundation in Electrical machines with strong analytical skills and Conceptual understanding of analytical methods in A.C. Machines.
3.	To make students aware of protective system with industry oriented learning.

	Course Contents	Hours
Unit 1	Construction & types of 3 ph. Induction motors, torque equation, starting torque, running torque, condition of maximum torque ,torque slip characteristics, Need of starters for 3 phase Induction motors, types of starters, Speed control methods from stator side (Stator voltage control ,Stator Frequency control, Pole changing) & rotor side (rotor resistance control), Applications of 3 ph. Induction motors.	**(6)**
Unit 2	Losses & efficiency of 3 phase induction motor, power flow diagram with numerical treatment, No load & blocked rotor test, equivalent circuit of 3 phase induction motor, Phasor diagram of 3 phase induction motor, performance of 3 phase induction motor using circle diagram, Cogging & crawling of 3 phase induction motor.	**(7)**
Unit 3	Construction, Working and types of single phase induction motors (Split phase, capacitor start/run, shaded pole motors), Double field revolving theory, Characteristics & Applications.	**(6)**
Unit 4	Construction, principle of operation of three phase alternator, emfequation, parameters of armature winding, armature reaction, concept of synchronous reactance and synchronous impedance. Equivalent circuit of 3 phase alternator, alternator on load (resistive, inductive &capacitive)	**(7)**
Unit 5	OC test & SC test on 3 Phase alternator, short circuit ratio, voltage regulation methods (emf, mmf, zero power factor and direct loading method) with numerical treatment, Losses and efficiency, power flow diagram, need of parallel operation, conditions for parallel operation, synchronizing procedures, hunting and oscillations in alternators.	**(7)**
Unit 6	Synchronous motor, starting methods, Phasor Diagram, Effect of excitation on power factor and armature current, V and inverted V Curves, Operation of Synchronous motor as Synchronous Condenser, Applications of three phase synchronous motor. Permanent Magnet Machines, Principle, operation and applications of Brushless motors	**(7)**

Text Books

1. "Electrical Machines", S. K. Bhattacharya, 3rd edition, Tata Mc-Graw-Hill publication.
2. "Electrical Machines", I. J. Nagrath, D. P. Kothari, 4th edition, Tata McGraw Hill publication

Reference Books

1. "Electric Machinery", A. E. Fitzgerald, Mc-Graw Hill publications
2. "Theory of AC machines", A. S. Langsdorf, Mc-Graw Hill publications.
3. "Design of Brushless Permanent Magnet motors,"J. R. Hendershot and T. J. E. Miller, Magna Physics Publishing and Clarendon press. 1994edition.
4. "Brushless Permanent Magnet Motor Design", Duane C. Hanselman, McGraw- Hill Inc.

Useful Links

1. www.nptel.iitm.ac.in (Video Courses on Electrical Machines by Prof. S K Bhattacharya, IIT Kharagapur)

EE2502

Government College of Engineering, Karad
Third Year (Sem.–V) B. Tech. Electrical Engineering
EE 2502 : Electrical Machines-II

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	To familiarize students with the concept of AC machines and their industrial applications
2.	To set a firm and solid foundation in Electrical machines with strong analytical skills and Conceptual understanding of analytical methods in A.C. Machines.
3.	To make students aware of protective system with industry oriented learning.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	3	1	2	3	1					2	3
CO 3	3	2	2	2	3	2	1					2	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	20
Evaluate	5	5	4	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem –V) B. Tech. Electrical Engineering

EE2503 : Power System-II

Teaching Scheme		Examination Scheme	
Lectures	03Hrs/week	CT – 1	15
Tutorials	00Hrs/week	CT – 2	15
Total Credits	03	TA	10
		ESE	60
		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Obtain the power flow solution of an interconnected power system.
2.	Analyse a power system network under symmetrical and unsymmetrical fault conditions.
3.	Explain the power system stability and factors affecting on transient stability
4.	Discuss the technical and economic advantages of dc systems over ac systems.

	Course Contents	Hours
Unit 1	**Load Flow Analysis**: Review of the structure of a power system and its components. Analysis of power flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of non-linear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.	**(6)**
Unit 2	**Symmetrical components and Sequence Networks**: Synthesis of unsymmetrical phasor from their symmetrical components, The symmetrical components of unsymmetrical phasor, Power in terms of symmetrical components, Representation of generators, lines and transformers in sequence networks, Unsymmetrical series impedances.	**(6)**
Unit 3	**Symmetrical Fault:** Introduction, Classification, Severity and occurrence of fault, Effect of faults, Balanced three phase fault, Transient on transmission line, Short circuit capacity.	**(6)**
Unit 4	**Unsymmetrical Faults:** Unsymmetrical faults on power systems, Single Line to ground, Line to line, Double line to ground fault, single & double conductor open faults.	**(6)**
Unit 5	**Power System Stability:** Dynamics of a synchronous machine, Power angle equation, Steady state stability, Equal area criterion and its application, M and H constant, Factors affecting transient stability, Critical clearance angle.	**(6)**
Unit 6	**HVDC and FACTS:** HVDC links, Asynchronous and synchronous links, limitations and advantages of HVDC links, converters, overview of FACTS and types of FACTS devices	**(6)**

Text Books

1.	"Power System Analysis", Grainger John J and W D Stevenson Jr, Mc-Graw Hill, 2003 Edition
2.	"Modern Power System Analysis", I. J. Nagrath, D. P. Kothari, (3rd Edition), Tata McGraw Hill Publishing Co. Ltd., 2003.

Reference Books

1.	Power System Analysis and Design ",J. D. Glover and M. Sarma (5thEdition), Brooks/ Cole Publishing
2.	"Electric energy systems theory: An introduction",O. I. Elgerd, Tata McGraw Hill, 4th edition.
3.	"Power system analysis",HadiSaadat,3rdedition, McGraw Hill International publication,2016
4.	"Power system analysis", A. R. Bergen and Vijay Vittal, (2nd edition), Pearson Education Asia, 2001

Useful Links

1.	www.nptel.iitd.ac.in
2.	www.nptel.iitm.ac.in

E2303

Government College of Engineering, Karad
Third Year (Sem –V) B. Tech. Electrical Engineering
EE2503 : Power System-II

Mapping of Cos and Pos

Course Outcomes (CO)	
Students will be able to	
1.	Obtain the power flow solution of an interconnected power system.
2.	Analyse a power system network under symmetrical and unsymmetrical fault conditions.
3.	Explain the power system stability and factors affecting on transient stability
4.	Discuss the technical and economic advantages of dc systems over ac systems.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	1	2	2	2				2	3		
CO 2	3	3	3	2	1	2	2	2				2	3		
CO 3	3	3	3	2	1	2	2	2				2	3		
CO 4	2	2	2	1	1	2	3	3				2	3		

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	4	20
Evaluate	5	5	3	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem. – V) B. Tech. Electrical Engineering

EE2504: Control System

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Model and represent the physical systems mathematically. (I)
2.	Analyze and formulate the given system in time and frequency domain.(II,III,IV)
3.	Design the controller for given system.(V)
4.	Estimate the parameters of given continuous time system using state space approach.(VI)

	Course Contents	Hours
Unit 1	**Modeling and representation of Control System and Transfer Function** : Laplace transform review, Transfer function of electrical system, Block diagram representation and reduction, types of feedback systems, signal flow graph, Mason's gain rule, SFG.	**(06)**
Unit 2	**Time Domain Analysis and Stability Concept** : Response of first and second order system, general second order system, response with additional pole and zeros, steady state error for unity feedback system, static error constants and systems type, steady state error specifications, Concept of stability for linear systems, Absolute and relative stability, Routh stability criterion and its application in special cases.	**(06)**
Unit 3	**Root Locus :** Definition of root locus, Rules for plotting root loci, Root contour, stability analysis using root locus, effect of addition of pole and zero.	**(06)**
Unit 4	**Frequency Domain Techniques :** Frequency domain specification, Correlation between time and Frequency domain specifications, Bode plot, stability, gain margin, phase margin by bode plot, Effect of gain variation and addition of poles and zeros on Bode plot.	**(08)**
Unit 5	**Introduction to Controller Design:** Root-loci method of feedback controller design, Lead and Lag compensation indesigns.	**(10)**
Unit 6	**State variable Analysis:** Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability.Pole-placement by state feedback.	**(08)**

Text Books

1.	"Control System Engineering", Norman S. Nise , John willey and Sons, 6th Edition, 2015.
2.	"Control System Engineering", I.J. Nagrath and M. Gopal,New age International publication, 5th Edition, 2014.

Reference Books

1.	"Modern Control Engineering", Katsuhiko Ogata, Prentice Hall of India Pvt Ltd, 5th edition.
2.	"Automatic Control System", Benjamin C. Kuo, Prentice Hall of India Pvt Ltd, Wiley publication, 9th edition.
3.	"Control Systems-Principles and Design", M. Gopal, Tata McGraw-Hill Education Pvt. Ltd, 4th edition, 2014.

Useful Links

1.	https://nptel.ac.in/courses/108/106/108106098/
2.	https://onlinecourses.nptel.ac.in/noc20_ee90/preview

Government College of Engineering, Karad
Third Year (Sem. – V) B. Tech. Electrical Engineering
EE2504: Control System

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Model and represent the physical systems mathematically. (I)
2.	Analyse and formulate the given system in time and frequency domain.(II,III,IV)
3.	Design the controller for given system.(V)
4.	Estimate the parameters of given continuous time system using state space approach.(VI)

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	3	1	3						2		2	3
CO 2	3	3	1	3						2		2	3
CO 3	3	3	3	3						2		2	3
CO 4	3	3	2	3	3					2		3	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	10	5	1	10
Analyse	5	5	2	10
Evaluate		5	3	20
Create			4	20
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem. – V) B. Tech. Electrical Engineering

EE 2505 : Elective I- EHVAC Transmission

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Identify and evaluate transmission line parameters
2.	Articulate the concept of modes of propagation and corona effects
3.	Identify causes of over-voltages and methods of protection
4.	Evaluate the effects travelling waves and standing waves

	Course Contents	Hours
Unit 1	**EHVAC Systems:** **Introduction to EHVAC Systems-**Engineering aspects & growth in EHV AC transmission line, trends & preliminaries & transferability, Transient stability limit & Surge Impedance loading **Calculation of Line & Ground Parameters**: Resistance, Power Loss, temperature rise; properties of bundled conductors, inductance & capacitances, calculations of sequence inductance & capacitance, line parameters for mode of propagations, resistance &inductance of ground return. **Corona Effects**: I^2R & corona loss, corona loss formula, charge voltage diagram with corona, Attenuation of travelling waves due to the corona loss, audible noise; corona pulses, their generation & properties, limits for radio interference fields.	**(10)**
Unit 2	**Theory of Traveling Waves & Standing Waves:** Waves at power frequency, Differential equation& solution for general case, Standing Waves & natural frequency, Open ended line, Double exponential response, Response to the sinusoidal excitation, Line energization with trapped charge voltage, Reflection & refraction of traveling waves.	**(6)**
Unit 3	**Lightning & lightning Protection:** Lightning strokes to lines, their mechanism, general principles of lightning protection problem, Tower footing resistance, lightning Arrestors & protective characteristics different arrestors & their characteristics.	**(6)**
Unit 4	**Over Voltage in EHV System Covered by Switching Operation**: Over voltages& their types, recovery voltage & circuit breakers, Ferro resonance over voltage & calculation of switching surges & single phase equivalents.	**(6)**
Unit 5	**Power Frequency Voltage Control & Over Voltages:** Generalized constants, charging currents, power circle diagram & its use, voltage control, shunt & series compensation, sub synchronous resonance in series capacitor compensated line & static reactive compensating system.	**(6)**
Unit 6	**Insulation co-ordination**: Insulation levels, voltage withstand levels of protected equipment & Insulation co-ordination based on lightning.	**(6)**

Text Books

1. R. D. Begamudre, "EHVAC Transmission Engineering", New Age International Publishers,

Reference Books

1. Twain Gonen, "EHVAC & HVDC Transmission Engg. & Design", John Wiley

Useful Links

1. https://nptel.ac.in/courses/117/106/117106034/
2. https://nptel.ac.in/courses/108108076/
3. https://nptel.ac.in/courses/108105062/

EE2505

Government College of Engineering, Karad
Second Year (Sem. – V) B. Tech. Electrical Engineering
EE 2505 : Elective I - EHVAC Transmission

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Identify and evaluate transmission line parameters
2.	Articulate the concept of modes of propagation and corona effects
3.	Identify causes of over-voltages and methods of protection
4.	Evaluate the effects travelling waves and standing waves

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	3	1	2	3	1					2	3
CO 3	3	2	2	2	3	2	1					2	3
CO 4	2	2	2	1	2	1							3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	20
Evaluate	5	5	4	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem. – V) B. Tech. Electrical Engineering

EE 2515 : Elective I - Electromagnetics

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	00Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Apply mathematical techniques to interpret electromagnetic phenomenon.
2.	Apply advanced mathematical techniques to solve electromagnetic problems.
3.	Articulate electromagnetic phenomenon and apply appropriate mathematical modelling techniques to design electromagnetic systems.
4.	Identify sources of error in the solution process.

	Course Contents	Hours
Unit 1	Vector Algebra and calculus, Cartesian, Cylindrical and Spherical Co-ordinate System. Transformation of Variables from Cartesian to Cylindrical and Spherical Coordinate System and Vice-Versa	**(8)**
Unit 2	Coulomb's Law, Electric Field Intensity, Field of 'N' Point Charges, Field of Line and Sheet of Charge, Electric Flux Density, Gauss's Law and Its Applications, Divergence and Divergence Theorem	**(7)**
Unit 3	Definition of Potential Difference and Potential, Potential of Point Charge and System of Charges Potential Gradient, Energy Density in Electrostatic Field. Poisson's and Laplace's Equations, Current and Current Density, Continuity of Current Capacitance, Dielectrics.	**(7)**
Unit 4	Biot-Savart Law, Amperes Circuital Laws and their Applications, Curl, Stoke's Theorem, Magnetic Flux Density, Scalar and Vector Magnetic Potential, Maxwell's Equations in Steady Electric and Magnetic Fields	**(7)**
Unit 5	Force on Moving Charge and Differential Current Element, Force and Torque on a Closed Circuit. Time Varying Fields and Maxwell's Equations.	**(6)**
Unit 6	Uniform Plane Waves, Wave Motion in Free Space, Perfect Dielectric, Lossy Dielectric and Good Conductor, Skin Effect, Pointing Vector and Power Considerations. Reflection of Uniform Plane Waves, Standing Ratio	**(7)**

Text Books

1.	"Engineering Electromagnetic", William Hayt and J. A. Buck, 8thedition, The McGraw Hill education Pvt. Ltd.
2.	"Principles of Electromagnetics", Matthew N. O. Sadiku, and S. V. Kulkarni,6th Asian Edition, Oxford University press India

Reference Books

1.	"Electromagnetics", Schaum's outline series, J A Edminister, 2nd edition, The Tata Mcgraw Hill Publishing company Ltd
2.	"Electromagnetic Engineering", Nathan Ida, 5thedition, Thomson Learning

Useful Links

1.	Virtual Electromagnetics Lab at EE Dept, IIT Bombay: https://www.ee.iitb.ac.in/course/~vel/
2.	NPTEL MOOC Course - Electrical Equipment and Machines: Finite Element Analysis (Lectures 3 to 10): https://nptel.ac.in/courses/108/101/108101167/

EE2515

Government College of Engineering, Karad
Third Year (Sem. – V) B. Tech. Electrical Engineering
EE 2515 : Elective I - Electromagnetics

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Apply mathematical techniques to interpret electromagnetic phenomenon.
2.	Apply advanced mathematical techniques to solve electromagnetic problems.
3.	Articulate electromagnetic phenomenon and apply appropriate mathematical modelling techniques to design electromagnetic systems.
4.	Identify sources of error in the solution process.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	3	2	2		1	1	1	1	1		3	3
CO 2	3	3	3	3	1	1	1	1	1	2		3	3
CO 3	2	3	3	3	2	2	2	3	2	2	2	3	3
CO 4	2	2	2	3	2	1	1	2	2	2	1	3	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	20
Evaluate	5	5	4	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem. – V) B. Tech. Electrical Engineering

EE 2525 : Elective I - Optimization Techniques

Teaching Scheme		Examination Scheme	
Lectures	03Hrs/week	CT – 1	15
Tutorials	00Hrs/week	CT – 2	15
Total Credits	03	TA	10
		ESE	60
		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Develop different types of algorithms for solving various types of optimization problems using SCILAB/MATLAB.
2.	Enumerate the fundamental knowledge of Linear Programming and Nonlinear Programming problems
3.	Apply knowledge of optimization to formulate and solve real world engineering problems.
4.	Solve a multi-objective problem through weighted and constrained methods and acquire an idea about the various direct and indirect search methods.

	Course Contents	Hours
Unit 1	Introduction to optimization, engineering applications of optimization, statement of an optimization problem, terminology, design variables , design surface, constraints, objective function, calculus method, classical methods, Introduction to MATLAB/SCILAB optimization toolbox.	**(8)**
Unit 2	**Linear Programming Problem-1** Formulation of LPP, Geometry of LPP and Graphical Solution of LPP, Solution of LPP: Simplex Method, Solution of LPP using MATLAB/SCILAB.	**(8)**
Unit 3	**Linear Programming Problem-2** Big - M Method, Two - Phase Method, Special Cases in Simple Applications, Introduction to Duality Theory, Dual Simplex Method,	**(4)**
Unit 4	**Classical optimization techniques** : Single variable Optimization, Unconstrained multivariable optimization, Nonlinear programming with equality constraint, Nonlinear programming KKT conditions	**(7)**
Unit 5	**Numerical optimization** : Non linear programming - unimodal function, unrestricted search, Region elimination techniques, Fibonacci Method, Golden Section Methods, Interpolation Methods	**(6)**
Unit 6	CPM and PERT introduction - Network representation of project, critical path, optimum scheduling by CPM, crashingof project.	**(7)**

Text Books

1. "Engineering Optimization Theory and Practice", S. S. Rao, 4th Edition ,John Wiley
2. L.S.Srinath : PERT and CPM Principles & Application, Affiliated East West Pvt. Ltd., New Delhi.

Reference Books

1. Optimization for Engineering Design", Kalyanmoy Deb, 2nd Edition, Prentice Hall of India
2. Optimization G.V. Reklaites", A. Ravindran and K.M. Rogsdeth, 3rd Edition, Wiley, New York.
3. J.C.Pant : Introduction to Optimization, Jain Brothers, New Delhi.

Useful Links

1. http://nptel.ac.in/courses/111105039/(NPTEL COURSE by Prof. Devyani Chaterjee IIT KHARAGPUR)

EE2525

Government College of Engineering, Karad
Third Year (Sem. – V) B. Tech. Electrical Engineering
EE 2525 : Elective I - Optimization Techniques

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Develop different types of algorithms for solving various types of optimization problems using SCILAB / MATLAB.
2.	Enumerate the fundamental knowledge of Linear Programming and Nonlinear Programming problems
3.	Apply knowledge of optimization to formulate and solve real world engineering problems.
4.	Solve a multi-objective problem through weighted and constrained methods and acquire an idea about the various direct and indirect search methods.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	1	1	1	1						1	1	3
CO 2	3	1		1	1							2	3
CO 3	2	1	1	1	1		2				1	1	3
CO 4	3	2	1	1								1	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	4	20
Analyse	5	5	3	20
Evaluate	5	5	3	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem V) B. Tech. Electrical Engineering

EE2506: Microcontroller Lab

Teaching Scheme			Examination Scheme	
Lectures	---		CT – 1	--
Tutorial	---		CT – 2	--
Practical	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 Hrs

Course Outcomes (CO)

Student will be able to

1.	Write assembly as well as c programs for microcontroller
2.	Design delays using timers in 8051
3.	Interface ADC,DAC, LCD, LED, Keyboard, Stepper motor, DC motor etc. with 8051
4.	Differentiate between microprocessor and microcontroller

	List of Experiments	
Experiment 1	a) Write a program to add two 8-bit numbers stored in registers or internal/External memory locations. b) Write a program to multiply two 8-bit numbers stored in registers or internal/External memory locations. c) Write a program to multiply two 16-bit numbers	
Experiment 2	a) Write a program to add block of data stored in internal/external memory locations. b) Write a program to transfer block of data from internal memory locations to external memory locations. c) Write a program to sort block of data in ascending or descending order	
Experiment 3	a) Write a program to perform the following. 1. Keep monitoring P1.2 until it becomes high. 2. When P1.2 becomes high write value 45H on P0. 3. Sent a high to low pulse to P2.3 b) A switch is connected to P1.7. Write a program to check the status of switch and perform the following. 1. if switch = 0, send letter “N” to P2 2. if switch = 1, send letter “Y” to P2	
Experiment 4	a) Write a program to generate 5 KHz pulse waveform of 50% duty cycle on pin 1.0 using timer 1 in mode 2. b) Write a program to generate 1 KHz pulse waveform of 70% duty cycle on pin 1.0 using timer.	
Experiment 5	a) Write a program for the 8051 to transfer letter “A” serially, continuously. b) Write a program to transfer the message “YES” serially. Do this continuously. c) Program the 8051 to receive bytes of data serially, and put them in P1	
Experiment 6	Interfacing ADC and DAC.	
Experiment 7	Interfacing Matrix Keyboard.	
Experiment 8	Interfacing LED and LCD Displays.	
Experiment 9	Measurement of voltage and current	
Experiment 10	Controlling DC motor using PWM.	
Experiment 11	Over current digital relay	
Experiment 12	Practicals on ARDUINO	

EE2506

Government College of Engineering, Karad
Third Year (Sem – V) B. Tech. Electrical Engineering
EE 2506: Microcontroller Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Write assembly as well as c programs for microcontroller
2.	Design delays using timers in 8051
3.	Interface ADC,DAC, LCD, LED, Keyboard, Stepper motor, DC motor etc. with 8051
4.	Differentiate between microprocessor and microcontroller

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	2	1	2	3							2
CO 3	3	1	1	2	3	2	1					2	3
CO 4	2	2	2	1	1	1							3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember				
Understand				
Apply			10	10
Analyse			10	10
Evaluate			5	5
Create				
TOTAL			25	25

Government College of Engineering, Karad

Third Year (Sem – V) B. Tech. Electrical Engineering

EE 2507: Electrical Machines-II Lab

Teaching Scheme			Examination Scheme	
Lectures	---		CT – 1	
Tutorials	---		CT – 2	
Practical	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 hrs

Course Outcomes (CO)

Student will be able to

1.	Make appropriate connections for testing of AC machines
2.	Deduce conclusions about the performance using obtained readings
3.	Calculate regulation and efficiency of single and three phase machines
4.	To select appropriate AC machines for the application

	List of Experiments	
Experiment 1	Determination of efficiency & speed regulation of 3 phase induction motor by direct loading method	
Experiment 2	Determination of circle diagram parameters of 3 Phase induction motor by conducting No Load &Blocked Rotor Tests.	
Experiment 3	Study of starters for 3 Phase induction motors.	
Experiment 4	Speed control methods of 3 Ph.IM. (Stator Side).	
Experiment 5	Speed control methods of 3 Ph.IM. (Rotor Side).	
Experiment 6	Determination of efficiency & speed regulation of 1-phIM.	
Experiment 7	Determination of Voltage regulation of an alternator by EMF method.	
Experiment 8	Determination of Voltage regulation of an alternator by MMF method	
Experiment 9	Determination of Voltage regulation of an alternator by ZPF method.	
Experiment 10	Determination of X_d and X_q of an Alternator by Slip test	
Experiment 11	Performance of synchronous generator connected to infinite bus-Using Synchronizing methods.	
Experiment 12	Determination of V and Inverted V curves of a synchronous motor.	
Experiment 13	Determination of efficiency of synchronous motor by direct loading method	
Experiment 14	Determination of efficiency and regulation of Alternator by direct loading method	

EE2507

Government College of Engineering, Karad
Third Year (Sem – V) B. Tech. Electrical Engineering
EE 2507: Electrical Machines-II Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Make appropriate connections for testing of AC machines
2.	Deduce conclusions about the performance using obtained readings
3.	Calculate regulation and efficiency of single and three phase machines
4.	To select appropriate AC machines for the application

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	2	1	2	3							2
CO 3	3	1	1	2	3	2	1					2	3
CO 4	2	2	2	1	1	1							3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember				
Understand				
Apply			10	10
Analyse			10	10
Evaluate			5	5
Create				
TOTAL			25	25

Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Electrical Engineering				
EE 2508: Power System-II Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	---
Tutorials	---		CT – 2	---
Practical	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 hrs

Course Outcomes (CO)	
Student will be able to	
1.	Formulate the Y_{BUS} matrix for given power system network.
2.	Construct standard power system network and apply load flow techniques.
3.	Analyse the faulty system for stable operation of the power system.
4.	Analyse rectifier circuits using software tool

	List of Experiments	
	Perform the experiments on MATLAB/PSIM/ETAP software	
Experiment 1	Formation of YBUS.	
Experiment 2	Load Flow Analysis using Gauss Seidel (GS) Method	
Experiment 3	Load Flow Analysis using Newton Raphson (NR) Method	
Experiment 4	Load Flow Analysis using Fast Decoupled (FD) Method	
Experiment 5	LG, LL and 3-Φ fault analysis of 3-Φ synchronous machine.	
Experiment 6	Transient and small signal stability analysis of Single Machine connected to Infinite Bus	
Experiment 7	Single Phase bridge rectifier circuit	
Experiment 8	Three Phase bridge rectifier circuit	
Experiment 9	Analysis of IEEE 6 bus system network (Use Newton Raphson Method)	
Experiment 10	Analysis of IEEE 14 bus system network (Use Fast Decoupled Method)	

EE2508

Government College of Engineering, Karad
Third Year (Sem – V) B. Tech. Electrical Engineering
EE 2508: Power System-II Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Formulate the Y_{BUS} matrix for given power system network.
2.	Construct standard power system network and apply load flow techniques.
3.	Analyse the faulty system for stable operation of the power system.
4.	Analyse rectifier circuits using software tool

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1
CO 1	2	2	2	3	3	1	1	1				2	3
CO 2	2	2	2	3	3	1	1	1				2	2
CO 3	2	2	2	3	3	1	1	1				2	3
CO 4	2	2	2	3	3	1	1	1				2	3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember				
Understand				
Apply			5	5
Analyse			10	10
Evaluate			10	10
Create				
TOTAL			25	25

Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Electrical Engineering				
EE 2509: Software Lab II				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	--
Tutorials	---		CT – 2	--
Practical	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 hrs

Course Outcomes (CO)	
Student will be able to	
1.	Comprehend the basics of ANSYS software and practical implementation of the fundamentals.
2.	Solve the basic Maxwell 2D & 3D models for magnetostatic,electrostatic,eddy current & transient solvers to fundamental electrical engineering design problems.
3.	Create models and simulate using PSIM
4.	Develop real time scenario for Modelling renewable sources and interfacing software with real model data acquisition

	Experiments	
Experiment 1	Create Maxwell 2D model based on magnetostatic effect –problem.	
Experiment 2	Create Maxwell 2D model based on electrostatic effect –problem.	
Experiment 3	Create Maxwell 2D model based on eddy current effect –problem.	
Experiment 4	Create Maxwell 3D model based on magnetostatic effect –problem.	
Experiment 5	Create Maxwell 2D model based on magneto-transient effect –problem.	
Experiment 6	Create Maxwell 3D model based on magneto-transient effect –problem.	
Experiment 7	Design and simulate Speed characteristics of a brushless dc motor under dc bus voltage change	
Experiment 8	Modelling and analysing photovoltaic power system.	
Experiment 9	Simulate battery charging and discharging process in an energy storage system	
Experiment 10	Modelling and analysis of Wind Turbine model	
Useful Link		
	NPTEL MOOC Course - Electrical Equipment and Machines: Finite Element Analysis (Lectures 11 to 22): https://nptel.ac.in/courses/108/101/108101167/	

EE2509

Government College of Engineering, Karad
Third Year (Sem – V) B. Tech. Electrical Engineering
EE 2509 : Software Lab II

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Comprehend the basics of ANSYS software and practical implementation of the fundamentals.
2.	Solve the basic Maxwell 2D & 3D models for magnetostatic, electrostatic, eddy current & transient solvers to fundamental electrical engineering design problems.
3.	Create models and simulate using PSIM
4.	Develop real time scenario for Modelling renewable sources and interfacing software with real model data acquisition

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	3	3	3							2	3
CO 2	3	3	2	3								1	3
CO 3	3	3	2	3			3					2	3
CO 4	2	2	2	3	2							1	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply			5	5
Analyse			10	10
Evaluate			10	10
Create				
TOTAL			25	25

Government College of Engineering, Karad

Third Year (Sem –V) B. Tech. Electrical Engineering

EE 2510: Mini Project

Teaching Scheme			Examination Scheme	
Lectures	---		CT – 1	--
Tutorials	---		CT – 2	--
Practical	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	1 hr.

Course Outcomes (CO)

Student will be able to

1.	Identify community needs
2.	Covert idea into product
3.	Demonstrate project model to meet desired result using suitable software and hardware.
4.	Improve their presentation skill, communication skill

Course Contents

The main aim of this course is to demonstrate the important attributes like critical thinking, creativity, collaborative efforts and communication skills in students.
The aim is also to make students aware with the process involved in making product from idea.
Not more than two students may carry out the minor project together.
One supervisor from the department shall be assigned five project batches of the minor project.
The project may be related to electrical engineering or may be interdisciplinary.

The steps involved for completion of minor project includes, but not limited to:
1. Conceptualization of innovative idea through literature and market survey; sight visits; interaction with community or industry, socio-economic survey etc.
2. Design of product, processes, methods and systems using multidisciplinary knowledge
3. Fabrication of product, development of software, measurement methods etc.
4. Deployment, implementation and demonstration of project.
5. Presentation of project

(For purchase of consumables required for completion of project, every project batch shall receive funding from institute with maximum limit decided by BOM)

List of Submission
1 Working model of the project
2 Project Report
3 Presentation and demonstration of project in exhibition

Teaching Load

One supervisor from the department shall be assigned five project batches of the minor project. The weekly load for the supervisor is 2Hr/week

EE2510

Government College of Engineering, Karad
Third Year (Sem – V) B. Tech. Electrical Engineering
EE 2510: Mini Project

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Identify community needs
2.	Covert idea into product
3.	Demonstrate project model to meet desired result using suitable software and hardware.
4.	Improve their presentation skill, communication skill

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2		1	1	2	2	3	3	2	2	2	3
CO 2	3	2	2	1	2	3		2	3	3	3		2
CO 3	3	1	1	2	3	2	1	2	2	3	3	2	3
CO 4	2	2	2	1	1	1			2	3	1		3

Assessment Pattern

The continuous assessment shall be done by the supervisor based on attributes like critical thinking, creativity, collaborative efforts and communication skills in students. The end semester assessment shall be done by external referee one week before the term end. The department shall arrange exhibition (all department will arrange the exhibition on same day) of the minor projects done by students and the referee will judge the project work in accordance with the outcomes of the course by interacting with students and marks will be awarded to individual student. This exhibition will remain open for all students, parents, and other citizens visiting the exhibition.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember				
Understand				
Apply			10	10
Analyse			10	10
Evaluate			5	5
Create				
TOTAL			25	25

Government College of Engineering, Karad				
Third Year (Sem –V) B. Tech. Electrical Engineering				
EE 2511: Technical Training & Technical Presentation				
Teaching Scheme			**Examination Scheme**	
Practical	--		CT1	--
Tutorials	1 Hr/week		CT2	--
Total Credits	1		TA/CA	25
			ESE	25
			Duration of ESE	1 hr.

Course Outcomes	
1.	Student will be familiar with Industrial Environment.
2.	Student will be aware of recent trends and technologies used in industry
3.	Student will be able communicate with their colleagues, superiors and subordinates in industry.
Course Contents	
	Students will undergo four weeks industrial training in industry of their interest during Summer vacation. They will prepare report on it and make presentation before their classmates and teachers in first semester of Final Year of B. Tech. The training report with certificate of industry will be submitted to department.

EE2511

Government College of Engineering, Karad
Third Year (Sem – V) B. Tech. Electrical Engineering
EE 2511: Technical Training & Technical Presentation

Mapping of COs and POs

Course Outcomes (CO)	
Student will be	
1.	Familiar with Industrial Environment.
2.	Aware of recent trends and technologies used in industry
3.	Able communicate with their colleagues, superiors and subordinates in industry.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2		1	1	2	2	3	3	2	2	2	3
CO 2	3	2	2	1	2	3		2	3	3	3		2
CO 3	3	1	1	2	3	2	1	2	2	3	3	2	3
CO 4	2	2	2	1	1	1			2	3	1		3

Assessment Pattern

Knowledge Level	CT 1	CT 2	CA	ESE
Remember				
Understand			5	5
Apply			10	10
Analyse			10	10
Evaluate				
Create				
TOTAL			25	25

Government College of Engineering, Karad

Third Year (Sem. – VI) B. Tech. Electrical Engineering

EE 2601 : Economics for Engineers

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	To acquaint elementary principles of economics
2.	To understand public sector economics
3.	To acquaint Indian economic development in post Independent era.
4.	To acquaint with standard concepts and tools of economics useful in engineering profession

	Course Contents	Hours
Unit 1	**Basic Principles and Methodology of Economics**: Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes	**(11)**
Unit 2	**Project Management and Value Engineering** Types of projects, appraisal, structure Types of production systems, productivity, Types of values, Value Analysis, Time value of money Project evaluation	**(5)**
Unit 3	**Public Sector Economics**–Welfare, Externalities, Labor Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve. **Electricity Market**: Mechanism of energy markets; comparative market systems; determination of prices under different market structures	**(8)**
Unit 4	**Elements of Business/Managerial Economics and forms of organizations**. Cost & Cost Control –Techniques, Types of Costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money. Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method	**(8)**
Unit 5	**Indian economy Brief overview of post-independence period**– plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors	**(8)**
Unit 6	Tendering and Bidding procedures	**(8)**

Text Books

1.	Pravin Kumar(2015), Fundamentals of Engineering Economics, Wiley Precise Text book Series
2.	V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill
3.	Misra, S.K. and Puri (2009), Indian Economy, Himalaya

Reference Books

1.	Pareek Saroj (2003), Textbook of Business Economics, Sunrise Publishers
2.	Mankiw Gregory N.(2002), Principles of Economics, Thompson Asia

EE2601

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2601 : Economics for Engineers

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	To acquaint elementary principles of economics
2.	To understand public sector economics
3.	To acquaint Indian economic development in post Independent era.
4.	To acquaint with standard concepts and tools of economics useful in engineering profession

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	2	1	2	3							2
CO 3	3	1	1	2	3	2	1					2	3
CO 4	3	1	2	1	1	1							3

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	20
Evaluate	5	5	4	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Electrical Engineering

EE 2602: Internet of Things

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Understand impact of IOT in engineering applications.
2.	Select appropriate sensors and network components for given application
3.	Design and develop IOT Systems for given application
4.	Use cloud computing and data analytics for interpretation of collected data

	Course Contents	Hours
Unit 1	**IOT Introduction and Fundamentals:** Deciphering the term IOT, Applications where IOT can be deployed, Benefits/challenges of deploying an IOT. IOT components: Sensors, front-end electronics (amplifiers, filtering, and digitization), digital signal processing, data transmission, choice of channel (wired/wireless), back-end data analysis. Understanding packaging and power constraints for IOT implementation	**(4)**
Unit 2	**Signals, Sensors, Actuators, Interfaces:** Sensors: types, signal types, shape and strength, Sensor non-idealities: Sensitivity and offset drift, noise, minimum detectable signal, non-linearity, Read-out circuits: Instrumentation-amplifier, SNR definition, noise-bandwidth-power trade-off, Circuit component mismatch and mitigation techniques (calibration, chopping, auto zeroing etc.), Power/energy considerations, Basic signal processing (filtering, quantization, computation, storage)	**(08)**
Unit 3	**Networking and Cloud Computing in IOT**: Review of Communication Networks, Challenges in Networking of IOT Nodes, range, Bandwidth, Machine-to-Machine (M2M) and IOT Technology Fundamentals, Medium Access Control (MAC) Protocols for M2M Communications, Standards for the IOT, Basics of 5G Cellular Networks and 5G IOT Communications, Low-Power Wide Area Networks (LPWAN) Wireless communication for IOT: channel models, power budgets, data rates,IOT Security and Privacy, MQTT Protocol, Publisher and Subscriber Model, Cloud computing platform (open source) and local setup of such environment, Embedded software relevant to microcontroller and IOT platforms (enterprise or consumer), user interfaces.	**(10)**
Unit 4	**Data Analysis for IOT applications:** Statistics relevant to large data, Linear regression, Basics of clustering, classification.	**(6)**
Unit 5	**Security, Privacy & Trust:** IOT security challenge, Spectrum of security considerations, Unique security challenges of IOT devices, Internet of things privacy background, Unique privacy aspects of internet of things, Trust for IOT.	**(6)**
Unit 6	**Case studies Illustrating IOT design:** Home automation: Smart lighting, Home intrusion detection, Cities: Smart parking, smart logistics and transportation Agriculture: Smart irrigation, Electrical Engineering: Smart grid. Remote metering and monitoring. Energy management	**(6)**

Text Books

1.	Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", UniversitiesPress (India) Private Limited, 2016, ISBN: 978 81 7371 954 7

2.	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, StamatisKarnouskos, Stefan Avesand&David Boyle "From Machine-to-Machine to the Internet of Things", Academic Press,Elsevier, 2014, ISBN: 978-0-12-407684-6
Reference Books	
1.	Karen Rose, Scott Eldridge, Lyman Chapin, "The Internet of Things: An Overview", Internet Society, 2015
2.	Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014, ISBN 978-1-118-43062-0
3.	Daniel Kellmereit, "The Silent Intelligence: The Internet of Things", 2013, ISBN 0989973700
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2.	https://www.coursera.org/specializations/iot
3.	https://nptel.ac.in/courses/106/105/106105166/

EE2602

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2602 : Internet Of Things

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Understand impact of IOT in engineering applications.
2.	Select appropriate sensors and network components for given application
3.	Design and develop IOT Systems for given application
4.	Use cloud computing and data analytics for interpretation of collected data

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	1	2	2	0	3	3	3	0	0	3	3	3
CO 2	1	3	3	3	3	2	1	3	3	3	2	3	3
CO 3	2	3	3	3	3	2	1	3	3	3	2	3	3
CO 4	2	3	3	3	3	2	1	3	3	3	2	3	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember	2	2	1	5
Understand	2	2	1	10
Apply	3	3	2	10
Analyse	3	3	2	10
Evaluate	3	3	2	10
Create	2	2	2	15
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Electrical Engineering

EE 2603 : Elective II - HVDC Transmission

Teaching Scheme		Examination Scheme	
Lectures	03Hrs/week	CT – 1	15
Tutorials	--	CT – 2	15
Total Credits	03	TA	10
		ESE	60
		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Analyze the operation of Line Commutated Converters and Voltage Source Converters..
2.	Apply the control strategies used in HVdc transmission system.
3.	Evaluate the improvement of power system stability using an HVdc system.
4.	Compare the advantages of dc transmission over ac transmission.

	Course Contents	Hours
Unit 1	**DC Transmission Technology:** Comparison of AC and dc Transmission (Economics, Technical Performance and Reliability). Application of DC Transmission. Types of HVDC Systems. Components of a HVDC system. Line Commutated Converter and Voltage Source Converter based systems..	**(4)**
Unit 2	**Analysis of Line Commutated and Voltage Source Converters:** Line Commutated Converters (LCCs): Six pulse converter, Analysis neglecting commutation overlap, harmonics, Twelve Pulse Converters. Inverter Operation. Effect of Commutation Overlap. Expressions for average dc voltage, AC current and reactive power absorbed by the converters. Effect of Commutation Failure, Misfire and Current Extinction in LCC links. Voltage Source Converters (VSCs): Two and Three-level VSCs. PWM schemes: Selective Harmonic Elimination, Sinusoidal Pulse Width Modulation. Analysis of a six pulse converter. Equations in the rotating frame. Real and Reactive power control using a VSC.	**(10)**
Unit 3	**Control of HVdc Converters:** Principles of Link Control in a LCCHVdc system. Control Hierarchy, Firing Angle Controls – Phase-Locked Loop, Current and Extinction Angle Control, Starting and Stopping of a Link. Higher level Controllers Power control, Frequency Control, Stability Controllers. Reactive Power Control. Principles of Link Control in a VSC HVdc system: Power flow and dc Voltage Control. Reactive Power Control/AC voltage regulation.	**(10)**
Unit 4	**Components of HVDC Systems:** Smoothing Reactors, Reactive Power Sources and Filters in LCC HVdc systems DC line: Corona Effects. Insulators, Transient Over-voltages. dc line faults in LCC systems. dc line faults in VSC systems. dc breakers. Monopolar Operation. Ground Electrodes.	**(8)**
Unit 5	**Stability Enhancement using HVdc Control:** Basic Concepts: Power System Angular, Voltage and Frequency Stability. Power Modulation: basic principles – synchronous and asynchronous links. Voltage Stability Problem in AC/dc systems.	**(4)**
Unit 6	**MTDC Links:** Multi-Terminal and Multi-Infeed Systems. Series and Parallel MTdc systems using LCCs. MTdc systems using VSCs. Modern Trends in HVdcTechnology. Introduction to Modular Multi-level Converters.	**(4)**

Text Books

1. K. R. Padiyar, “HVDC Power Transmission Systems”, New Age International Publishers, 2011.
2. E. W. Kimbark, “Direct Current Transmission”, Vol.1, Wiley-Interscience, 197

Reference Books

1. J. Arrillaga, “High Voltage Direct Current Transmission”, Peter Peregrinus Ltd., 1983

Useful Links

1.	https://nptel.ac.in/courses/117/106/117106034/
2.	https://nptel.ac.in/courses/108108076/
3.	https://nptel.ac.in/courses/108105062/

EE2603

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2603 : Elective II - HVDC Transmission

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Analyse the operation of Line Commutated Converters and Voltage Source Converters..
2.	Apply the control strategies used in HVdc transmission system.
3.	Evaluate the improvement of power system stability using an HVdc system.
4.	Compare the advantages of dc transmission over ac transmission..

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	2	1	2	3							2
CO 3	3	1	1	2	3	2	1					2	3
CO 4	2	2	2	1	1	1							3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember				
Understand				
Apply			10	10
Analyse			10	10
Evaluate			5	5
Create				
TOTAL			25	25

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Electrical Engineering

EE 2613 : Elective II- Electrical Utilization and Traction

Teaching Scheme		Examination Scheme	
Lectures	03Hrs/week	CT – 1	15
Tutorials	--	CT – 2	15
Total Credits	03	TA	10
		ESE	60
		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	select the type and rating of motor for a particular industrial application.
2.	design lighting schemes for indoor and outdoor lighting.
3.	analyse the moment of trains and their energy consumption by means of speed-time curves.
4.	analyse the performance parameters of the traction system.

	Course Contents	Hours
Unit 1	**Industrial Utilization of Electric Motors**: Factors governing selection of motors, nature of mechanical load and matching of speed-torque characteristics of load and motor, selection and rating of drive, starting condition of the load and calculation of starting time for motors, load equalization, applications of electric motors in textile mills, cranes, lifts, excavators, pumps, refrigeration and air conditioning. Control devices for industrial motors: pilot devices - push buttons, limit switches, proximity switches, pressure switches, thermostats, output devices - contactor, relays and solenoid valves, single line diagrams using these devices.	**(8)**
Unit 2	**Electrolytic Processes**: Faraday's laws of electrolysis, applications of electrolysis – electroplating, anodizing, electro-deposition, electro-polishing, electro-extraction, electro-facing, power supply for electrolytic processes.	**(4)**
Unit 3	**Illumination:** Terms used in illumination, laws of illumination, measurement of illumination, classification of light fittings and luminaries, types of lighting schemes, factors to be considered for design of indoor and outdoor lighting schemes, street lighting and floodlighting.	**(6)**
Unit 4	**Electric Heating and Welding:** Classification of electric heating methods, resistance heating, design of heating element, arc furnaces, arc furnaces, induction heating, high frequency eddy current heating, dielectric heating. Electric welding: resistance welding, electric arc welding, ultrasonic welding, electron beam welding, laser beam welding, requirements of good weld, electric welding equipment.	**(8)**
Unit 5	**Electric Traction-I:** Systems of electric traction, systems of track electrification, typical speed-time curves, crest speed, average speed, schedule speed, factors affecting schedule speed, mechanics of train movement, tractive effort for propulsion of train, factors affecting specific energy consumption, dead weight, accelerating weight and adhesive weight.	**(7)**
Unit 6	**Electric Traction-II:** General features of traction motors, suitable motors for traction, starting and speed control of DC and AC traction motors, power supply for electric traction, current collection system, current collectors for overhead system, power supply arrangement for AC and DC track electrification.	**(7)**

Text Books

1. J. B. Gupta, "Utilization of Electrical Power and Electric Traction", S. K. Kataria and Sons, 10th edition 2012, Reprint 2018.

Reference Books

1. E. Openshaw Taylor, "Utilization of Electric Energy", Orient Longman, Edition 1971, Reprint 2006.

2.	N. V. Suryanarayana, “Utilization of Electric Power”, New Age International Publishers, 1st Edition 1994, Reprint 2005.
3.	H. Partab, “Art and Science of Utilization of Electrical Energy”, DhanpatRai and Sons, 2014.
Useful Links	
1.	https://nptel.ac.in/courses/108/105/108105060/

EE2613

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2613 :Elective II- Electrical Utilization and Traction

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	select the type and rating of motor for a particular industrial application.
2.	design lighting schemes for indoor and outdoor lighting.
3.	analyse the moment of trains and their energy consumption by means of speed-time curves.
4.	analyse the performance parameters of the traction system.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	3	1	2	3	1					2	3
CO 3	3	2	2	2	3	2	1					2	3
CO 4	2	2	2	1	2	1							3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	20
Evaluate	5	5	4	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Electrical Engineering

EE 2623 : Elective II - Special Electrical Machines

Teaching Scheme		Examination Scheme	
Lectures	03Hrs/week	CT – 1	15
Tutorials	--	CT – 2	15
Total Credits	03	TA	10
		ESE	60
		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	To understand concept of special purpose machines and their industrial applications
2.	To set a firm and solid foundation in Electrical machines with strong analytical skills and conceptual understanding of analytical methods in special electrical Machines.
3.	To make students aware of protective system with industry oriented learning.

	Course Contents	Hours
Unit 1	Constructional features of Synchronous Reluctance Motor,-- Types, Axial & Radial flux motors, Operating principles, Variable Reluctance Motors, Voltage & Torque equations, Phasor diagram, Performance characteristics.	**(6)**
Unit 2	Constructional features of Stepper Motors,--principle of operation, variable reluctance motor, Hybrid motor, single & multistack configurations, Torque equations, Modes of excitation, characteristics, drive circuits, Microprocessor control of steppermotors, closed loop control, concept of lead angle.	**(6)**
Unit 3	Constructional features of Switched Reluctance Motor(SRM),-- Rotary & linear SRM, principle of operation, Torque production, steady state performance prediction, Analytical methods, power converters & their controllers, Methods of rotor position sensing, Sensorless operation, characteristics & closed loop control .	**(6)**
Unit 4	Permanent magnet brushless dc motors, Permanent magnet materials, hysteresis loop, Magnetic characteristics, permeance coefficient, principle of operation, Types, Magnetic circuit analysis, EMF & Torque equations,Commutation, power converter circuits & their controllers,Motor characteristics &control.	**(8)**
Unit 5	Permanent magnet synchronous motors(PMSM),principle of operation, EMF & Torque equations, Armature MMF, Synchronous reactance, sine wave motor with practical windings,phasor diagram, Torque/speed characteristics, power controllers, converter volt ampere requirement.	**(6)**
Unit 6	Industrial Applications: Synchronous Reluctance Motors, Stepper Motors, Switched Reluctance Motor, Permanent magnet brushless dc motors, Permanent magnet synchronous motors.	**(8)**

Text Books

1.	K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008
2.	T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press,Oxford, 1989.
3.	T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

Reference Books

1.	R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design andApplication', CRC Press, New York, 2001.
2.	P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter PerengrinusLondon, 1982.
3.	T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4.	E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi,2014. Permanent Magnet Synchronous & Brushless DC Motordrives,R.Krishnan, CRC Press.

Useful Links

1.	www.ocw.mit.edu
2.	www.nptel.iitm.ac.in (Video courses on Special Electrical Machines.)

EE2623

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE2623 : Elective II - Special Electrical Machines

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	To understand concept of special purpose machines and their industrial applications
2.	To set a firm and solid foundation in Electrical machines with strong analytical skills and conceptual understanding of analytical methods in special electrical Machines.
3.	To make students aware of protective system with industry oriented learning.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	3	1	2	3	1					2	3
CO 3	3	2	2	2	3	2	1					2	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	20
Evaluate	5	5	4	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Electrical Engineering

EE 2604: Power Electronics

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	--		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Apply the basic knowledge of Power Electronics for practical implementation.
2.	Analyse switching circuits & gate drive circuits for control of power switches.
3.	Evaluate functioning and design process of various Power Electronics converters.

	Course Contents	Hours
Unit 1	**Introduction:** Applications of Power Electronics in various sectors, Power Electronics Structure (how it differs from low power analog electronics) **Power Electronics Switches:** Basic construction, characteristics, commercial ratings, integrated power modules (IPM), study of modules / power switches available in commercial market.	**(04)**
Unit 2	**Analysis of switching circuits**, **Gate Drive Circuits:** Requirements of gate drive, Gate drive circuits for various power switches (transistor, MoSFET, IGBT etc), study of gate drivers available in commercial market	**(04)**
Unit 3	**Uncontrolled Rectifiers:** 1-ph, 3-ph, rectifiers, control techniques, analysis with R-L-E load, numerical, applications in practice **Controlled Rectifiers:** 1-ph, 3-ph, rectifiers, control techniques, analysis with R-L-E load, numerical, applications in practice **Multipulse (12, 18, 24 pulse) rectifiers & its controls**, **Dual Converters**, applications of various converters in practice **Effect of source impedance on performance of converters**.	**(12)**
Unit 4	**Non-isolated DC-DC Converters:** Buck, Boost, Buck-Boost, Cuk converters and analysis, Introduction to modified DC-DC converters **Isolated DC-DC Converters,** Applications of DC-DC converters in practice **Introduction:** Modified DC-DC converters	**(06)**
Unit 5	**AC-AC Converters:** 1-ph, 3-ph converters, control techniques, applications, introduction to matrix converters	**(02)**
Unit 6	**DC-AC Converters:** Classifications of inverters, 1-ph, 3-ph VSI and CSI, Control (modulation) techniques of VSI (e.g., SPWM, SVPWM, Simple Harmonic Elimination etc.) **Introduction to Multilevel inverters (MLI) and control techniques (SPWM)**	**(14)**

Text Books

1. Power Electronics: Circuits Devices and Applications, M. H. Rashid, 3rd Edition, Pearson / Prentice Hall Publications
2. Power Electronics Converters, Applications and Design, Ned Mohan, 3rd edition, Jonh Wiley and Sons.

Reference Books

1. Power Electronics: Principles and Applications, Joseph Vithayathil, McGraw Hill Publication, 2010
2. Power Electronics, Cyril W. Lander, 3rd Edition McGraw Hill publication.
3. High Power Converters and AC Drives, Bin Wu, IEEE press, Wiley interscience, Jonh Wiley and Sons Inc. Pub.
4. Pulse Width Modulation for Power Converters: Principles and Practice, D. G. Holmes, Thomas A. Lipo, IEEE press, Wiley interscience, Jonh Wiley and Sons Inc. Pub.

Useful Links

1. https://nptel.ac.in/courses/108/101/108101038/ (Prof. B. G. Fernandes)

2.	https://nptel.ac.in/courses/108/102/108102145/ (Prof. G. Bhuvaneshwari)
3.	https://nptel.ac.in/courses/108/101/108101126/ (Prof. L. Umanand)
4.	https://nptel.ac.in/courses/108/107/108107128/ (Prof. Avik Bhattacharya)

EE2604

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2604 :Power Electronics

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Apply the fundamentals of Power Electronics for practical implementation of PE (converter) applications.
2.	Analyse switching circuits & gate drive circuits for control of power switches.
3.	Evaluate functioning and design process of various Power Electronics converters.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	1	3	2	1			1				2	3
CO 2	3	2	3	3			2					3	3
CO 3	3	3	3	3	3	2	1	2		1		3	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember	8	-	2	10
Understand	7	5	2	10
Apply	-	10	2	20
Analyse	-	-	2	10
Evaluate	-	-	2	10
Create	-	-	-	-
TOTAL	15	15	10	60

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Electrical Engineering

EE 2605 : Electrical Machine Design

Teaching Scheme		Examination Scheme	
Lectures	03Hrs/week	CT – 1	15
Tutorials	--	CT – 2	15
Total Credits	03	TA	10
		ESE	60
		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Analyse the effect of design parameters on performance of electrical machines
2.	Evaluate the performance parameters of static and dynamic electric machines
3.	Design different parts of AC &DC machine.

	Course Contents	Hours
Unit 1	**Concept of computer-aided design:** Introduction, Computer Aided Design, Explanation of details of flow chart, Input data to be fed into the program, Applicable constraints Max or Minimum permissible limits, Output data to be printed after execution of program, Various objective parameters for optimization in an electrical machine, Selection of optimal design, Explanation of lowest cost and significance of "Kg/KVA", Flowcharts	**(8)**
Unit 2	**Fundamental aspects of electrical machine design:** Introduction, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques. Output coefficient, Importance of specific loadings, Electrical Materials: Conducting Materials, Desirable Properties, Insulating Materials and Magnetic Materials; Magnetic circuit calculations	**(6)**
Unit 3	**Design of dc machines:** Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Dimensions of Yoke, Main Pole and Air Gap. Design of Shunt and Series Field Windings.	**(6)**
Unit 4	**Design of transformers:** Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, No Load Current. Expression for the Leakage Reactance of core type transformer with concentric coils, and calculation of Voltage Regulation. Design of Tank and Cooling (Round and Rectangular) Tubes.	**(8)**
Unit 5	**Design of three phase induction motors:** Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring. Design of Slip Ring rotor. Estimation of No Load Current and Leakage Reactance.	**(8)**
Unit 6	**Computer aided design of dc machines& transformer:** Introduction; Flowcharts and programs for computer aided design of DC machines& Transformer. 2D FEM open source software-based DC machine& Transformer part design	**(6)**

Text Books

1. A K Sawhney, " A Course in Electrical Machine Design", Dhanpatrai and sons, Delhi.
2. K M Vishnu Murthy, Computer Aided Design of Electrical Machines, BS Publication.

Reference Books

1. M. V. Deshpande, "Design and Testing of Electrical Machines", Wheeler Publishing.
2. R. K. Agarwal, "Principles of Electrical Machine Design", Essakay Publications, Delhi.

3.	Ramamoorthy M, “Computer Aided Design of Electrical Equipment”, East-West Press.
4.	M. N. O. Sadiku, “ Numerical techniques in Electromagnetics”, CRC Press Edition-2001

Useful Links			
1.	NPTEL MOOC Course - Electrical Equipment and Machines: Finite Element Analysis (Lectures 23 to 40): https://nptel.ac.in/courses/108/101/108101167/		

EE2605

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2605 : Electrical Machine Design

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Analyze the effect of design parameters on performance of electrical machines
2.	Evaluate the performance parameters of static and dynamic electric machines
3.	Design different parts of AC & DC machine.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	3	2	3	3	2	2					2	3
CO 2	3	3	3	3	2	3	3					2	3
CO 3	3	3	2	2	3	2	3					2	3

Assessment Pattern

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	20
Evaluate	5	5	4	20
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Electrical Engineering				
EE 2606: Internet of Things Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	--
Tutorials	---		CT – 2	--
Practical	02 Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 hrs

Course Outcomes (CO)	
Student will be able to	
1.	Understand interfacing of sensors and actuators for IOT systems
2.	Program the microcontroller assembly using appropriate tool
3.	Use communication interface to transfer and receive data from storage devices and cloud
4	Design the IOT system for given application

	Experiments	
Experiment 1	Study of IOT (Microcontroller) Arduino/ STM and R'pi.	
Experiment 2	Study of different types of sensors, actuators, transducers.	
Experiment 3	Experiment based on IR sensor. Write an application to detect obstacle and notify user using LED.	
Experiment 4	Experiment based on FIRE sensor. Write an application to detect Fire and notify users using LED.	
Experiment 5	Experiment based on Ultrasonic sensor. Write an application to find out distance between obstacles.	
Experiment 6	Experiment based on DHT11 (Temperature and humidity) sensor. Write an application to find out the temperature and humidity.	
Experiment 7	Experiment based on interfacing to control the operation of stepper motor remotely	
Experiment 8	Create a simple web interface to control the connected LEDs remotely through the interface.	
Experiment 9	Control the operation of elevator operations.	
Experiment 10	Study and implement clustering and configuring devices using MPI library.	
Experiment 11	Implement a mini project in any one of the application from the following domains: (Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities: Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, Environment: Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection, Energy: Smart Grids, Renewable Energy Systems, Prognostics, Retail: Inventory Management, Smart Payments, Smart Vending Machines, Logistics - Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics, Agriculture: Smart Irrigation, Green House Control, Industry: Machine Diagnosis & Prognosis, Indoor Air Quality, Monitoring, Health and Lifestyle: Health and Fitness Monitoring.)	

EE2606

Government College of Engineering, Karad
Second Year (Sem – VI) B. Tech. Electrical Engineering
EE 2606 : Internet Of Things Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Understand interfacing of sensors and actuators for IOT systems
2.	Program the microcontroller assembly using appropriate tool
3.	Use communication interface to transfer and receive data from storage devices and cloud
4.	Design the IOT system for given application

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	1	2	2	0	3	3	3	0	0	3	3	3
CO 2	1	3	3	3	3	2	1	3	3	3	2	3	3
CO 3	2	3	3	3	3	2	1	3	3	3	2	3	3
CO4	2	3	3	3	3	2	1	3	3	3	2	3	3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember			3	
Understand			2	
Apply			5	10
Analyse			5	5
Evaluate			5	5
Create			5	5
TOTAL			25	25

Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Electrical Engineering				
EE 2607:Power Electronics Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	--
Tutorials	---		CT – 2	--
Practical	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 hrs

Course Outcomes (CO)	
Student will be able to	
1.	Simulate converter circuits and analyse its performance.
2.	Build his/her own simple converter circuit in the laboratory and test the same.

	Experiments	
Experiment 1	Study & verification of Power Switching devices characteristics	
Experiment 2	Study of Gate Drive circuits for various power switching devices and analyse one of the circuits.	
Experiment 3	MATLAB simulation and verification of performance parameters of 1-ph diode rectifiers.	
Experiment 4	MATLAB simulation and verification of performance parameters of 3-ph diode rectifiers.	
Experiment 5	Power factor improvement test using MATLAB Simulink and verification of performance parameters of 1-ph controlled rectifiers.	
Experiment 6	Performance parameters verification of 3-ph controlled rectifiers.	
Experiment 7	MATLAB simulation and verification of performance parameters of non-isolated DC-DC converters.	
Experiment 8	MATLAB simulation and verification of performance parameters of isolated DC-DC converters.	
Experiment 9	Study of 1-ph and 2-ph cycloconverters.	
Experiment 10	MATLAB Simulink study of voltage source inverters and comparative study of control techniques.	
Experiment 11	MATLAB Simulink study of multilevel inverters. (3-level, 5-level)	
Task	Group of students shall be assigned a task to build some converter circuit in the laboratory and test the same.	

- Minimum eight experiments covering all the types of converters shall be simulated using MATLAB Simulink.
- Students shall also build converter prototype in the laboratory, test the same and analyse its performance.
- Students shall be guided to use advanced equipment (like oscilloscope) required for analysis & record of power electronics circuits.

EE2607

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2607:Power Electronics Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Simulate converter circuits and analyse its performance.
2.	Build his/her own simple converter circuit in the laboratory and test the same.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1		2	3	3	3		1					1	3
CO 2		3	3	3	3	2	1					2	3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember				
Understand				
Apply			10	10
Analyse			10	10
Evaluate			5	5
Create				
TOTAL			25	25

Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Electrical Engineering				
EE 2608 : Electrical Machine Design Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	-
Tutorials	---		CT – 2	-
Practical	02Hrs/week		CA	50
Total Credits	01		ESE	50
			Duration of ESE	3 hrs

Course Outcomes (CO)	
Student will be able to	
1.	Develop step by step procedure for design of AC & DC Machines.
2.	Apply optimization techniques for design of electrical machine.
3.	Use GUI in machine design.

	Experiments	
Experiment 1	Prepare a flow chart and computer program for optimum design of a small transformer with given specifications and constraints. Use of GUI (Graphical User Interface) may be a better choice.	
Experiment 2	Prepare a flow chart and computer program for optimum design of starter for a DC motor with given specifications and constraints.	
Experiment 3	Prepare a flow chart and computer program for optimum design of field regulator for a DC motor with given specifications and constraints.	
Experiment 4	Prepare a flow chart and computer program for optimum design of a choke coil with given specifications and constraints	
Experiment 5	Prepare a flow chart and computer program for optimum design of a distribution transformer with given specifications and constraints. Use of GUI may be a better choice.	
Experiment 6	Prepare a flow chart and computer program for optimum design of a power transformer with given specifications and constraints. Use of GUI may be a better choice	
Experiment 7	Prepare a flow chartand computer program for optimum design of a DC motor to be used for industrial applications with given specifications and constraints. Use of GUI may be a better choice	
Experiment 8	Prepare a flow chart and computer program for optimum design of a smallDC motor to be used for a lab with given specifications and constraints	

EE2608

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2608 : Electrical Machine Design Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Develop step by step procedure for design of AC & DC Machines.
2.	Apply optimization techniques for design of electrical machine.
3.	Use GUI in machine design.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	3	2	3	1	2	2					2	3
CO 2	3	3	2	3	2	3							3
CO 3	3	3	3	2	3	2	1					2	3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember				
Understand				
Apply			20	20
Analyse			15	15
Evaluate			15	15
Create				
TOTAL			50	50

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Electrical Engineering

EE2609: Electrical Workshop Lab

Teaching Scheme			Examination Scheme	
Lectures	---		CT – 1	-
Tutorials	---		CT – 2	-
Practical	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 hrs

Course Outcomes (CO)

Student will be able to

1.	understand working of electrical appliances.
2.	construct small electrical circuits.
3.	handle different tools used in electrical circuit building and repair.

Course Contents

Students are expected to choose small electrical circuits, built them and test them. They are also expected to find faults in circuits built by them. Also students are expected to open electrical appliances and find fault in it. The repair of electrical appliances is expected during lab session.

EE2609

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE2609: Electrical Workshop Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	understand working of electrical appliances.
2.	construct small electrical circuits.
3.	handle different tools used in electrical circuit building and repair.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	2	2	1	2	2	2		1			2	3
CO 2	3	3	3	2	3	3	1	2	2	2	2		3
CO 3	3	3	2	2	3	2	1	3	3	3	1	2	3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember			04	04
Understand			04	04
Apply			05	05
Analyse			04	04
Evaluate			03	03
Create			05	05
TOTAL			25	25

Government College of Engineering, Karad

Third Year (Sem – VI) B. Tech. Electrical Engineering

EE 2610: Technical Presentation

Teaching Scheme			Examination Scheme	
Lectures	---		CT – 1	-
Tutorials	01Hr/week		CT – 2	-
Practical	--		CA	25
Total Credits	01		ESE	25
			Duration of ESE	1 hrs

Course Outcomes (CO)

Student will be

1.	Familiar with technical issues.
2.	Able improve presentation skills .
3.	Able to improve communication skills and stage daring.

Course Contents

Students will select any technical topic of their interest irrespective of branch. He/She will do literature survey. Collect detail information about topic and make presentation before all students of class and in-charge faculty. He/She is supposed to submit spiral bound report of his presentation.

EE2610

Government College of Engineering, Karad
Third Year (Sem – VI) B. Tech. Electrical Engineering
EE 2610: Technical Presentation

Mapping of COs and POs

Course Outcomes (CO)	
Student will be	
1.	familiar with technical issues.
2.	able improve presentation skills .
3.	able to improve communication skills and stage daring.

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	2	1	1	2	2	2		2	1		2	3
CO 2	2	1	1	2	3	1	1	2	2	2	1		3
CO 3	1			2	3	2	1	3	2	3	1	2	3

Assessment Pattern

1. Assessment for laboratory work will be based on skills acquired by students during the course.
2. Continuous Assessment Sheet (CAS) will be maintained for each student.

Knowledge Level	CT 1	CT 2	CA	ESE
Remember			05	05
Understand			05	05
Apply			05	05
Analyse			05	05
Evaluate			05	05
Create				
TOTAL			25	25

Semester V

Sr. No.	Course code Course title	Course Outcomes Student Will be able to:
1	EE2501: Microcontroller	1. Develop algorithm to perform the task
		2. Select appropriate peripherals to develop digital system
		3. Select suitable microcontroller for given application and program it
		4. Design and develop suitable microcontroller based system for given application
2	EE 2502 : Electrical Machines-II	1. To familiarize students with the concept of AC machines and their industrial applications
		2. To set a firm and solid foundation in Electrical machines with strong analytical skills and 3. Conceptual understanding of analytical methods in A.C. Machines.
		4. To make students aware of protective system with industry oriented learning.
3	EE2503 : Power System-II	1. Obtain the power flow solution of an interconnected power system.
		2. Analyse a power system network under symmetrical and unsymmetrical fault conditions.
		3. Explain the power system stability and factors affecting on transient stability
		4. Discuss the technical and economic advantages of dc systems over ac systems.
4	EE2504: Control System	1. Model and represent the physical systems mathematically. (I)
		2. Analyze and formulate the given system in time and frequency domain.(II,III,IV)
		3. Design the controller for given system.(V)
		4. Estimate the parameters of given continuous time system using state space approach.(VI)
5	EE 2505 : Elective I-EHVAC Transmission	1. Identify and evaluate transmission line parameters
		2. Articulate the concept of modes of propagation and corona effects
		3. Identify causes of over-voltages and methods of protection
		4. Evaluate the effects travelling waves and standing waves
6	EE 2515 : Electromagnetics	1. Apply mathematical techniques to interpret electromagnetic phenomenon.
		2. Apply advanced mathematical techniques to solve electromagnetic problems.
		3. Articulate electromagnetic phenomenon and apply appropriate mathematical modelling techniques to design electromagnetic systems.
		4. Identify sources of error in the solution process..
7	EE 2525 : Optimization Techniques	1. Develop different types of algorithms for solving various types of optimization problems using SCILAB/MATLAB.
		2. Enumerate the fundamental knowledge of Linear Programming and Nonlinear Programming problems
		3. Apply knowledge of optimization to formulate and solve real world engineering problems.
		4. Solve a multi-objective problem through weighted and constrained methods and acquire an idea about the various direct and indirect search methods.
8	EE2506: Microcontroller Lab	1. Write assembly as well as c programs for microcontroller
		2. Design delays using timers in 8051
		3. Interface ADC,DAC, LCD, LED, Keyboard, Stepper motor, DC motor etc. with 8051
		4. Differentiate between microprocessor and microcontroller
9	EE 2507: Electrical Machines-II Lab	1. Make appropriate connections for testing of AC machines
		2. Deduce conclusions about the performance using obtained readings
		3. Calculate regulation and efficiency of single and three phase machines
		4. To select appropriate AC machines for the application
10	EE 2508: Power System-II Lab	1. Formulate the YBUS matrix for given power system network.
		2. Construct standard power system network and apply load flow techniques.
		3. Analyze the faulty system for stable operation of the power system.
		4. Analyze rectifier circuits using software tool
11	EE 2509 : Software Lab II	1. Comprehend the basics of ANSYS software and practical implementation of the fundamentals.
		2. Solve the basic Maxwell 2D & 3D models for magnetostatic,electrostatic,eddy current & transient solvers to fundamental electrical engineering design problems.
		3. Create models and simulate using PSIM
		4. Develop real time scenario for Modelling renewable sources and interfacing software with real model data acquisition
12		1. Identify community needs.

	EE 2510: Mini Project	2. Covert idea into product
		3. Demonstrate project model to meet desired result using suitable software and hardware.
		4. Improve their presentation skill, communication skill
13	EE 2511: Technical Training & Technical Presentation	1. Student will be familiar with Industrial Environment.
		2. Student will be aware of recent trends and technologies used in industry
		3. Student will be able communicate with their colleagues, superiors and subordinates in industry.

Semester VI

Sr. No.	Course code Course title	Course Outcomes Student Will be able to:
1	EE 2601: Economics for Engineers	1. To acquaint elementary principles of economics
		2. To understand public sector economics
		3. To acquaint Indian economic development in post Independent era.
		4. To acquaint with standard concepts and tools of economics useful in engineering profession
2	EE 2602: Internet Of Things	1. Understand impact of IOT in engineering applications.
		2. Select appropriate sensors and network components for given application
		3. Design and develop IOT Systems for given application
		4. Use cloud computing and data analytics for interpretation of collected data
3	EE 2603: Elective II, HVDC Transmission	1. .Analyse the operation of Line Commutated Converters and Voltage Source Converters..
		2. Apply the control strategies used in HVdc transmission system.
		3. Evaluate the improvement of power system stability using an HVdc system.
		4. Compare the advantages of dc transmission over ac transmission..
4	EE 2613: Electrical Utilization and Traction	1. select the type and rating of motor for a particular industrial application.
		2. design lighting schemes for indoor and outdoor lighting.
		3. analyse the moment of trains and their energy consumption by means of speed-time curves.
		4. analyse the performance parameters of the traction system.
5	EE 2623: Special Electrical Machines	1. To understand concept of special purpose machines and their industrial applications
		2. To set a firm and solid foundation in Electrical machines with strong analytical skills and conceptual understanding of analytical methods in special electrical Machines.
		3. To make students aware of protective system with industry oriented learning..
6	EE 2604: Power Electronics	1. Apply the rudiments of Power Electronics for practical implementation.
		2. Analyse switching circuits & gate drive circuits for control of power switches.
		3. Evaluate functioning and design process of various Power Electronics converters.
7	EE 2605: Electrical Machine Design	1. Analyze the effect of design parameters on performance of electrical machines
		2. Evaluate the performance parameters of static and dynamic electric machines
		3. Design different parts of AC &DC machine.
8	EE 2606: Internet Of Things Lab	1. Understand interfacing of sensors and actuators for IOT systems
		2. Program the microcontroller assembly using appropriate tool
		3. Use communication interface to transfer and receive data from storage devices and cloud
		4. Design the IOT system for given application
9	EE 2607: Power Electronics Lab	1. Simulate converter circuits and analyse its performance
		2. Build his/her own simple converter circuit in the laboratory and test the same.
10	EE 2608: Electrical Machine Design Lab	1. Develop step by step procedure for design of AC & DC Machines.
		2. Apply optimization techniques for design of electrical machine.
		3. Use GUI in machine design.
11	EE2609: Electrical Workshop Lab	1. To understand working of electrical appliances.
		2. To construct small electrical circuits.
		3. To handle different tools used in electrical circuit building and repair.
12	EE 2610: Technical Presentation	1. Familiar with technical issues.
		2. Able improve presentation skills .
		3. Able to improve communication skills and stage daring.