Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VII

EE701: Electrical Drives

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs./week		**CT 1**	15
Tutorials	02 Hrs./week		**CT 2**	15
Total Credits	05		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives

1.	To describe the structure of Electric Drive systems and their role in various applications.
2.	Understand the basic principles of control aspects in drives using controlled converters.
3.	Review the basic concepts of operation and modern control aspects of ac and dc motors.
4.	To select suitable electric drive for various applications in industrial field.

Course Contents		**Hours**
Unit I	**Introduction:** Advantages of Electrical Drives, Parts of Electrical drive, Choice of Electric drives. **Dynamics of Electrical Drives:** fundamental torque equations, multi-quadrant operation, nature and classification of load torques, steady state stability, concept of load equalization in drives.	**06**
Unit II	**Control of Electrical Drives:** Modes of operation like Steady state, Acceleration, Deceleration, Drive classification. **Closed loop control of Drives:** Current limit control, torque control, speed control, position control, Control of multi motor drives, speed sensing, current sensing, Classes of motor duty, criteria for selection of motor	**06**
Unit III	**DC Motor Drives:** Review of basic characteristics of DC motors, **AC-DC converter Drives: (i) Single phase converter fed drives:** Single phase half wave converter drives, semi converter drives, Full converter drives, Dual converter drives. **(ii) Three phase converter fed drives:** Three phase half wave drives, semi-converter drives, full converter drives, dual converter drives. **DC-DC converter fed drives:** Principle of rheostatic and regenerative braking control, combined control, two and four quadrant DC-DC converter fed drives. Introduction to closed loop control of DC drives, and brushless motor drives.	**08**
Unit IV	**Induction Motor Drives:** Review of starting, braking and speed control of three phase induction motors, Stator voltage control, Rotor voltage control, frequency control, Voltage and	**06**

	frequency control (v/f control), Current control, Closed loop control of Induction motors, Principle of Scalar and Vector control of Induction motor, Multiquadrant operation of induction motor drives fed from Voltage Source Inverters. Static rotor resistance control method, static slip power recovery control-Static Scherbius drive and Static Kramer drive.	
Unit V	**Synchronous Motor Drives:** Review of starting, pull in and braking of Synchronous motor, Static variable frequency control for Synchronous motors, Load commutated inverter fed Synchronous motor drive, Introduction to closed loop control of Load commutated inverter fed Synchronous motor drive.	**06**
Unit VI	**Drives for Specific Applications: (i) Textile Mill:** various stages and drive requirements, control of ac motors for controlling torque. **(ii) Steel Rolling Mill:** reversing and continuous hot and cold rolling mills, Drive requirements, motors for mill drive. **(iii) Cement Mill:** Stages in cement production, requirements of mill motors, Kiln drives, crusher drives, fan/blower drives, compressor drive. **(iv) Sugar Mill:** Requirements for various drive motors, selection of motors for various processes. **(v) Drives in other applications:** Chemical/Petrochemical Industries, Machine tool applications, miscellaneous applications like automobile control for vehicle, hybrid drives, applications of permanent magnet machines etc. Introduction to IS standard (like IS325)	**06**
Tutorial		
	Two tutorials based on each Unit.	
Course Outcomes		
After Completion of the course student will be able to		
1.	apply knowledge of mathematics to solve numerical based on dynamics of drive, to study various parameters for effective control of drives and converters to find output power.	
2.	describe the drive characteristics used in industry and of power semiconductor devices and identify suitable controller for a given application.	
3.	enjoy overall ability to use different techniques, and modern engineering tools necessary for electrical drives in practice.	
Text Books		
1.	"Fundamentals of Electrical Drives", G. K. Dubey, Narosa Publishing house	
2.	"A first course in Electrical Drives", S. K. Pillai, New Age International Publishers, 3rd edition.	
References		
1.	"Electrical Drives and Control", Vedam Subramanyam, TMH Publications	
2.	"Electric Drives", N. K. De, P. K. Sen, Prentice Hall of India	
Useful Links		

1.	http://nptel.ac.in/courses/108102046/
2.	http://nptel.ac.in/courses/108108077/
3.	http://nptel.ac.in/courses/108104011/

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	√			√	√			√		√				√
CO2	√		√	√	√		√	√	√	√				√
CO3	√	√	√	√	√	√	√	√	√	√			√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VII

EE702: Switchgear and Protection

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs./week		**CT1**	15
Tutorials	1		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives

1.	To understand working principles of various Circuit Breakers.
2.	To understand working principles of protective relaying
3.	To understand need and implementation of various protections in power systems

Course Contents		**Hours**
Unit I	**Introduction:** Requirement, Basic Elements of Circuit Breaking, Operating principle, Arc Phenomenon, Arc Extinction, Re-striking voltage, Voltage Recovery, RRRV, Current Chopping, Capacitive Current Breaking, Circuit Breaker Ratings	**06**
Unit II	**Circuit Breakers:** Classification**,** Oil Circuit Breakers, Air Circuit Breakers, SF6 Circuit Breakers, Vacuum Circuit Breakers**,** DC Circuit Breakers	**06**
Unit III	**Protective Relaying**: Relaying schemes, Properties of Relays, Instrument Transformers and their use in protection **Relays:** Classification, Electromagnetic Relays, Static Relays, Numerical Relays	**08**
Unit IV	**Transformer Protection**: Various faults and abnormal operating Conditions, Types of protections used, Differential Protection, Restricted Earth fault protection, Over current protection,	**06**
Unit V	**Generator Protection**: Various faults and abnormal operating Conditions, Protection against Stator fault, Rotor fault, Restricted earth fault and inter-turn fault protection, Generator-Transformer Unit protection scheme.	**08**
Unit VI	**Feeder Protection:** Over current, Carrier current protection, Distance protection. **Protection against Over voltage**: Causes of overvoltage, protection of transmission line, transformer, substation against over voltage safety features, failure reasons and maintenance	**06**

Course Outcomes

1.	Student will understand working principles of various Circuit Breakers
2.	Student will be able to select appropriate relay for different protection schemes
3.	Student will understand various protections in power systems.

Text Books

1.	Sunil S. Rao, Switchgear, Protection and power systems, Khanna

	Publication,2008
References	
1.	Badri Ram, D Vishvakarma;Power System Protection and Switchgear, Tata McGrawhill,2/e
2.	R.P. Maheshwari, Nilesh G. Chothani Bhavesh Bhalja; Protection and switchgear, OXFORD Press
Useful Links	
1.	www.ocw.mit.edu
2.	www.nptel.iitm.ac.in

Mapping of CO and PO

	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
CO1	√			√	√			√		√				√
CO2	√		√	√	√		√	√	√	√				√
CO3	√	√	√	√	√	√	√	√	√	√			√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VII

EE703: Microcontrollers

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs./week		**CT1**	15
Total Credits	3		**CT2**	15
			TA	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	Provide an overview of difference between microprocessor and micro controller.
2.	Give an understanding about the concepts and basic architecture of 8051.
3.	Study the architecture and addressing modes of 8051.
4.	Impart knowledge about assembly language programs of 8051.
5.	Help understand the importance of different peripheral devices & their interfacing to 8051.
6.	Impart knowledge of different types of external interfaces including LEDS, LCD, Keypad Matrix, Switches & Seven segment display.

Course Content		**Hours**
Unit I	**Basics of 8051 Microcontrollers:** Evolution from Microprocessors to Micro controllers. Block diagram description of microprocessor 8085. Instruction cycle, Timing Diagram Types of Instructions and examples, memory organization in 8085, Assembly language programming. Introduction to various Architectures, Concept of RISC and CISC processors. Microcontrollers and embedded processors, Overview of the 8051 family, Architecture of 8051 , Pin description of the 8051,RAM and ROM Organization in 8051	**7**
Unit II	**8051 Assembly Language Programming:** 8051 Addressing Modes :Immediate and register addressing modes, Accessing memory using various addressing modes, Bit addresses for I/O and RAM, Extra 128-byte on-chip RAM in 8052.Concept of Instruction cycle, Machine cycle. Types of Instructions ,Introduction to 8051 assembly programming, Assembling and running an 8051 program, The program counter and ROM space in the 8051, 8051 data types and directives, 8051 flag bits and the PSW register, 8051 register banks and stack. Jump, Loop, And Call Instructions. I/O Port Programming. Arithmetic and Logic Instructions and Programs.	**7**
Unit III	**8051 Programming in C:** Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C. 8051 Hardware Connection and Intel Hex File	4
Unit IV	**8051 Timer Programming in Assembly and C:** Programming	

	8051 timers, counter programming, Programming timers 0 and 1 in 8051 C as well as in assembly.	3
Unit V	**8051 Serial Port Programming in Assembly and C:** Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in Assembly, Programming the second serial port, Serial port programming in C.	3
Unit VI	**Interrupts Programming in Assembly and C:** 8051 interrupts programming, Timer interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in the 8051/52, Interrupt programming in C.	4
Unit VII	**Interfacings of 8051:** Details of LCD interfacing, Keyboard interfacing. Parallel and serial ADC, DAC interfacing, Sensor interfacing and signal conditioning. Semiconductor memory, Memory address decoding, 8031/51 interfacing with external ROM, Flash RAM, 8051 data memory space, Accessing external data memory in 8051C. RTC Interfacing and Programming. Motor Control: Relay, PWM, DC and Stepper Motors PWM. ARDUINO	7
Unit VIII	**Microcontrollers in Power systems:** Phase detection, Measurement of Voltage, current and Power. PWM generation for converters, Applications in protection and switchgear and its controller. CE marking VDE marking CSA, UL marking	**7**
Course Outcome (CO):		
After Completion of the course student will be able to		
1.	Explain the difference between microprocessor and microcontroller	
2.	Explain different addressing modes of 8051	
3.	Explain the working of various peripherals and their interfacing	
4.	Write assembly as well as c programs for 8051	
5.	Design system based on 8051 for electrical engineering applications	
Text Books		
1.	Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Second Edition, Pearson Education.	
2.	K. J. Ayala, D. V. Gadre, "The 8051 Microcontroller & Embedded Systems using Assembly and C", Cengage Learning, India Edition.	
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/IIT-KANPUR/microcontrollers/ micro/ui/TOC.htm	
2.	http://freevideolectures.com/Course/3018/Microprocessors-and-Microcontrollers	

Mapping of CO and PO

	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
CO1														
CO2		√	√	√							√			
CO3		√	√								√			
CO4	√	√	√								√			
CO5			√								√			

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	5	5	2	10
Understand	5	5	2	20
Apply	5	5	2	10
Analyze	-	-	2	10
Evaluate	-	-	2	10
Create	-	-	-	-
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VII

EE705: Electrical Drives Lab.

Laboratory Scheme			**Examination Scheme**	
Practical	2 Hrs./week		**CA**	50
Total Credits	1		**ESE**	50#
			Total	100

Course Objectives

1.	To understand importance of load torque and drive torque characteristics, its relation in selection of electrical drive.
2.	To select and develop converters, their control techniques essential for control of electrical drives in industry.
3.	To simulate the designed control techniques for electrical drives and analyze the characteristics of drive as well as controller.

Course Contents

Experiment1	Control of DC motor using single phase converters.
Experiment 2	Control of DC motor using three phase converters.
Experiment 3	Control of DC motor using DC-DC converters.
Experiment 4	Control of DC motor using dual converters.
Experiment 5	V/f control of 3-ph induction motor using 3-ph inverters.
Experiment 6	Performance characteristics of 3-ph induction motor fed from 3-ph inverters.
Experiment 7	Study of control techniques of brushless motor fed from converters.
Experiment 8	Simulations study of scalar control of 3-ph induction motor.
Experiment 9	Simulation study of vector control Direct Torque Control (DTC) of 3-ph induction motor.
Experiment 10	Simulation study of vector control Field Oriented Control (FoC) of 3-ph induction motor.

Submission:

ESE	Minimum 8 experiments to be performed/ simulated and evaluated in journal.

Course Outcomes

After completing this course students will able to

1.	Select proper electrical drive motor for required applications.
2.	Analyze the advanced control techniques applicable for AC and DC motors in practice.
3.	Design, develop and simulate advanced control schemes for electrical drives.

Mapping of CO and PO

	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
CO1	√			√	√			√		√				√
CO2	√		√	√	√		√	√	√	√				√
CO3	√	√	√	√	√	√	√	√	√	√			√	

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Avg.
Task I	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	
CA									

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VII

EE 706: Switchgear and Protection Lab

Laboratory Scheme			**Examination Scheme**	
Practical	2 Hrs./week		**CA**	50
Total Credits	1		**ESE**	25
			Total	75

Course Objectives	
After completion of the course student will	
1.	understand operation and working of different Relays.
2.	understand operation and working of various protection schemes.
3.	understand construction of different Circuit breakers.

Course Contents		
Experiment 1	Drawing Sheet showing construction of Circuit Breakers. Single Line Diagram of Substation.	
Experiment 2	Drawing Sheet showing Protections of Transformer and Generator.	
Experiment 3	Study of Construction and working of Induction Disc Relays.	
Experiment 4	IDMT relay characteristics.	
Experiment 5	Operation and characteristics of over voltage Relay.	
Experiment 6	Operation and characteristics of under voltage Relay.	
Experiment 7	Operation and characteristics of over current Relay.	
Experiment 8	Operation of Buchholz Relay.	
Experiment 9	Operation and working of feeder protection.	
Experiment 10	Operation and working of Differential protection of Transformer	
Experiment11	Operation and working of Differential protection of Alternator	

Submission	
Total number of Experiments 8	
Course Outcomes(CO):	
1.	Students will be able to handle different types of Relays.
2.	Students will understand working of Generator, Feeder and Transformer protection schemes.
3.	Students will develop electrical drawing skill.

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	√			√	√			√		√				√
CO2	√		√	√	√		√	√	√	√				√
CO3	√	√	√	√	√	√	√	√	√	√			√	

Assessment Pattern

Knowledge Level	TA	ESE
Remember	2	12
Understand	2	12
Apply	2	12
Analyze	2	12
Evaluate	2	12
Total	25	60

Government College of Engineering, Karad

Final Year B. Tech. (Electrical) Sem. VII

EE707: Microcontroller Lab

Laboratory Scheme			**Examination Scheme**	
Practical	2 Hrs./week		**CA**	50
Total Credits	1		**ESE**	25#
			Total	75

Course Objectives:	
1.	To understand the Assembly language programming for 8051
2.	To understand the various peripheral devices and their interfacing
3.	To understand the programming and virtual simulation of system designed in PROTEUS
4.	To understand the working of various inbuilt modules like Timers, counters, Interrupts, etc.

Course Contents	
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
Submission	
	Total number of Experiments:11
Additional Information	
Course Outcome(CO):	
After completing this course students will 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

Mapping of CO and PO

	PO												PSO	
	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO1	√	√	√							√	√			
CO2	√	√	√							√	√			
CO3		√	√	√							√			
CO4											√			

Assessment Pattern

Skill Level	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	TA	ESE
Assembling						√	√	√	√	√	√		
Testing						√	√	√	√	√	√		
Observing	√	√	√	√	√	√	√	√	√	√	√	√	√
Analysing	√	√				√	√		√			√	√
Interpreting		√	√						√	√	√	√	√
Designing	√	√	√	√	√	√	√	√	√		√	√	√
Creating												√	√
Deducing conclusions	√	√	√	√	√	√	√	√	√			√	√
Total	10	10	10	10	10	10	10	10	10	10	10	50	25

Government College of Engineering, Karad

Final Year B. Tech. (Electrical) Sem. VII

EE708: Project-I

Seminar Scheme			**Examination Scheme**	
Practical	2Hrs./week		**CA**	50
Total Credits	4		**ESE**	50
			Total	100

Course Objectives: Students will be able to

1	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 fieve students may carry out the project together. One supervisor from the department shall be assigned as guide to project batche. The steps involved for completion of 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

Course Contents

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

Submission

Report on Literature Survey and Preliminary work

Course Outcome(CO): students will be able to

1.	understand community needs
2.	covert idea in to product
3.	work in group
4.	communicate effectively.

Mapping of CO and PO

	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
CO1	√		√	√					√				√	
CO2	√		√									√	√	√
CO3	√	√		√	√	√			√			√		√
CO4		√	√	√	√	√			√			√		

Government College of Engineering, Karad				
Final Year B. Tech. (Electrical) Sem. VII				
EE 709: Seminar				
Seminar Scheme			**Examination Scheme**	
Practical	1Hrs./week		**CA**	25
Total Credits	1		**Total**	25
Course Objectives				
1.	Student should know the state of the art in the relevant subjects of Electrical engineering.			
2.	Student should become familiar with the experimental procedure to validate theories related to Electrical engineering.			
3.	Student should learn how to prepare and present research topic.			
Course Contents				
Seminar to be delivered by the students on general topic related to Electrical engineering. The selected topic can be any of the following:				
1.	Presentation of study made after referring to a peer reviewed journal paper			
2.	Presentation of any of the International standard and its IS equivalent			
3.	Presentation based on any magazine article and its references published by professional societies (e.g. IEEE Power engineering society, Power electronics society, Industrial electronic society, ISO9001-2015 etc.			
Submission				
	Seminar report duly signed by respective guide and head of department.			
Course Outcome(CO):				
1.	Student will know the state of the art in the relevant subjects of Electrical engineering.			
2.	Student will be able to prepare and present research articles			

Mapping of CO and PO

	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
CO1			√	√	√			√	√	√	√			
CO2	√	√	√	√	√	√		√	√	√	√		√	√
CO3			√	√	√	√	√		√		√			

Assessment Pattern

Government College of Engineering, Karad				
Final Year B. Tech (Electrical) Sem. VII				
EE 710: Industrial Training Presentation				
Teaching Scheme			**Examination Scheme**	
Practical	1Hr/week		**CT1**	--
Tutorials	--		**CT2**	--
Total Credits	2		**CA**	25
			ESE	--
			Total	25

Course Objectives	
1.	To make student familiar with Industrial Environment.
2.	To make student aware of recent trends and technologies used in industry.
3.	To improve communication.

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.	

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.

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1			√	√	√			√	√	√	√			
CO2	√	√	√	√	√	√		√	√	√	√		√	√
CO3			√	√	√	√	√		√		√			

Assessment Pattern

Knowledge Level	CA
Remember	5
Understand	5
Describe	5
Analyze	5
Presentation Skills	5
Total	25

Elective I

Government College of Engineering Karad				
Final Year B. Tech (Electrical) Sem. VII				
Elective I EE714: High Voltage DC Transmission (HVDC)				
Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	--		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	To provide detail knowledge of HVDC transmission system.
2.	To introduce basic concepts of control and protection systems in HVDC transmission system
3.	To introduce students to recent trends in HVDC transmission system.

Course Contents		**Hours**
Unit I	**General Background:** Trends in transmission voltages, hierarchical levels in transmission and distribution, standard rated voltage of EHV-AC and HVDC, general aspects of HVDC transmission: Constitution of EHVAC and DC links, kinds of DC links, HVDC projects in India and abroad, limitations and advantages of HVDC transmission over EHVAC, layout of HVDC station.	**8**
Unit II	**Grid Control and Characteristics:** Grid control of thyristor, valve-analysis with grid control with no overlap, overlap less than 60 degrees and overlap greater than 60 degrees, basic means of control, power reversal, manual control and its limitations, constant current versus constant voltage control, desired features of control, actual control characteristics, constant minimum ignition angle, current and extinction angle controls , power control and current limits.	**8**
Unit III	**Faults and over-voltages:** Converter mal-operations: short circuit on a rectifier, commutation failure, causes and remedies, protection of HVDC system, d.c. reactors, damper circuits, over-current protection and over-voltage protection, fault clearing and reenergizing the line.	**6**
Unit IV	**Harmonics and their suppression:** Characteristic and uncharacteristic harmonics: causes, consequences and suppression, troubles caused by harmonics, harmonic filters- types, location, series or shunt, sharpness of tuning, quality factor.	**6**
Unit V	**Reactive Power Compensation:** Reactive power requirement of HVDC converter, reactive power balance in HVDC substation, effect of angle of advance and extinction angle on reactive power requirement of converters.	**6**
Unit VI	**Multi-terminal DC Systems:** Introduction, configurations and types of MTDC systems, control and protection of MTDC systems, configurations and types of	**6**

	MTDC systems, comparison between MTDC and AC interconnections.	

Course Outcomes:	
After completing this course students will be able to	
1.	nalyze HVDC system.
2.	Suggest appropriate control and protection schemes for HVDC system
3.	Appraise recent trends in HVDC system
Text Books:	
1.	Edward Wilson Kimbark "Direct Current Transmission" Wiley Interscience publications
2.	K R Padiyar "HVDC power transmission systems" second edition, New Age International Ltd
References:	
1.	EHV –AC and HVDC Transmission Engineering & Practice : S. Rao, Khanna Publishers, 3rd Edition, 2012.
2.	J. Arrillaga, "H.V.D.C. Transmission", Second Edition, Institution of Electrical Engineers, London.
Useful Links:	
1.	http://www.nptelvideos.in/2012/11/high-voltage-dc-transmission.html

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 10	PO1 11	PO1 12	PSO 1	PSO 2
CO1	√	√	√	√					√			√	√	
CO2	√		√	√					√			√		
CO3	√	√	√	√					√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VII

Elective-I EE 724: FACTS (Flexible AC Transmission Systems)

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs./week		**CT1**	15
Tutorials	1		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min

Course Objectives

1.	To understand FACTS concept.
2.	To become familiar with series and shunt compensation using FACTS devices.
3.	To introduce the concept of UPFC

Course Contents		**Hours**
Unit I	Transmission Interconnections, Flow of Power in an AC System, Loading Capability, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of Controllable Parameters.	**6**
Unit II	Brief Description and Definitions of FACTS Controllers, Benefits from FACTS technology, HVDC vs. FACTS Static Shunt Compensators	**6**
Unit III	SVC and STATCOM: Objectives of Shunt Compensation, Methods of Controllable Var Generation, Static Var Compensators: SVC and STATCOM, Comparison Between STATCOM and SVC, Static Var Systems.	**6**
Unit IV	Static Series Compensators: Objectives of Series Compensation, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators	**8**
Unit V	Static Voltage and Phase Angle Regulators: Objectives of Voltage and Phase Angle Regulators, Approaches to Thyristor-Controlled Voltage and Phase Angle Regulators, Switching Converter-Based Voltage and Phase Angle Regulators	**8**
Unit VI	Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC), Introduction, The Unified Power Flow Controller, The Interline Power Flow Controller (IPFC)	**6**

Course Outcome

1.	Student will understand concept of FACTS.
2.	Student will understand series and shunt compensation
3.	Student will understand voltage regulation of transmission line.

Text Books

1	Understanding FACTS , N.G. Hingorani IEEE Press, 1999

References

1.	Power Electronic Control in Electrical Systems , E. Acha, V.G. Agelidis, O. Anaya-Lara, T. J.E. Miller Newnes Power Engineering Series, Oxford, 2002

2.	Flexible AC transmission systems (FACTS) , Yong Hua Song IEE Press, 1999
Useful Links	
1.	http://web.iitd.ac.in

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	√			√	√			√		√				√
CO2	√		√	√	√		√	√	√	√				
CO3	√	√	√	√	√	√	√	√	√	√			√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

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Final Year B. Tech (Electrical) Sem. VII

Elective I EE734: Digital Signal Processing(DSP)

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	0		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min

Course Objectives

1	To understand Discrete-Time Signals and Systems
2	To understand Structures for Discrete Time Systems
3	To understand Filter Design Techniques

Course Contents		**Hours**
Unit I	**Discrete-Time Signals and Systems:** Discrete-Time Signals, Discrete-Time Systems, LTI Systems, Properties of LTI Systems, Linear convolution and its properties, Linear Constant Coefficient, Difference equations, Frequency domain representation of Discrete-Time Signals & Systems, Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete time Fourier Transform, and correlation of signals, Fourier Transform	**06**
Unit II	**The Z- Transform and Analysis Linear Time-of Invariant System**: Z-Transform, Properties of ROC for Z-transform, the inverse Z transform methods, Z- transforms properties, Analysis of LTI systems in time domain and stability considerations, Frequency response of LTI system, System functions for systems with linear constant-coefficient, Difference equations, Freq. response of rational system functions relationship between magnitude & phase, All pass systems, inverse systems, Minimum/Maximum phase systems, systems with linear phase	**06**
Unit III	**Structures for Discrete Time Systems:** Block Diagram and signal flow diagram representations of Linear Constant-Coefficient. Difference equations, Basic Structures of IIR Systems, Transposed forms, Direct and cascade form Structures for FIR Systems, Effects of Co-efficient quantization	**08**
Unit IV	**Discrete-Fourier Transform**: Representation of Periodic sequences: The discrete Fourier Series and its Properties, Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT	**06**
Unit V	**Fast Fourier Transform:** Computational complexity of direct Computation of DFT, DIT-FFT algorithm, DIF- FFT algorithm, Comparison between DIT and DIF algorithm	**08**
Unit VI	**Filter Design Techniques:** Design of Discrete-Time IIR filters from	**06**

	Continuous-Time filters, Approximation by derivatives, Impulse invariance and Bilinear Transformation methods, Design of FIR filters by windowing techniques, Illustrative design examples of IIR and filters	
Course Outcomes		
1	Student will understand Discrete-Time Signals and Systems	
2	Student will understand Structures for Discrete Time Systems	
3	Student will understand various Filter Design Techniques	
Text Books		
1	S. K. Mitra, Digital Signal Processing: A Computer-Based Approach, McGraw-Hill	
References		
1	Digital Signal Processing Using MATLAB (r), V. Ingle, J. Proakis, Brooks/Cole Pub. Co., 1999	
2	A Course in Digital Signal Processing, B. Porat, J. Wiley and Sons, 1996:	
3	Understanding Digital Signal Processing, R. Lyons, Prentice-Hall, 1996	
4	Digital Signal Processing: Principles, Algorithms and Applications, J. Proakis, D. Manolakis, Prentice-Hall, 2006 (4-th edition)	
5	Digital Filter Design, T. W. Parks and C. S. Burras, J. Wiley & Sons, 1987	
6	The Fast Fourier Transform and its Applications, E. O. Brigham, Prentice-Hall, 1988	
Useful Links		
1	www.ocw.mit.edu	
2	www.nptel.iitm.ac.in	

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	√			√	√			√		√				√
CO2	√		√	√	√		√	√		√				
CO3	√	√	√		√	√	√	√	√	√			√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

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Final Year B. Tech (Electrical) Sem. VII

Elective II EE744: FUZZY LOGIC

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	0		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min

Course Objectives

1	To understand concept of Fuzzy logic
2	To understand Fuzzy Systems
3	To understand Design of Fuzzy Controllers

Course Contents		**Hours**
Unit I	**Introduction:** Definitions and Concepts, Intelligent Control Fuzzy Logic, Fuzzy Control, Fuzzy Mathematics, Applications, Rule Base, Fuzzy Sets, Fuzzy System, Classic versus Fuzzy Control System Design, An Example of Fuzzy Control	**06**
Unit II	**Fuzzy Mathematics**: Fuzzy Sets and Membership Functions, Mathematical Operations on Fuzzy Sets, Fuzzy Relations, Linguistic Variables, Fuzzy Rules, Approximate Reasoning	**06**
Unit III	**Fuzzy Systems**: Fuzzy Rule Base, Fuzzy Inference Engine, Fuzzifier, Defuzzifier, Mathematical Representations of Fuzzy Systems, The Approximation Properties of Fuzzy Systems	**08**
Unit IV	**Design of Fuzzy Systems Using Input-Output Data:** Look-up Table Scheme, Gradient Descent Training, Batch Algorithm, Clustering	**06**
Unit V	**Design of Fuzzy Controllers:** Trial and Error Approach, Control surface of a fuzzy controller, Stable Fuzzy Controllers, Optimal Fuzzy Controllers, Robust Fuzzy Controllers, Fuzzy System as Sliding Mode Control, Fuzzy Sliding Mode Control, Fuzzy Supervisory Control, Fuzzy Gain Scheduling, TSK Fuzzy Systems	**08**
Unit VI	**Adaptive Fuzzy Control:** Indirect Adaptive Fuzzy Controller, Direct Adaptive Fuzzy Controller, Self-organizing Fuzzy Logic Control	**06**

Course Outcomes

1	Student will understand concept of Fuzzy logic
2	Student will understand Fuzzy Systems
3	Student will be able to Design of Fuzzy Controllers

Text Books

1	Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley, Fourth Edition

2	L. X. Wang, "A Course in Fuzzy Systems and Control", Prentice-Hall, 1997
3	K. M. Passino, "Fuzzy Control", Addison-Wesley, 1998
References	
1	L. Reznik, "Fuzzy Controllers", 1997.
2	M. Margaliot and G. Langholz, "Fuzzy Modeling and Control", 2000.
3	H. Ying, "Fuzzy Control & Modeling", 2000
4	K. Tanaka and H. Wang, "Fuzzy Control Systems", 2001
5	G. Chen and T. T. Pham, "Introduction to Fuzzy Sets, Fuzzy Logic, and Fuzzy Control Systems", 2001.
6	K. Michels et. al., " Fuzzy Control, Fundamentals, Stability and Design", 2005
Useful Links	
1	www.ocw.mit.edu
2	www.nptel.iitm.ac.in

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	√			√	√			√		√				√
CO2	√		√	√	√		√	√		√				
CO3	√	√	√		√	√	√	√	√	√			√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

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Final Year B. Tech (Electrical) Sem. VII

Elective I- EE754: Power System Operation & Control

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	1		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	To understand the basics of speed governing system and the concept of control areas.
2.	To provide knowledge about Hydrothermal scheduling, Unit commitment and solution techniques.
3.	To understand the need of computer control in power system.

Course Contents		**Hours**
Unit I	**Introduction-** System load variation: System load characteristics, load curves - daily, weekly and annual, load-duration curve, load factor, diversity factor. Reserve requirements: Installed reserves, spinning reserves, cold reserves, hot reserves. Overview of system operation: Load forecasting, techniques of forecasting, basics of power system operation and control.	**06**
Unit II	**Real power - frequency control**– Fundamentals of speed governing mechanism and modeling,Load sharing between two synchronous machines in parallel; concept of control area, LFC control of a single-area system, Multi-area systems: Two-area system modelin, tie line with frequency bias control of two-area system derivation, state variable model.	**06**
Unit III	**Hydrothermal scheduling problem-** Hydrothermal scheduling problem: short term and long term-mathematical model, algorithm. Dynamic programming solution methodology for Hydro-thermal scheduling with pumped hydro plant: Optimization with pumped hydro plant-Scheduling of systems with pumped hydro plant during off-peak seasons: algorithm. Selection of initial feasible trajectory for pumped hydro plant- Pumped hydro plant as spinning reserve unit	**06**
Unit IV	**Unit commitment and economic dispatch-** Statement of Unit Commitment (UC) problem; constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints; UC solution methods: Priority-list methods, forward dynamic programming approach,Incremental cost curve, co-ordination equations without loss and with loss, solution by direct method and λ-iteration method. Base point and participation factors.-Economic dispatch controller added to LFC control.	**08**
Unit V	**COMPUTER CONTROL OF POWER SYSTEMS-** Energy control centre: Functions – Monitoring, data acquisition and control. System hardware configuration – SCADA and EMS	**06**
Unit VI	**POWER SYSTEM SECURITY:** Contingency analysis , linear sensitivity factors ,AC power flow methods, contingency selection	**06**

	,concentric relaxation ,bounding-security, constrained optimal power flow-Interior point algorithm-Bus incremental costs.	
Course Outcomes:		
After completing this course students will be able to		
1.	understand the basics of speed governing system and the concept of control areas.	
2.	provide knowledge about Hydrothermal scheduling, Unit commitment and solution techniques.	
3.	understand the need of computer control in power system.	
Text Books:		
1.	Olle. I. Elgerd, „Electric Energy Systems Theory – An Introduction", Tata McGraw Hill Publishing Company Ltd, New Delhi, Second Edition, 2003.	
2.	D.P. Kothari and I.J. Nagrath, „Modern Power System Analysis", Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.	
References:		
1.	.L.L. Grigsby, „The Electric Power Engineering, Hand Book", CRC Press & IEEE Press, 2001.	
2.	Allen.J.Wood and Bruce F.Wollenberg, „Power Generation, Operation and Control", John Wiley & Sons, Inc., 2003	
3.	P. Kundur, Power System Stability & Control", McGraw Hill Publications, USA, 1994.	
Useful Links:		
1.	www.nptel.com	

Mapping of CO and PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	√	√	√	√					√			√		
CO2	√	√	√	√					√			√		
CO3	√	√	√	√										

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

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Final Year B. Tech (Electrical) Sem. VIII

EE801: Electrical Utilization and Traction

Teaching Scheme			**Examination Scheme**	
Lectures	3Hrs/week		**CT 1**	15
Tutorials	2Hrs/week		**CT 2**	15
Total Credits	5		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives:

1	To mold students professionally to possess in-depth and advanced knowledge by course contents along with emerging topics.
2	To develop an ability to design a system to meet desired needs of an industry within realistic constraints and confirms manufacturability, and sustainability
3	To prepare students for successful career in industries.

Course Contents		**Hours**
Unit I	**Industrial Utilization of Electric Motors :** Review of nature of mechanical load, Matching of speed torque characteristics of load & motor, Starting condition of the load & calculation of starting time for motors, load equalization, Control devices, Pilot devices, push buttons, limit switches, float switches, pressure switches, thermostats, plugging switches, contactor relays & solenoid values, simple line diagrams using above devices, applications of electrical motors in textiles mills, Mines cranes, Lifts, Excavators, Marine drives pumps, refrigerators & air conditioning.	**08**
Unit II	**Electrolytic Processes :** Faradays laws of electrolysis, Application of electrolysis, like Electroplating, Anodizing, electrical polishing & electroextraction, Accumulators & cell, Types & construction of batteries, Charging & discharging, recent trends in manufacturing of batteries.	**06**
Unit III	**Illumination :** Requirement of good illuminations, Classification of light fitting & luminaries, Factor to be considered for design of indoor & outdoor lighting scheme, Design procedure for factory lighting, flood lighting & street lighting.	**06**
Unit IV	**Electric Heating :** Advantages of electrical heating, Resistance heating, Design of heating element in resistance oven and temperature control, Electric arc furnaces, Induction furnaces, Dielectric heating. **Electric Welding :** Electric arc welding & Resistance welding, Modern welding techniques like Ultrasonic & Laser welding, under water welding.	**08**
Unit V	**Electric Traction :** Different systems of traction, current collecting systems, types pentagraphs, advantages & limitations, systems of track electrification, speed-time curve for traction, tract effort, adhesive weight, coefficient of adhesion, specific energy consumption, power supply arrangements.	**06**

Unit VI	**Traction Motors and Control:** Desirable characteristics of traction motors, Suitable motors for traction, Control of D.C. traction motors, Shunt transition, Bridge transition, Regenerative braking, Study of performance, operation & metering system, D.C. & A. C. transition, introduction to modern traction systems.	**06**
List of Tutorials		
	Two-tutorials based on each unit pertaining to practical / field applications.	
Course Outcomes		
After completing this course student will be able to		
1	realize broad education necessary to understand the impact of electrical energy and its utilization in practical field, design solutions in a global and economical context.	
2	make use of data tables & specification of various devices, appliances for design and applications in practical framework.	
3	understand various industrial systems, its control and design.	
Text Books		
1	"Utilization of Electric Power & Electric Traction", J. B. Gupta, S. K. Kataria & Sons	
References		
1	"Utilization of Electrical Engineering", O. E. Taylor, Longman	
2	"Electrical Power", S. L. Uppal, Khanna Book Publication	
3	"Art & Science of Utilization of Electrical Engineering", H. P. Partab, Dhanpat Rai Publications	

Mapping of CO and PO

	PO1	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
CO1	√	√		√			√		√			√	√	
CO2	√		√	√	√				√			√		
CO3	√	√	√	√					√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	3	3	2	10
Evaluate	3	3	2	10
Total	15	15	10	50

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Final Year B. Tech (Electrical) Sem. VIII

EE802: Computer Aided Design of Electrical Machines

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	2		**CT2**	15
Total Credits	5		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	To understand concept of Computer aided Design of Electrical Machines
2.	To understand basic concepts in Machine Design.
3.	To understand design of DC Motor and Transformer

Course Contents		**Hours**
Unit I	CONCEPT OF COMPUTER-AIDED DESIGN-I : 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	**08**
Unit II	CONCEPT OF COMPUTER-AIDED DESIGN-II 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	**06**
Unit III	BASIC CONCEPTS OF DESIGN: Introduction; Specification; Output coefficient; Importance of specific loadings; Electrical Materials: Conducting Materials, Insulating Materials and Magnetic Materials; Magnetic circuit calculations;	**06**
Unit IV	General procedure for calculation of Amp-Turns; Heating and Cooling; Modes of heat dissipation; Standard ratings of Electrical machines; Ventilation schemes in static machines (Transformers) and in rotating machines; Quantity of cooling medium; Types of enclosures; General design procedure; Steps to get optimal design..	**08**
Unit V	COMPUTER AIDED DESIGN OF DC MACHINES: Introduction; Flowcharts and programs for computer aided design of DC machines. 2D FEM open source software-based DC machine part design	**06**
Unit VI	COMPUTER AIDED DESIGN OF TRANSFORMERS: Introduction; Flowcharts and programs for computer aided design of transformers. 2D FEM open source software-based transformer part design	**06**

Course Outcomes:	
After completing this course students will be able to	
1.	understand concept of Computer aided Design of Electrical Machines
2.	understand basic concepts in Machine Design
3.	understand design of DC Motor and Transformer

Text Books:	
1	K M Vishnu Murthy, Computer aided design of electrical machines - B S Publications
References:	
1	A.K. Sawhney,, A course in Electrical machine Design, Dhanpat Rai & Co.
2	Maurya, Jallan, Shukla, Computer aided design of electrical machines – Kataria publication
Useful Links:	
1	http://nptel.iitm.ac.in/courses/

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 10	PO1 11	PO1 12	PSO 1	PSO2
CO1	√	√		√			√		√			√	√	
CO2	√		√	√	√				√			√		
CO3	√	√	√	√					√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

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EE805: Computer Aided Design of Electrical Machines Lab

Laboratory Scheme			**Examination Scheme**	
Practical	4Hrs./week		**CA**	50
Total Credits	2		**ESE**	50
			Total	100

Course Objectives:	
1.	To make students familiar with Electrical Machine design
2.	To make students familiar with Computer aided design of Electrical machines.

Course Contents	
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 chart and 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 small DC motor to be used for a lab with given specifications and constraints

Submission	

Additional Information	
Course Outcome(CO):	
After completing this course students will familiar to	
1.	Concept of Electrical Machine design
2.	Computer aided design of Electrical machines.

Mapping of CO and PO

	PO												PSO	
	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CO1	√	√	√							√	√			
CO2	√	√	√							√	√			

Assessment Pattern

Skill Level	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	TA	ESE
Assembling						√	√	√		
Testing						√	√	√		
Observing	√	√	√	√	√	√	√	√	√	√
Analysing	√	√				√	√		√	√
Interpreting		√	√						√	√
Designing	√	√	√	√	√	√	√	√	√	√
Creating									√	√
Deducing conclusions	√	√	√	√	√	√	√	√	√	√
Total	10	10	10	10	10	10	10	10	50	25

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EE806:Project-II

Seminar Scheme			**Examination Scheme**	
Practical	6 Hrs./week		**CA**	100
Total Credits	8		**ESE**	200
			Total	300

Course Objectives

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 fieve students may carry out the project together. One supervisor from the department shall be assigned as guide to project batche.

The steps involved for completion of project includes, but not limited to:

6. Conceptualization of innovative idea through literature and market survey; sight visits; interaction with community or industry, socio-economic survey etc.
7. Design of product, processes, methods and systems using multidisciplinary knowledge
8. Fabrication of product, development of software, measurement methods etc.
9. Deployment, implementation and demonstration of project.
10. Presentation of project

Course Contents

1	Working model of the project
2	Project Report
3	Presentation and demonstration of project

Course Outcome(CO): Students will be able to

1.	covert idea in to product
2.	work in group
3.	communicate effectively.
4.	understand testing of the project.

Mapping of CO and PO

	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
CO1	√		√	√					√				√	
CO2	√		√									√	√	√
CO3	√	√		√	√	√			√			√		√
CO4		√	√	√	√	√			√			√		

Elective II

Government College of Engineering Karad

Final Year B. Tech (Electrical) Sem. VIII

Elective-II EE813: Extra High Voltage AC Transmission (EHVAC)

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	--		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	To learn calculation of EHVAC line parameters
2.	To learn voltage gradients and corona effects
3.	To learn over-voltages and protection

Course Contents		**Hours**
Unit I	**Introduction to EHVAC Transmission :** Standard transmission voltages, Engineering aspect and growth of EHVAC Transmission line, trends and preliminaries, power handling capacity and line losses, calculation of line and ground parameters, transient stability limit, and surge impedance loading. Resistance of conductor and power loss, temperature rise and current carrying capacity of conductor, properties of bundled conductors, calculation of inductance and capacitance of bundled conductor, calculation of sequence inductances and capacitances, line parameters for modes of propagations.	**08**
Unit II	**Voltage gradients of conductor and corona loss:** Charge-potential relations for multi-conductor lines, surface voltage gradient on conductor, distribution of voltage gradients on sub conductors of bundle. I^2R and corona loss, corona-loss formulae, charge-voltage diagram and corona loss, attenuation of traveling waves due to corona loss, Audible noise, corona pulses: their generation and properties, limits for radio interface fields.	**06**
Unit III	**Theory of the Traveling waves and standing waves :** Travelling and standing waves at the power frequency, differential equations and solutions for general case, standing waves and natural frequencies, open ended line: double exponential response and response to sinusoidal Excitation, line energization with trapped-charge voltage, reflection and refraction of traveling waves.	**06**
Unit IV	**Lightning and lightning protection & Insulation Co-ordinations :** Lightning strokes to lines, their mechanism, General principle of the lightning protections problems, tower footing resistance, lightning arrestors and protective characteristics, Insulation level, Voltage withstands levels of protected equipment and insulation coordination based on lightning.	**06**
	Over-voltage in EHV system caused by switching operations : Origin of over-voltages and their types, short circuit current and	**06**

Unit V	circuit breaker, recovery voltage and circuit breaker, over-voltages caused by interruption of low inductive and capacitive currents, ferro-resonance over-voltages, calculation of switching surges- single phase equivalents.	
Unit VI	**Power frequency voltage control and over voltages :** Generalized constants, no load voltage conditions and charging current, power circle diagram and its use, cascade connection of components: shunt and series compensation, sub-synchronous resonance in series-capacitor compensated lines, static reactive compensating systems (Static VAR).	**06**
Course Outcomes		
After completing this course students will be able to		
1.	Calculate EHVAC line parameters	
2.	Study voltage gradients and corona effects	
3.	Find over-voltages and methods of protection	
Text Books		
1	Rakosh Das Begamudre ,"Extra high voltage AC transmission engineering", 4th edition, New Age Publication.	
References		
1	EHV –AC and HVDC Transmission Engineering & Practice : S. Rao, Khanna Publishers, 3rd Edition, 2012.	
2	Electric Power Transmission System Engineering analysis and design: Tarun Gonen, Third Edition, CRC press.	
Useful Links		
1	http://nptel.iitm.ac.in/courses/	

Mapping of CO and PO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO110	PO111	PO112	PSO1	PSO2
CO1	√	√	√	√					√			√	√	
CO2	√		√	√					√			√		
CO3	√	√	√	√					√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VIII

Elective-II EE823: Wind & Solar power

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	0 Hrs/week		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min

Course Objectives	
1.	To understand solar radiation with photo thermal & photo voltaic systems.
2.	To analyze design & modeling of solar energy systems.
3.	To study wind energy fundamentals.
4.	Understand the requirements wind turbines technology & components of MW series WTGs.
5.	To study modern wind turbine control & monitoring system.

Course Contents		**Hours**
Unit I	**Solar Radiation :** Nature of Solar Radiation, Global, Beam and Diffuse Radiation, Hourly, Daily and Seasonal variation of solar Radiation, Estimation of Solar Radiation, Measurement of Solar Radiation.	**06**
Unit II	**Photovoltaic systems :** Solar cells & panels, performance of solar cell, estimation of power obtain from solar power, solar panels PV systems, components of PV systems, performance of PV systems, design of PV systems, applications of PV systems, concentrating PV systems, power plant with fuel.	**07**
Unit III	**Design & modeling of solar energy systems :** F Chart method, φ– F Chart method, Modeling & simulation of Solar Energy Systems. **Economic analysis of Solar energy Systems :** Life cycle analysis of Solar Energy Systems, Time Value of Money, Evaluation of Carbon Credit of Solar Energy Systems.	**06**
Unit IV	**Wind Energy Fundamentals :** Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines, Atmospheric Boundary Layers, Turbulence. **Wind Measurements, Analysis and Energy Estimates :** Instrumentation for wind measurements, Wind data analysis, tabulation, Wind resource estimation, Betz's Limit, Turbulence Analysis. **Aerodynamics Theory :** Airfoil terminology, Blade element theory, Blade design, Rotor performance and dynamics, Balancing technique (Rotor & Blade), Types of loads; Sources of loads.	**07**
Unit V	**Wind Turbines Technology & Components of MW series WTGs. :** Wind turbines types: Vertical Axis Type, Horizontal Axis, Constant Speed Constant Frequency, Variable speed Variable Frequency, Up Wind, Down Wind, Stall Control , Pitch Control, Gear Coupled Generator type, Direct Generator Drive /PMG/Rotor Excited Sync Generator Wind Turbine Technology & Components of WTG	**08**

	1) Gear Coupled Generator Type [Const. Speed] 2) Direct Coupled Generator Type [Variable Speed Variable Frequency]: Multipole Synchronous / PMG Generators. 3) Doubly Fed Induction Generator and Power Control	
Unit VI	**Modern Wind Turbine Control & Monitoring System :** Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA & Databases: Remote Monitoring and Generation Reports, Operation & Maintenance for Product Life Cycle, Balancing technique (Rotor & Blade), FACTS control & LVRT & New trends for new Grid Codes. **Concept of Wind Farms and project cycle :** Project planning, Site selection, Project execution, Operation and maintenance Environmental concerns: Pollution free power; Noise; birds; Aesthetics; Radio waves interference; Rainfall. **Cost Economics :** Wind resource assessment and R & D costs, Fixed and variable costs, Value of wind energy, Life cycle costing and cash flow of wind power projects, Wind project owners/developers, Wind energy market	**08**

Course Outcomes	
After taking this course the students should be able to	
1.	get the concepts of solar radiations & its systems.
2.	understand design & modeling of solar energy systems.
3.	recognize different techniques of Wind Turbines Technology & Components of MW series WTGs.
4.	familiarize with Modern Wind Turbine Control & Monitoring System.
Text Books	
1.	J.A.Duffie & W.A. Beckman: Solar Engineering of Thermal Process.
2.	Anna Mani : Wind Energy Data for India.
3.	B.H.Khan: Non-Conventional Energy Sources.
References	
1.	C-Wet : Wind Energy Resources Survey in India VI
2.	S. Rangrajan : Wind Energy Resources Survey in India V Sathyajith Mathew : Wind Energy Prepared by WISE: Wind Power in India (5000MW BY 2015)
3.	S.A.Kalogirou: Solar Energy Engineering

Mapping of CO and PO

	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
CO1	√	√	√	√					√			√		
CO2	√	√	√	√					√			√		
CO3	√	√	√	√	√	√			√			√		
CO4		√	√	√	√	√			√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering Karad

Final Year B. Tech (Electrical) Sem. VIII

Elective-II EE833: Robotics & Automation

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	--		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	To explain the basic principles of Robotic technology, configurations, control and programming of Robots
2.	To Design an industrial robot which can meet kinematic and dynamic constraints.
3.	To describe the concept of Robot kinematics and dynamics, latest algorithms & analytical approaches

Course Contents		**Hours**
Unit I	Automation and Robotics, Historical Development, Definitions, Basic Structure of Robots, Robot Anatomy, Complete Classification of Robots, Factors related to use Robot Performance, Basic Robot Configurations and their Relative Merits and Demerits, the Wrist & Gripper Subassemblies. Concepts about Basic Control System, Control Loops of Robotic Systems, Different Types of Controllers Proportional, Integral, Differential, PID controllers.	**06**
Unit II	Kinematics of Robot Manipulator: Introduction, General Mathematical Preliminaries on Vectors& Matrices, Direct Kinematics problem, Geometry Based Direct kinematics problem, Co-ordinate and vector transformation using matrices, Rotation matrix, Inverse Transformations, Composite Rotation matrix, Homogenous Transformations, Robotic Manipulator Joint Co-Ordinate System, Euler Angle & Euler Transformations, Roll Pitch-Yaw(RPY) Transformation. D H Representation & Displacement Matrices for Standard Configurations, Jacobian Transformation in Robotic Manipulation.	**06**
Unit III	Dynamics of Robotic Manipulators: Introduction, Preliminary Definitions, Generalized Robotic Coordinates, Jacobian for a Two link Manipulator, Euler Equations, The Lagrangian Equations of motion. Application of Lagrange–Euler (LE) Dynamic Modeling of Robotic Manipulators: - Velocity of Joints, Kinetic Energy T of Arm, Potential Energy V of Robotic Arm, The Lagrange L, Two Link Robotic Dynamics with Distributed Mass	**06**
Unit IV	Robot Sensing & Vision: Various Sensors and their Classification, Use of Sensors and SensorBased System in Robotics, Machine Vision System, Description, Sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic Assembly Sensors and Intelligent Sensors. Industrial Applications: Objectives, Automation in Manufacturing, Robot Application in Industry, Task Programming,, Robot Intelligence and Task Planning, Modern Robots, Future Application	**06**

	and Challenges and Case Studies.	
Unit V	Control Technologies in Automation: Industrial Control Systems, Process Industries Versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms.	**06**
Unit VI	Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems& RTU. Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems.	**06**
Course Outcomes		
After completing this course students will be able to		
1	discuss and apply the concepts of dynamics for a typical Pick and Place robot.	
2	choose the appropriate Sensor and Machine vision system for a given application.	
3	identify potential areas for automation and justify need for automation	
Text Books		
1.	Robotics, control vision and intelligence-Fu, Lee and Gonzalez. McGraw Hill International, 2nd edition, 2007.	
2	Introduction to Robotics- John J. Craig, Addison Wesley Publishing, 3rd edition, 2010.	
3	Automation, Production Systems and Computer Integrated Manufacturing M. P. Groover, Pearson Education.5th edition, 2009.	
References		
1.	Saeed B. Niku, "Introduction to Robotics, Analysis, Systems, Applications", Pearson Education	
2.	Richard D. Klafter, "Robotic Engineering: An Integrated Approach", Prentice Hall of India	
Useful Links		
1.	www.nptel.iitm.ac.in	

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	P O7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	√	√	√	√					√			√	√	
CO2	√		√	√					√			√		
CO3	√	√	√	√					√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12

Total	15	15	10	60

Government College of Engineering Karad

Final Year B. Tech (Electrical) Sem. VIII

Elective-II EE843: Sliding Mode Control

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	--		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	To Design and analyze sliding mode controller for uncertain systems
2.	To Design estimators for state and uncertainty estimations.
3.	To Design and analyze discrete sliding mode controller.

Course Contents		**Hours**
Unit I	Notion of variable structure systems and sliding mode control.	**06**
Unit II	Design continuous sliding mode control, chattering issue, Alleviation of chattering	**08**
Unit III	Integral Sliding Mode Control. Sliding Mode Observer for state estimation	**06**
Unit IV	Discrete sliding mode control, uncertainty estimation using sliding mode	**08**
Unit V	Discrete output feedback SMC using multirate sampling	**06**
Unit VI	Introduction to higher order sliding mode control, twisting and super twisting algorithms	**06**

Course Outcomes		
After completing this course students will be able to		
1.	Design and analyze sliding mode controller for uncertain systems	
2.	Design estimators for state and uncertainty estimations.	
3.	Design and analyze discrete sliding mode controller.	

Text Books	
1.	Spurgeaon and Edwards," Sliding Mode Control Theory and Applications"
2.	. Utkin, Vadim ,Theory of Sliding Modes, Springer

References	
1.	B. Bandyopadhyay and S. Janardhanan , "Discrete-time Sliding Mode Control : A MultirateOutput Feedback Approach", Ser. Lecture Notes in Control and Information Sciences, Vol. 323, Springer-Verlag, Oct. 2005.
2.	Yuri Shtessel , Christopher Edwards, Leonid Fridman ,Arie Levant "Sliding Mode Control and Observation "Birkhauser
3.	S. Kurode, B. Bandyopadhyay and P.S. Gandhi, "Output feedback Control for Slosh free Motion using Sliding modes", Lambert Publications 2012

Useful Links	
	www.nptel.iitm.ac.in

Mapping of CO and PO

	PO	PO	PO	PO	PO	PO	P	PO	PO	PO	PO	PO	PSO	PSO

	1	2	3	4	5	6	O7	8	9	10	11	12	1	2
CO1	√	√	√	√					√			√	√	
CO2	√		√	√					√			√		
CO3	√	√	√	√					√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VIII

Elective-II EE853 Special Electrical Machines

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	--		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
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 I	Constructional features of Synchronous Reluctance Motor,--Types, Axial & Radial flux motors, Operating principles, Variable Reluctance Motors, Voltage & Torque equations, Phasor diagram, Performance characteristics.	**06**
Unit II	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 stepper motors, closed loop control, concept of lead angle.	**06**
Unit III	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 .	**06**
Unit IV	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.	**08**
Unit V	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.	**06**
Unit VI	**Industrial Applications**: Synchronous Reluctance Motors, Stepper Motors, Switched Reluctance Motor, Permanent magnet brushless dc motors, Permanent magnet synchronous motors.	**08**

Course Outcomes

After completing this course students will be able to

1.	understand concepts of special electrical machines.
2.	acquire knowledge of special electrical machines and its testings.
3.	understand applications of special electrical machines.
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.
References	
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 Motor drives,R.Krishnan, CRC Press. Del Toro
Useful Links	
1.	www.ocw.mit.edu
2.	www.nptel.iitm.ac.in (Video courses on Special Electrical Machines.)

Mapping of CO and PO

	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
CO1	√	√	√	√					√			√		
CO2	√	√	√	√					√			√		
CO3	√	√	√	√	√	√			√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Elective III

Government College of Engineering Karad

Final Year B. Tech (Electrical) Sem. VIII

Elective-III EE814: Restructured Power System

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials			**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	To Illustrate about various power sectors in India
2.	To analysis the differences between the conventional power system operation and the restructured power system with techno-commercial solutions
3.	To impart knowledge on fundamental concepts of congestion management

Course Contents		**Hours**
Unit I	**Power Sector in India :** Introduction to various institutions in Indian Power sector such as CEA, Planning Commissions, PGCIL, PFC, Ministry of Power, state and central governments, REC, utilities and their roles. Critical issues / challenges before the Indian power sector, Salient features of Electricity act 2003, Various national policies and guidelines under this act.	**06**
Unit II	**Fundamentals of Economics :** Introduction, Reasons for restructuring / deregulation of power industry, restructuring process, issues involved in deregulation, Consumer behavior, Supplier behavior, Market equilibrium, Short-run and Long-run costs, Various costs of production, Market models based on contractual arrangements, Comparison of various market models, Electricity vis-à-vis other commodities, Market architecture	**08**
Unit III	**Transmission congestion management :** Introduction, Classification of congestion management methods, Calculation of ATC, Non-market methods, Market methods, Nodal pricincing,Inter zonal and Intra zonal congestion management, Price area congestion management, Capacity alleviation method	**06**
Unit IV	**Locational marginal prices:** Mathematical preliminaries, Locational marginal pricing, Lossless DCOPF model for LMP calculation ,Loss compensated DCOPF model for LMP calculation, ACOPF model for LMP calculation	**06**
Unit V	**Financial Transmission rights:** FTR issuance process, Treatment of revenue shortfall, Secondary trading of FTRs, Flow gate rights, FTR and market power, FTR and merchant transmission investment.	**06**
Unit VI	**Ancillary service management and pricing of transmission network :** Introduction of ancillary services, Types of Ancillary services ,Classification of Ancillary services, Load generation balancing related services, Voltage control and reactive power support devices, Black start capability service, How to obtain ancillary service, Co-optimization of energy and reserve services,	**08**

	International comparison, Transmission pricing, Principles ,Classification ,Rolled in transmission pricing methods ,Marginal transmission pricing paradigm ,Composite pricing paradigm , Merits and demerits of different paradigm.	
Course Outcomes		
After completing this course students will be able to		
1.	Understand various power sectors in India	
2.	Understand the restructuring of power industry and market models.	
3.	Analyze the concepts of locational marginal pricing and financial transmission rights.	
Text Books		
	Sally Hunt," Making competition work in electricity", John Willey and Sons Inc. 2002	
References		
1.	Steven Stoft," Power system economics: designing markets for electricity", John Wiley & Sons, 2002.	
2.	Mohammad Shahidehpour, Muwaffaq Alomoush, Marcel Dekker, "Restructured electrical power systems: operation, trading and volatility" Pub., 2001	
3.	Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen," Operation of restructured power systems", Kluwer Academic Pub., 2001.	
Useful Links		
	www.nptel.com	

Mapping of CO and PO

	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
CO1	√	√	√	√					√			√		
CO2	√	√	√	√					√			√		
CO3	√	√	√	√	√	√					√			√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem.VIII

Elective-III EE824: Power Plant Engineering

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	0 Hrs/week		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min.

Course Objectives	
1.	To understand basic knowledge of different types of Power Plants, site selection criteria of each one of them.
2.	Understanding of Thermal Power Plant Operation, turbine governing, different types of high pressure boilers etc.
3.	To study of different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.
4.	Understanding of Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
5.	Understanding of energy audit, environmental and safety aspects of power plant operation.

Course Contents		**Hours**
Unit I	**Introduction:** Resources and development of power in India, NTPC, NHPC and their role in Power development in India, Power distribution, National Grid, Indian Electricity Grid Code, Structure of IEGC, Operating Policies and Procedures, Present Power position in India and Maharashtra. Power Plants Introduction, Factors affecting Selection and relative merits of steam, Gas, Diesel, Hydro Power Plants.	**06**
Unit II	**Steam turbine power plant:** Introduction, general layout of modern thermal power plant, of steam power plant, con treatment), necessity of feed water treatment, high pressure boilers and importance of water purity, effect of operating variable on thermal efficiency, regeneration, reheating, Cogeneration power Plant Gas turbine **Power plant:** Introduction, general layout of gas power plant, effect of operating variable on thermal efficiency, regeneration, reheating, and performance of closed and semi closed cycle gas turbine plant.	**06**
Unit III	**Nuclear power plant:** Elements of nuclear power plant, nuclear reactor and its types, coolants, control rod, classification of nuclear power plants, waste disposal. Diesel Power Plant: Diesel engine performance and operation, plant layout, log sheet, application, selection of engine size	**06**
Unit IV	**Hydroelectric power plant:** Hydroelectric Power Plant: site selection, classification of HPP, and their field of use, capacity calculation for hydro power, dam, head water control, penstock,	**06**

	water turbines, specific speeds, governors, hydroelectric plant auxiliaries, plant layout, automatic and pumped storage, project cost of hydroelectric plant. Advantages of hydro power plant.	
Unit V	**Environmental aspects in power station**: Environmental aspects: Introduction, Constitutes of the atmosphere, Different pollutants due to thermal power plant and their effect on human health, environmental control of different pollutants such as particulate matter, oxides of sulphur (Pre and Post Treatments) oxides of Nitrogen ,Global warming and green house effect, Thermal Pollution of Water and its control.	**06**
Unit VI	**Economic analysis and energy audit and energy marketing:** Introduction Cost of electric Energy, Fixed and operating cost, Selection and Type of Generation, Selection of generation equipment, Performance and Operation Characteristics of power plants and Tariff methods. Energy Audit and Energy Marketing: Selling and marketing in India, Creating supply chain in India, Successfully working with business and virtual teams in India, Navigating the financial, legal and accounting environment, Human Resources issues, India's business culture in transition. Ratings/BIS	**08**
Course Outcomes		
After taking this course the students should be able to		
1.	Select the suitability of site for a power plant.	
2.	Calculate performance of thermal power plant.	
3.	Explain working principle of different types of nuclear power plant	
4.	Calculate load factor, capacity factor, average load and peak load on a power plant.	
5.	Indicate safety aspects of power plants.	
Text Books		
1.	1. E.I.Wakil, ―Power Plant Engineering‖, McGraw Hill Publications New Delhi	
2.	P.K.Nag, ―Power Plant Engineering‖, McGraw Hill Publications New Delhi.	
References		
1.	Black & Veatch,Springer,Power Plant Engineering,1996.	
2.	Thomas C.Elliott,Kao Chen and Robert C.Swanekamp,Standard Handbook of Power Plant Engineering,Second Edition,McGraw-Hill,1998.	
3.	Godfrey Boyle,Renewable energy.Open University,Oxford University Press in association with the open university,2004	

Mapping of CO and PO

	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
CO1	√	√	√		√					√			√		
CO2	√	√	√		√					√			√		
CO3	√	√	√		√	√	√			√			√		
CO4		√	√		√	√	√			√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem.VIII

Elective-III EE834: Neural Network

Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorials	0		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min

Course Objectives

After taking this course the students should be able to understand

1.	Basic neuron models: McCulloch-Pitts model and the generalized one, distance or similarity based neuron model, radial basis function model, etc.
2.	Basic neural network models: multilayer perceptron, distance or similarity based neural networks, associative memory and self-organizing feature map, radial basis function based multilayer perceptron, neural network decision trees, etc.
3.	Basic learning algorithms: the delta learning rule, the back-propagation algorithm, self-organization learning, the r4-rule, etc.

Course Contents		**Hours**
Unit I	**Introduction to Neural Networks:** History, Artificial and biological neural networks, Artificial intelligence and neural networks	**06**
Unit II	**Neurons and Neural Networks:** Biological neurons, Models of single neurons, Different neural network models	**06**
Unit III	**Single Layer Perceptrons :** Least mean square algorithm, Learning curves, Learning rates, Perceptron	**08**
Unit IV	**Multilayer Perceptrons :** The XOR problem, Back-propagation algorithm, Heuristic for improving the back-propagation algorithm , Some examples	**06**
Unit V	**Radial-Basis Function Networks:** Interpolation, Regularisation, Learning strategies	**08**
Unit VI	**Kohonen Self-Organising Maps:** Self-organising map, The SOM algorithm, Learning vector quantisation	**06**

Course Outcomes

After taking this course the students will be able to understand

1.	Basic neuron models
2.	Basic neural network models
3.	Basic learning algorithms

Text Books

	Jacek M. Zurada, Introduction to Artificial Neural Systems, PWS Publishing Company, 1995

References

1.	Simon Haykin, Neural Networks: A Comprehensive Foundation, Macmillan College Publishing Company, 1994.
2.	Mohamad H. Hassoun, Foundamentals of Artificial Neural Networks, The MIT Press, 1995.
3.	Laurene Fausett, Fundamentals of Neural Networks: Architectures,

	Algorithms, and Applications, Prentice Hall International, Inc., 1994
4.	B. D. Ripley, Pattern Recognition and Neural Networks, Cambridge University Press., 1996
Useful Links	
1.	www.ocw.mit.edu
2.	www.nptel.iitm.ac.in

Mapping of CO and PO

	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
CO1	√	√	√		√					√				
CO2	√	√	√		√					√			√	
CO3	√	√	√		√	√	√			√		√	√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem.VIII

Elective-III EE844:Electrical Engineering Materials

Teaching Scheme			**Examination Scheme**	
Lectures	3Hrs/week		**CT1**	15
Tutorials			**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min

Course Objectives	
1.	To introduce the student with different materials & their characteristics used in various electrical equipment.
2.	select a suitable material for manufacturing electrical equipment

Course Contents		**Hours**
Unit I	**Conducting Materials:** Introduction of Classification of material into conducting, semi conducting and insulating materials, Resistance and factors affecting it such as alloying and temperature , Classification of conducting material as low resistivity and high resistivity materials , their practical applications applications, Super conductivity materials	**06**
Unit II	**Semi- Conducting Materials:** Introduction - Semi-conductors and their properties, Different semiconducting materials (silicon and germanium) used in manufacture of various semiconductor devices (i.e p-type and n-type semiconductors) , Materials used for electronic components like resistors, capacitors, diodes, transistors and inductors etc.	**06**
Unit III	**Insulating Materials - General Properties:** Electrical Properties - Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant, Physical Properties - Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness, Thermal Properties- Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electrothermal breakdown in solid dielectrics, Chemical Properties - Solubility, chemical resistance, weather ability, Mechanical properties – mechanical structure, tensile structure IS Standards	**06**
Unit IV	**Insulating Materials and Their Applications:** Plastics-Definition and classification, thermosetting materials, Thermoplastic materials; Natural insulating materials, properties and their applications; Gaseous materials – Ceramics-properties and applications.	**06**
Unit V	**Magnetic Materials and Special Materials:** Introduction , classification - ferromagnetic materials, permeability, BH curve, magnetic saturation, hysteresis loop (including) coercive force and residual magnetism, concept of eddy current and hysteresis loss,	**06**

	curie temperature, magnetostriction effect, Soft Magnetic Materials, Hard magnetic materials , Hall effect and its applications. Thermocouple, bimetals, leads soldering and fuses Material - their applications. Magnetization, Demagnetizations, nano materials	
Course Outcomes		
After taking this course, the students should be able to		
1.	analyze the characteristics of different types of materials viz. conductors, insulators, semiconductors and magnetic materials etc..	
2.	select a suitable material for manufacturing electrical equipment	
Text Books		
	A.J. Dekker "Electrical Engineering Materials", PHI, 2006. (2rd Edition)	
References		
1.	SK Bhattacharya, "Electrical and Electronic Engineering Materials"1stedition Khanna Publishers, New Delhi, 2006.	
2.	S.P. Seth, P.V. Gupta "A course in Electrical Engineering Materials", Dhanpat Rai& Sons.	
3.	C. S. Indulkar& S. Thiruvengadam, "Electrical Engineering Materials", S. Chand & Com. Ltd, New Delhi -55	
Useful Links		
	www.nptel.com	

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	√	√	√	√					√			√		
CO2	√	√	√	√					√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60

Government College of Engineering, Karad

Final Year B. Tech (Electrical) Sem. VIII

Elective-II EE854: Electrical Estimation and Costing

Teaching Scheme			**Examination Scheme**	
Lectures	3Hrs/week		**CT1**	15
Tutorials	--		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	2Hrs.30 Min

Course Objectives	
1.	To understand concept of Electrical Estimation and Costing
2.	To understand analytical methods in Electrical Estimation and Costing .
3.	To make students aware of protective system with industry oriented learning.

Course Contents		**Hours**
Unit I	**Drawing and IE rule :** Classification of Electrical Installation, General requirement of Electrical Installation, Reading and Interpretation of Electrical Engineering Drawings, Various diagrams, plans and layout, Important definitions related to Installation, IE rules related to Electrical Installation & Testing.	**06**
Unit II	**Service Connection :** Concept of service connection, Types of service connection & their features, Methods of Installation of service connection, Estimates of under ground & overhead service connections.	**06**
Unit III	**Residential Building Electrification :** General rules & guidelines for wiring of Residential Installation and positioning of equipments, Principles of circuit design in lighting and power Circuits, Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram, Selection of type of wiring and rating of wires & Cables, Load calculations and selection of size of conductor, Selection of rating of main switch, distributions board, protective switchgear ELCB and MCB and wiring accessories, Earthing of Residential Installation, Sequence to be followed for preparing Estimate, Preparation of detailed estimates and costing of Residential Installation.	**06**
Unit IV	**Electrification of commercial Installation :** Concept of commercial Installation, Differentiate between electrification of Residential and commercial Installation, Fundamental considerations for planning of an electrical Installation system for commercial building, Design considerations of electrical Installation system for commercial building, Load calculations & selection of size of service connection and nature of supply, Deciding the size of cables, busbar and busbar chambers, Mounting arrangements and positioning of switchboards, distribution boards & main switch ,Earthing of the electrical Installation, Selection of type wire, wiring system & layout, Sequence to be followed to prepare estimate, Preparation of detailed estimate and costing of commercial	**06**

	Installation.	
Unit V	**Electrification of factory unit Installation :** Concept of Industrial load, Concept of Motor wiring circuit and single line Diagram, Important guidelines about power wiring and Motor Wiring, Design consideration of Electrical Installation in small Industry/Factory/workshop. Motor current calculations, Selection and rating of wire, cable size & conduct. Deciding fuse rating, starter, distribution boards & main Switch, Deciding the cable route, determination of length of wire, cable, conduit, earth wire, and earthing, Sequence to be followed to prepare estimate, Preparations of detailed estimate and costing of small factory unit/ workshop.	**06**
Unit VI	**Testing of Installation :** Testing of wiring Installation for verification of current, earthing, insulation resistance and continuity as per IS, Contracts, Tenders and Execution-,Concept of contracts and Tenders, Contracts, types of contracts, contractors, Valid Contracts, Contract documents.	**06**
Course Outcomes		
After taking this course the students should be able to		
1.	Student will be able to understand concepts of Electrical Estimation and Costing.	
2.	Student will be able to acquired knowledge of Electrical Estimation and Costing	
3.	Student will be able to understand Electrical Estimation and Costing fundamentals and various test preformed on it.	
4.	Student will be understanding applications of Electrical Estimation and Costing	
Text Books		
1.	Surjit Singh,"Electrical Estimating and costing"Dhanpat Rai and company, New Delhi	
2.	K.B. Raina,S.K.Bhattacharya,"Electrical Design;Estimating and costing", New Age International (p)Limited, New Delhi.	
3.	B.D.Arora," Electrical wiring,Estimating and costing",R.B. Publication, New Delhi.	
References		
1.	N. Alagappan,S. Ekambaram,"Electrical Estimating and costing", Tata Mc Graw Hill Publication,New Delhi.	
2.	S.L. Uappal," Electrical wiring Estimating and costing",Khanna Publication	
Useful Links		
1.	www.ocw.mit.edu	
2.	www.nptel.iitm.ac.in (Video courses on Electrical Estimation and costing)	

Mapping of CO and PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO1 2	PSO 1	PSO2
CO1	√	√	√	√					√			√		
CO2	√	√	√	√					√			√		
CO3	√	√	√	√	√	√			√			√		

CO4													

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Total	15	15	10	60