Electrical Engineering Department
Government College of Engineering, Karad

Curriculum for FY Electrical from Academic Year 2022-23

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

Program Educational Objectives

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

Program Outcomes (POs)

Engineering Graduates will be able to:

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

PROGRAM SPECIFIC OUTCOME (PSO)

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

Government College of Engineering, Karad

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering

`Scheme of Instructions: Final Year B. Tech. in Electrical Engineering

Semester – VII

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	OEC	EE2701	Computer Network & Communication	3	-	-	3	3	15	15	10	60	100
2	PEC	EE27*2	Elective – III	3	-	-	3	3	15	15	10	60	100
3	**PEC**	**EE27*3**	**Elective – IV**	3	1	-	4	4	15	15	10	60	100
4	PCC	EE2704	Switchgear and Protection	3	-	-	3	3	15	15	10	60	100
5	PCC	EE2705	Electrical Drives	4	-	-	~~4~~	~~4~~	15	15	10	60	100
6	OEC	EE2706	Computer Network & Communication Lab	-	-	2	2	1	-	-	50	—	50
7	PEC	EE27*7	Elective – III Lab	-	-	2	2	1	-	-	25	25	50
8	PEC	EE27*8	Elective – IV Lab	-	-	2	2	1	-	-	25	25	50
9	PCC	EE2709	Switchgear and Protection Lab	-	-	2	2	1	-	-	25	25	50
10	PCC	EE2710	Electrical Drives Lab	-	-	2	2	1	-	-	25	25	50
11	P/S/IT	EE2711	Case study	-	-	2	2	1	-	-	50	--	50
12	P/S/IT	EE2712	Industrial Training & Technical Presentation	-	1	-	1	1	-	-	50	--	50
			Total	**16**	**02**	**12**	**30**	**24**	**75**	**75**	**300**	**400**	**850**

L- Lecture T-Tutorial P-Practical

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

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

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	MCC (Mandatory Courses)	Project / Seminar / Industrial Training
Credits	--	--	--	08	09	03	--	04
Cumulative Sum	10	22	27	46	15	15	Yes	07

PROGRESSIVE TOTAL CREDITS :118+24 = 142

Government College of Engineering, Karad

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering

Scheme of Instructions: Final Year B. Tech. in Electrical Engineering (ACADEMIC MODE)

Semester – VIII

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	HSMC	EE2801	Laws for Engineers	3	-	-	3	3	15	15	10	60	100
2	OEC	EE2802	Embedded System	3	-	-	3	3	15	15	10	60	100
3	PEC	EE28*3	Elective – V	3	-	-	3	3	15	15	10	60	100
4	OEC	EE2804	Embedded System Lab	-	-	2	2	1	-	-	25	50	75
5	PEC	EE28*5	Elective – V Lab	-	-	2	2	1	-	-	25	50	75
6	P/S/IT	EE2806	Project	-	-	14	14	7	ISA-I 50	ISA-II 50	50	150	300
			Total	**09**	**00**	**18**	**27**	**18**	**95**	**95**	**130**	**430**	**750**

L- Lecture T-Tutorial P-Practical

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

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

Intermediate assessment of the project work (ISA-I & ISA-II) shall be done 2 times by a departmental committee after every 4weeks from start of project work. The contact Hrs shown are for students to work in a group of minimum 4 students per group.

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	PEC (Programme Elective courses)	OEC (Open Elective courses from other discipline)	MCC (Mandatory Courses)	Project / Seminar / Industrial Training
Credits	03	--	--	---	04	04	--	14
Cumulative Sum	13	22	27	46	19	19	--	14

PROGRESSIVE TOTAL CREDITS: 142+18= 160

Government College of Engineering, Karad

SCHEME OF INSTRUCTION & SYLLABI

Programme: Electrical Engineering

Scheme of Instructions : Final Year B. Tech. in Electrical Engineering (INDUSTRY MODE)

Semester – VIII

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	OEC	EE2807	(MOOC – 1)/ Online course offered by department-1	-	-	-	-	3	-	-	-	-	100
2	PEC	EE2808	(MOOC – 2)/ Online course offered by department-2	-	-	-	-	3	-	-	-	-	100
3	P/S/IT	EE2809	Industrial Project	-	-	-	-	12	ISA-I 75	ISA-II 75	100	300	550
4													
			Total	**00**	**00**	**00**	**00**	**18**	**75**	**75**	**100**	**300**	**750**

Intermediate assessment of the project work (ISA-I & ISA-II)shall be done 2 times by a Guide after every 4weeks from start of project work

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core courses)	MOOCS	OEC (Open Elective courses from other discipline)	MCC (Mandatory Courses)	Project / Seminar / Industrial Training
Credits	00	--	--	---	06	--	--	12
Cumulative Sum	10	22	27	46	21	15	Yes	19

PROGRESSIVE TOTAL CREDITS: 142+18= 160

* The faculty coordinator shall be appointed for OEC EE2807 & PEC EE2808 for continuous monitoring of students' progress for the opted online MOOC course.

** The Industrial Project guide from department will be allotted to every student to continuous monitor the progress of Industrial Project work.

For MOOC 1 and 2 department will dclare list of MOOC 1/2 from which student have to select any one.

List of PROGRAM ELECTIVE courses:

Verticals	Advanced Power System		Advanced Electrical Modelling		Industrial Control & Atomization		Energy & Utilization	
Elective – III	EE2712	Restructured Power System	EE2722	Special Electrical Machines	EE2732	Industrial Automation and Control	EE2742	Smart Grid
Elective – IV	EE2713	Generation planning and load forecasting	EE2723	Electrical Equipments and Machines	EE2733	Process Control Engineering	EE2743	Power System Operation and Control
Elective – V	EE2813	FACTS	EE2823	Electric and hybrid vehicles	EE2833	Advanced Control System	EE2843	Power Quality and harmonics

COMMON INSTRUCTIONs

Departments shall suggest & execute

1. *Bridge courses* for the *Students Admitting to Direct Second year via Lateral Entry scheme in the III semester*. (Diploma students)
2. *Bridge courses* for the students who may be *Admitted in Autonomous mode from University mode*.
3. *MOOCs* for students adapting *Industry Mode* to fulfil the credit requirements. Copy of certificates / grade card shall be submitted to Controller of Examinations, GCE Karad through Program Coordinator prior to ESE.

Government College of Engineering, Karad

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

EE2701: Computer Network &Communication

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

Course Outcomes (CO)

Students will be able to

1.	Apply the issues and challenges in the architecture of a computer network
2.	Analyze the function(s) of the layers of the OSI model and TCP/IP Model
3.	Analyze the requirements for a given organizational structure to select the most appropriate networking architecture and technologies
4.	Evaluate the different types of network devices and their functions within a network
5	Create the skills of sub netting and routing mechanisms

	Course Contents	**Hours**
Unit 1	**Introduction to Data Communication:** Networks, Protocols and Standards, Categories of Networks, OSI & TCP/IP Protocol suites. Topology, Different media and network Devices.	**(6)**
Unit 2	**Data Link Layer and Medium Access Technique:** Framing, Error control, Flow control, Elementary data link protocols (ARQs: Stop and Wait, go back N, Sliding window.), HDLC, PPP. **Medium Access Technique:** Wired LANs: Ethernet, Wireless LANs, CSMA /CD, CSMA/CA, channel allocation, Random Access, Channelization.	**(6)**
Unit 3	**Network Layer:** IP addressing, IPV4, ARP, RARP, Error reporting protocol ICMP .IGMP. Forwarding and Unicast Routing protocols.	**(4)**
Unit 4	**Transport Layer:** Transport Protocols, Addressing, Establishing & releasing a connection Transport protocol for Internet TCP & UDP	**(5)**
Unit 5	**Application Layer:** Application Layer Protocols DHCP, DNS, TELNET, FTP, SMTP, HTTP, WWW, VoIP, Introduction to Network security: Goals of Security Basic Cryptography	**(5)**
Unit 6	**Basics of network security and network administration:** Network security: Introduction to Cryptography, Basics of Security attacks, Security algorithm, Internet security IPSec.	**(4)**

Text Books

1.	Behrouz A. Forouzan, Data Communications And Networking, 5th Edition, Tata McGraw Hill 2017
2.	Andrew S. Tanenbaum, Computer Networks, 8th Edition, Prentice Hall 2003

Reference Books

1.	William Stallings Data And Computer Communication, 8th Edition, Prentice Hall Of India, New Delhi, 2007.
2.	Douglas E Comer, Computer Networks And Internet, Pearson Education Asia, 4thEdition2008

Useful Links

1.	http://www.rfc-editor.org/rfcsearch.html
2.	http://www.cisco.cn.com

EE2701

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE2701: Computer Network &Communication

Course Outcomes (CO)	
Students will be able to	
1.	Apply the issues and challenges in the architecture of a computer network
2.	Analyze the function(s) of the layers of the OSI model and TCP/IP Model
3.	Analyze the requirements for a given organizational structure to select the most appropriate networking architecture and technologies
4.	Evaluate the different types of network devices and their functions within a network
5	Create the skills of sub netting and routing mechanisms

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	2	3	2	1	1	-	-	-	-	-	-	2	-
CO 2	3	2	3	1	2	3	1	-	-	-	-	2	-
CO 3	2	3	2	2	1	2	1	-	-	-	-	2	3
CO 4	2	2	2	1	2	1	-	-	-	-	-	-	3
CO5	2	3	2	2	2	-	-	-	-	-	1	1	-

Assessment Pattern (with revised Bloom's Taxonomy)

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

ELECTIVE III

Government College of Engineering, Karad

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

Elective III - EE 2712: Restructured Power System

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

Course Outcomes (CO)

Students will be able to

1.	Identify the need of regulation and deregulation.
2.	Define and describe the Technical and Non-technical issues in Deregulated Power Industry.
3.	Identify and give examples of existing electricity markets.
4.	Classify different market mechanisms and summarize the role of various entities in the market.

	Course Contents	Hours
Unit 1	**Deregulation of Electricity Supply Industry** Fundamentals of restructured system. Background of deregulation and current situation around the world, Benefits from competitive electricity market	**(6)**
Unit 2	**Power system operation in competitive environment** Role of ISO, operational planning activities of ISO, operational planning activities of GENCO	**(7)**
Unit 3	**Transmission Open access and pricing:** Power wheeling, transmission open access, cost components in transmission, transmission open access and pricing mechanism in various countries, security and congestion management in deregulation	**(8)**
Unit 4	**Ancillary services management:** General description of some ancillary services. Ancillary services management in various countries, reactive power as an ancillary service	**(7)**
Unit 5	**Power sector restructuring in India:** Electricity Act 2003, MERC	**(6)**
Unit 6	**Various institutions in Indian power sector**: CEA, PFC, Ministry of Power, India Energy Exchange (IEX)	**(6)**

Text Books

1.	Kankar Bhattacharya, Jaap E. Daadler, Math H.J. Boolen, "Operation of restructured power systems",Kluwer Academic Publishers

Reference Books

1.	Mohammad Shahidehpour, MuwaffaqAlomoush, "Restructured electrical power systems: operation, trading and volatility", Marcel Dekker.
2.	LorrinPhilipson, H. Lee Willis, "Understanding electric utilities and de-regulation", Marcel Dekker Pub.,1998.

Useful Links

1.	https://nptel.ac.in/courses/108/101/108101005/
2.	https://www.youtube.com/watch?v=aM9CrGHFlg4

EE2712

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
Elective III - EE 2712: Restructured Power System

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Identify the need of regulation and deregulation.
2.	Define and describe the Technical and Non-technical issues in Deregulated Power Industry.
3.	Identify and give examples of existing electricity markets.
4.	Classify different market mechanisms and summarize the role of various entities in the market.

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

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply	5	5	3	20
Analyse	5	5	3	25
Evaluate	5	5	4	15
Create				
TOTAL	15	15	10	60

Government College of Engineering, Karad

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

EE 2722 : Elective III - Special Electrical Machines

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

Course Outcomes (CO)

Students will be able to

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

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

Text Books

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

Reference Books

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

Useful Links

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

EE2722

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE2722 : Elective III - Special Electrical Machines

Mapping of COs and POs

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

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

Assessment Pattern

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

Government College of Engineering, Karad

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

EE2732 : Elective III - Industrial Automation and Control

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

Course Outcomes (CO)

Students will be able to

1.	Identify different components of an automation system.
2.	Interface the given I/O device with appropriate PLC module.
3.	Prepare PLC ladder diagram for given application.
4.	Select the suitable motor drive for the specified application.

	Course Contents	Hours
Unit 1	**Introduction to Industrial Automation and Control:** Architecture of Industrial Automation Systems. Types of automation systems-fixed, programmable, flexible. Components of automation systems viz. contactors, relays, actuators and sensors and PLC	**(8)**
Unit 2	**PLC Fundamentals:** Building blocks of PLC: CPU, Memory organization, Input-output modules, Special I/O modules, power supply. Fixed and Modular PLC and their types, Redundancy in PLC module.	**(8)**
Unit 3	**PLC Programming:** PLC I/O addressing. PLC programming instructions: relay type instructions, timer instructions: on delay, off delay, retentive, Counter instructions, Up, Down, High speed, Logical Instructions, comparison instructions, Data handling instructions, Arithmetic instructions. PLC programming language: Functional block diagram, Instruction list, structured text, sequential function chart, ladder programming.	**(4)**
Unit 4	**PLC Applications:** Simple programming examples using ladder logic: language based on relay, timer counter, logical, comparison, arithmetic and data handling instructions. PLC based application: Motor sequence control, Traffic light Control, elevator control, tank level control, conveyer system, stepper motor control, rector control	**(7)**
Unit 5	**Electrical Drives and Special Machines:** Electrical drives: Types, functions, characteristics, four quadrant operation DC and AC drive Controls: V/F control, parameters, direct torque control. Drives: working principle, specifications, parameters, types and applications. Applications: speed control of AC motor/ DC motor	**(6)**
Unit 6	**Supervisory Control and Data Acquisition System:** Introduction to SCADA, typical SCADA architecture/block diagram, benefits of SCADA. Various editors of SCADA Interfacing SCADA system with PLC: Typical connection diagram, object linking and embedding for process control architecture. Steps in creation SCADA screen for simple objects (defining tags and items) with PLC ladder program using OPC. Applications of SCADA: water distribution, pipeline control.	**(7)**

Text Books

1.	"Programmable Logic Controller", Jadhav. V. R, Khanna publishers, New Delhi, 2017, ISBN : 9788174092281
2.	"Programmable logic controllers" Petruzell.F.D, Tata — McGraw Hill India, New Delhi, Fourth edition,20l0, ISBN: 9780071067386
	"Programmable logic controllers and industrial automation: an introduction" ,MadhuchhandaMitra and

	SamarjitSen Gupta, second edition ,Penrarn International Publication, New Delhi, 2015, Fifth reprint, ISBN: 9788187972174
Reference Books	
1.	"Introduction to Programmable logic controllers", Dunning.G. Thomson/Delmar learning, New Delhi,2005, ISBN: 13.
2.	"Supervisory Control and Data Acquisition", Boyar.S.A, ISA Publication NcwDxellii (4'l' edition) ISBN: 975-1936007097
3.	"Industrial automation and process control",Stenerson,Jon,PHIlearning,New Delhi ISBN:9780130618900
4.	"Practical SCADA for industry", Bailey, David; Wright,Edwin, Newnes (an imprint ofElsevier)internationa1 edition, 2003, ISBN: 0750658053
5	"Programmable Controllers Theory and Implementation", Luis A. Bryan, Industrial Text Co. publication, Edition:first.
Useful Links	
1.	https://nptel.ac.in/courses/108/105/108105062/
2.	https://nptel.ac.in/courses/108/105/108105063/

EE2732

Government College of Engineering, Karad
Final Year (Sem. –VII) B. Tech. Electrical Engineering
EE2732: Elective III - Industrial Automation and Control

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Identify different components of an automation system.
2.	Interface the given I/O device with appropriate PLC module.
3.	Prepare PLC ladder diagram for given application.
4.	Select the suitable motor drive for the specified application.

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

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

EE 2742: Smart Grid

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

Course Outcomes (CO)

Students will be able to

1.	appreciate the difference between smart grid & conventional grid.
2.	apply smart metering concepts to industrial and commercial installations.
3.	formulate solutions in the areas of smart substations, distributed generation, and wide area measurements.
4.	provide smart grid solutions using modern communication technologies.

	Course Contents	Hours
Unit 1	**Introduction to Smart Grid**: • Introduction to Smart Grid, Evolution of Electric Grid. • Concept of Smart Grid, Definitions, Need of Smart Grid. • Concept of Robust &Self-Healing Grid. • Present development & International policies in Smart Grid.	**(6)**
Unit 2	**Smart Metering and Automation**: • Introduction to Smart Meters, Real Time Pricing, Smart Appliances. • Automatic Meter Reading (AMR) • Outage Management System (OMS). • Plug in Hybrid Electric Vehicles(PHEV). • Vehicle to Grid, Smart Sensors.	**(8)**
Unit 3	**Wide Area Measurement Systems:** • Geographic Information System (GIS). • Intelligent Electronic Devices (IED) & their application for monitoring & protection, Smart storage like Battery, SMES, Pumped Hydro. • Compressed Air Energy Storage. • Wide Area Measurement System (WAMS), Phase Measurement Unit (PMU).	**(6)**
Unit 4	**Smart Substation** • Home & Building Automation, • Smart Substations, • Substation Automation, • Feeder Automation.	**(8)**
Unit 5	• Micro Grid: • Concept of micro-grid, need & applications of micro-grid. • Formation of micro-grid, Issues of interconnection. • Protection & control of micro-grid. • Plastic & Organic solar cells, thin film solar cells. • Variable speed wind generators, fuel-cells, micro-turbines. • Captive power plants, Integration of renewable energy sources.	**(8)**
Unit 6	• Modern Communication Technologies: • Advanced Metering Infrastructure (AMI), Home Area Network (HAN). • Neighbourhood Area Network (NAN), Wide Area Network (WAN). • Bluetooth, ZigBee, GPS, Wi-Fi, Wi-Max based communication. • Wireless Mesh Network basics of CLOUD Computing &Cyber Security for Smart Grid. • Broadband over Power line (BPL). IP based protocols.	

Text Books

1.	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, “Smart Grid: Technology and Applications”, Wiley 2012.

2.	Ali Keyhani, “Design of smart power grid renewable energy systems”, Wiley IEEE,2011			
Reference Books				
1.	Clark W. Gellings, “The Smart Grid: Enabling Energy Efficiency and Demand Response”, CRC Press, 2009.			
2.	Stuart Borlase, “Smart Grid:Infrastructure, Technology and solutions “CRC Press.			
3.	A.G.Phadke, “Synchronized Phasor Measurement and their Applications”, Springer.			
Useful Links				
1.	https://nptel.ac.in/courses/108/107/108107113/			
2.	https://nptel.ac.in/courses/108/107/108107143/			

EE2742

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2742: Smart Grid

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	appreciate the difference between smart grid & conventional grid.
2.	apply smart metering concepts to industrial and commercial installations.
3.	formulate solutions in the areas of smart substations, distributed generation, and wide area measurements.
4.	provide smart grid solutions using modern communication technologies.

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

ELECTIVE IV

Government College of Engineering, Karad				
Final Year (Sem. – VII) B. Tech. Electrical Engineering				
Elective IV - EE 2713 : Generation Planning and Load Forecasting				
Teaching Scheme			**Examination Scheme**	
Lectures	03Hrs/week		CT – 1	15
Tutorials	01Hr./week		CT – 2	15
Total Credits	04		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Determine the power or energy needed to balance the supply and load demand at all the times.
2.	Examine the different methods of load forecasting.
3.	Illustrate the different ways of generation system cost and reliability analysis.
4.	determine economic operation of Power System.

	Course Contents	Hours
Unit 1	**Generation-** Fossil fuels, Hydropower and Nuclear power generation systems. Load Curves, Load duration curve. Characteristics of Steam units, Variation in steam unit characteristics, Characteristics of hydroelectric unit.	**(6)**
Unit 2	**Optimum Generation allocation**: Long range and short range Hydro generation scheduling. The short term and long term Hydro-thermal scheduling of generation. Hydroelectric plant models, Scheduling problems.	**(8)**
Unit 3	**Economic Dispatch:** Economic dispatch of thermal unit, Economics dispatch problem, Thermal system dispatch with Network losses, Lambda iteration method, Gradient methods of economic dispatch, Newtons method.	**(8**
Unit 4	**Economic operation of Power System:** Distribution of load between unit within a plant, Transmission loss function of Plant Generation, Distribution load between plants.	**(7)**
Unit 5	**Load Forecasting :** Classification of loads -Load forecasting methodology-Energy forecasting peak demand forecasting Weather sensitive and Non-weather sensitive forecasting - Total forecasts - Annual and Monthly peak demand forecast.	**(6)**
Unit 6	**Load dispatch:** Consideration for centralized control of system operations. Requirements of the central load dispatch centre, Energy management & conservation.	**(5)**

Text Books

1.	Power Generation, Opearion and Control : A.J. Wood and B.F. Wollenberg:, John Wiley
2.	Economic Control of Interconnected System -Kirchmayers, L.K.,John Wiley and Sons, New York.

Reference Books

1.	Privatization, Restructing, and Regulation of Network Utilities (Walras-Pareto Lectures) : by David M. Newbery
2.	Power system analysis operation & control , Abhijit Chakrabharati, PHI
3.	Power System Planning - R.L. Sullivan, McGraw Hill.

EE2713

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
Elective IV - EE 2713 : Generation Planning and Load Forecasting

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Determine the power or energy needed to balance the supply and load demand at all the times.
2.	Examine the different methods of load forecasting.
3.	Illustrate the different ways of generation system cost and reliability analysis.
4.	Find need of load dispatch centres and deregulation of electric utilities

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

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

Elective IV- EE2743 : Power System Operation and Control

Teaching Scheme			Examination Scheme	
Lectures	03Hrs/week		CT – 1	15
Tutorials	01Hrs/week		CT – 2	15
Total Credits	04		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Identify significance of power system operation and control.
2.	Evaluate the real power-frequency interaction and design of power-frequency controller.
3.	Analyse the reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
4.	Elaborate the economic operation of power system.
5.	Analyse the SCADA system and its application for real time operation and control of power systems

	Course Contents	Hours
Unit 1	**Power System Stability** The stability problem, Steady-state and transient stability concepts, rotor dynamics and swing equation, equal area criterion, step by step solution of swing curve, multi-machine stability, factors affecting transient stability.	**(6)**
Unit 2	**Preliminaries on Power System Operation and Control** Power scenario in Indian grid ,National and Regional load dispatching centers, requirements of good power system, necessity of voltage and frequency regulation – real power vs frequency and reactive power vs voltage control, system load variation, load curves and basic concepts of load dispatching ,load forecasting, Basics of speed governing mechanisms and modelling, speed load characteristics ,regulation of two generators in parallel.	**(8)**
Unit 3	**Real Power- Frequency Control** Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases, LFC of two area system, tie line modelling, block diagram representation of two area system, static and dynamic analysis, tie line with frequency bias control, state variability model, integration of economic dispatch control with LFC.	**(6)**
Unit 4	**Reactive Power – Voltage Control** Generation and absorption of reactive power, basics of reactive power control, Automatic Voltage Regulator (AVR), brushless AC excitation system, block diagram representation of AVR loop, static and dynamic analysis, stability compensation, voltage drop in transmission line, methods of reactive power injection, tap changing transformer, SVC (TCR + TSC) and STATCOM for voltage control.	**(6)**
Unit 5	**Economic Operation of Power System** Statement of economic dispatch problem, input and output characteristics of thermal plant , incremental cost curve, optimal operation of thermal units without and with transmission losses (no derivation of transmission loss coefficients) , base point and participation factors method, statement of unit commitment (UC) problem, constraints on UC problem, solution of UC problem using priority list, special aspects of short term and long term hydrothermal problems.	**(6)**
Unit 6	**Computer Control of Power Systems** Need of computer control of power systems-concept of energy control centers and functions – PMU, system monitoring, data acquisition and controls, System hardware configurations – SCADA and EMS functions , state estimation problem , measurements and errors -weighted least square estimation – various operating states – state transition diagram.	**(6)**

Text Books

1.	Olle.I.Elgerd, Electric Energy Systems theory – An introduction, McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
2.	Allen. J. Wood and Bruce F. Wollen berg, Power Generation, Operation and Control, John Wiley and Sons, Inc.,

	2016.
3.	AbhijitChakrabarti and SunitaHalder, Power System Analysis Operation and Control, PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.
Reference Books	
1.	Kothari D.P. and Nagrath I.J., Power System Engineering, Tata McGraw-Hill Education, Second Edition, 2008.
2.	HadiSaadat, Power System Analysis, McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
3.	Kundur P., Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
Useful Links	
1.	https://nptel.ac.in/courses/108/101/108101040/
2.	https://nptel.ac.in/courses/108/104/108104052/

EE2743

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
Elective IV- EE2743 : Power System Operation and Control

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Identify significance of power system operation and control.
2.	Evaluate the real power-frequency interaction and design of power-frequency controller.
3.	Analyse the reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
4.	Elaborate the economic operation of power system.
5.	Analyse the SCADA system and its application for real time operation and control of power systems

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

Assessment Pattern (with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

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

EE2704: Switchgear and Protection

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

Course Outcomes (CO)

Students will be able to

1.	Understand the relaying principles, working of circuit breakers and L.T. switchgears.
2.	Select the different components of protection system such as CT, PT, circuit breakers, relays etc.
3.	Identify, formulate and solve problems in protection of transformer, generator, transmission lines, bus bar, motors etc.
4.	Understand various protections utilised in power system to maintain stability of the same.

	Course Contents	Hours
Unit 1	**Fundamentals of power system protection, Instrument Transformers, Circuit Breakers**: Need of protection, protection principles, protection paradigms - apparatus protection and system protection, desirable attributes of protection. Introduction to C.T., C.T. equivalent circuit, C.T. saturation and dc offset current, V.T. equivalent circuit, Ferro resonance, Circuit Breakers: arc voltage, arc interruption, resistance switching, interruption of capacitive and inductive current, circuit breaker ratings, classification of C.B.s - air break, air blast, vacuum, minimum oil and bulk oil, SF6 C.B. L.T. switchgear: - MCB, MCCB, HRC fuses, type construction and application.	**(8)**
Unit 2	**Fault analysis and over current protection:** Review of calculation of fault currents, C. B. selection, fuse protection, over current protection, PSM and TMS setting, phase relay coordination, earth fault protection using over current relays, introduction to directional over-current relays.	**(6)**
Unit 3	**Basics of numerical relaying:** Numerical relaying fundamentals, sampling theorem, anti-aliasing filters, least square method for estimation of phasors, Fourier algorithms, Fourier analysis and discrete Fourier transform, estimation of phasors from discrete Fourier transform, Applications for implantation of various numerical relays. Fundamentals of PMU and WAMS.	**(6)**
Unit 4	**Transmission System Protection using distance relays:** Introduction to distance relaying, zones of protection, effect of fault arc resistance, directional properties, setting and coordination of distance relays, pilot protection with distance relays, realization of distance relays using numerical relaying algorithms, Basics of load encroachment and power swing.	**(7)**
Unit 5	**Protection of Transformer, Generator, Motors:** Percentage differential protection, magnetic inrush current phenomenon, percentage differential relay with harmonic restraint, restricted earth fault protection, incipient faults, Buchholz relay, protection against over fluxing. Generator protection: Stator phase and ground fault protection, protection against unbalanced loading, loss of excitation, loss of prime mover and over speeding, protection of large motors.	**(7)**
Unit 6	**Bus bar protection, Lightning Protection and system grounding:** Bus bar protection: Different bus bar arrangements, differential protection of bus bar, high impedance differential relay. Lightening and switching over voltages, need and types of lightening arresters, insulation coordination. System grounding, need, methods of system grounding, substation ground mats.	**(6)**

Text Books

1.	Fundamentals of power system protection by Y. G. Paithankar, S. R. Bhide., Prentice hall, India, second edition, 2010."
2.	A Web Course on Digital protection of power system by Prof. Dr. S. A. Soman, IIT Bombay.

Reference Books

1.	Switchgear protection and power system by Sunil S. Rao, Khanna Publishers, 13th edition, 2008.
2.	Computer relaying for power systems by A.G.Phadke, J.S.Thorp-research studies press ltd. England John Wiley & sons Inc. New York.
3.	Protection of power systems by Blackburn.
Useful Links	
1.	http://www.cdeep.iitb.ac.in/webpage_data/nptel/Electrical%20Engineering/Power%20System%20Protection/TOC_M1.ht
2.	https://nptel.ac.in/courses/108/107/108107167/
3.	www.ocw.mit.edu

EE2704

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE2704: Switchgear and Protection

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Understand the relaying principles, working of circuit breakers and L.T. switchgears.
2.	Select the different components of protection system such as CT, PT, circuit breakers, relays etc.
3.	Identify, formulate and solve problems in protection of transformer, generator, transmission lines, bus bar, motors etc.
4.	Understand various protections utilised in power system to maintain stability of the same.

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

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

EE 2705: Electrical Drives

Teaching Scheme		**Examination Scheme**	
Lectures	04Hrs/week	CT – 1	15
Tutorials	00Hrs/week	CT – 2	15
Total Credits	04	TA	10
		ESE	60
		Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Apply mathematical skill with Power Electronics to demonstrate drive characteristics and applications of various controllers in electrical drive systems.
2.	Analyse dynamics of electrical drives, and its stability.
3.	Analyse and evaluate advanced control schemes for torque and speed control of electrical drives.
4.	Recommend and Design suitable control schemes for required drive application.

	Course Contents	**Hours**
Unit 1	**Introduction:** Drive concepts, energy conversion, energy saving and pay-off using Power Electronics Converter; advantages, parts, choice of electrical drive; multi-quadrant operation; modes of operation (steady-state, acceleration, deceleration); open-loop, closed-loop, torque, speed, and current control of electrical drive.	**(4)**
Unit 2	**Dynamics of Electrical Drive:** Fundamental torque equation, nature, and classification of various torques; control & stability of electrical drive; load equalization; thermal effects in electrical machines. Classes of motor duty, IP protection (ingress protection), calculations for rating, criteria for selection of motor for various applications,	**(6)**
Unit 3	**DC Motor Drives:** Review of basic characteristics, classical control schemes (starting, braking, speed, torque), Performance of dc motors, starting, braking, transient analysis, speed control, methods of armature voltage control, modes of speed control, Ward-Leonard drives, **Advanced Control Schemes:** Single phase and three phase controlled rectifier-fed dc drives, dual converter control, chopper-controlled dc drives, performance analysis, Brushless DC motor drive, applications of DC drives	**(6)**
Unit 4	**Induction Motor Drives:** Review of basic characteristics, classical control schemes (starting, braking, speed, torque), **Scalar Control Schemes:** Stator voltage control, V/f control, Staticrotorresistancecontrolmethod,staticslippowerrecoverycontrol- Static Scherbius drive and Static Kramer drive, Limitation of scalar control schemes, applications **Vector Control Schemes:** Voltage Source Inverter and its PWM strategy for motor control, Direct Torque Control (DTC), Field Oriented Control (FOC), applications	**(8)**
Unit 5	**Synchronous Motor Drives:** Review of starting, pulling and braking of Synchronous motor,StaticvariablefrequencycontrolforSynchronousmotors,LoadcommutatedinverterfedSynchronousmotordrive, IntroductiontoclosedloopcontrolofLoadcommutatedinverterfedSynchronousmotordrive, Permanent Magnet Synchronous Motor Drive, Switched Reluctance Motor Drive, applications	**(8)**
Unit 6	Different components of standard industrial drives, practical issues of interconnections between motors and inverters **Drives for Specific Applications :**Textile Mill, Steel Rolling Mill, Cement Mill, Sugar Mill, Chemical / Petrochemical industry, Electrical Vehicles, machine tools	**(4)**

Textbooks

1.	FundamentalsofElectricalDrives,G.K.Dubey,NarosaPublishinghouse
2.	AfirstcourseinElectricalDrives,S.K.Pillai,NewAgeInternationalPublishers
3.	Dynamics and Control of Electrical Drives, PiotrWach, Springer Publication

Reference Books

1.	Modern Power Electronics and AC Drives, B. K. Bose, PrenticeHall(I)Pvt.Ltd

2.	ElectricalMotorDrives:Modelling,AnalysisandControl,R.Krishnan, PrenticeHall(I)Pvt.Ltd
3.	Analysis of Electric Machine, P. C. Krause, Wiley-IEEE press 3rd edition.

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

EE2705

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2705: Electrical Drives

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Apply mathematical skill with Power Electronics to demonstrate drive characteristics and applications of various controllers in electrical drive systems.
2.	Analyse dynamics of electrical drives, and its stability.
3.	Analyse and evaluate advanced control schemes for torque-speed control of electrical drives.
4.	Recommend and Design suitable control schemes for required drive application.

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

Assessment Pattern (with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

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

EE2706: Computer Network &Communication Lab

Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	---
Tutorials	---		CT – 2	---
Practicals	02 Hrs/week		CA	50
Total Credits	01		ESE	--
			Duration of ESE	--

Course Outcomes (CO)

Student will be able to

1.	Implement principles of computer networking
2.	Analyze performance of various computer network
3.	Build Data Networks for LAN
4.	Analyze networking protocols using Modern tools

	Experiments	
Experiment 1	Study of Networking components (Hardware/software) i.e. cables, connectors, topologies, switches/ hubs, crimping tool, IP addressing scheme, Subnetting, College Network Design	
Experiment 2	Construction of CAT 6/ CAT 7 Ethernet cable (straight/ crossover). Layer 2 & 3 Switch Data Networking, PC Network, TCP/IP configuration	
Experiment 3	Execution of Windows Networking Commands such s Ping, Netstat ARP, Netstat, Hostname, Tracert, Ipconfig, NSLookup, Route, PathPing, NetDiag, Telnet, FTP, Netsh Execution of Linux Networking Commands such as ifconfig, ip, trace route, tracepath, ping, netstat, ss, dig, nslookup, route, host, arp, iwconfig, hostname, curl or wget, mtr, whois, ifplugstatus, iftop, tcpdump	
Experiment 4	Implementation of Error Detection / Error Correction Techniques a] bit stuffing b] Character stuffing. c] CRC Code.	
Experiment 5	Implementation of Stop and Wait Protocol and sliding window.	
Experiment 6	Implementation of Go back-N and selective repeat protocols.	
Experiment 7	Implementation of simple client server architecture	
Experiment 8	Configuration of Network topology using Packet Tracer.	
Experiment 9	Utilization of Wireshark network analyser, Network Simulation tools NS2/NS3	
Experiment 10	Study of MANET and configure static routing protocol in MANET environment using NS2/OMNET/QualNet.	

EE2706

Government College of Engineering, Karad
Final Year (Sem – VII) B. Tech. Electrical Engineering
EE2706: Computer Network &Communication Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Implement principles of computer networking
2.	Analyze performance of various computer network
3.	Build Data Networks for LAN
4.	Analyze networking protocols using Modern tools

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

Assessment Pattern

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

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

Government College of Engineering, Karad

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

EE 2717 : Restructured Power System Lab

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

Course Outcomes (CO)

Students will be able to

1.	Identify the need of online platform for energy business.
2.	Illustrate Day Ahead Market and Term Ahead Market online
3.	Demonstrate grid management of regional load dispatch centre
4.	Demonstrate Business rules and bye laws for online energy business

	Experiments	
1	Analyse Energy Exchange India working online	
2	Illustrate Day Ahead Market (DAM) online	
3	Illustrate Term Ahead Market (TAM) online	
4	Demonstrate Business rules and bye laws in ‘Energy Exchange India’ online business	
5	Demonstrate grid management from wrldc, Mumbai	
6	Illustrate load dispatch management at LDC, Kalwa	

EE2717

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2717 : Restructured Power System Lab

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Identify the need of online platform for energy business.
2.	Illustrate Day Ahead Market and Term Ahead Market online
3.	Demonstrate grid management of regional load dispatch centre
4.	Demonstrate Business rules and bye laws for online energy business

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad				
Final Year (Sem. – VII) B. Tech. Electrical Engineering				
EE 2727 : Special Electrical Machines Lab				
Laboratory Scheme			**Examination Scheme**	
Practical	2 Hrs./week		**CA**	25
Total Credits	1		**ESE**	25*
			Total	50

Course Outcomes (CO)

Students will be able to

1	Select proper electrical motor with control technique 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 motors.

Course Contents

Experiment1	Simulation study of speed control of BLDC motor.
Experiment 2	Simulation study of speed control of PMS motor.
Experiment 3	Simulation study of speed control of SR motor.
Experiment 4	Simulation study of speed control of Stepper motor.
Experiment 5	Simulation study of speed control of Synchronous reluctance motor.
Experiment 6	Study of performance characteristics of BLDC motor.
Experiment 7	Study of performance characteristics of PMS motor.
Experiment 8	Study of performance characteristics of SR motor.
Experiment 9	Study of performance characteristics of Stepper motor.
Experiment 10	Study of performance characteristics of Synchronous reluctance motor.

Submission:

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

EE2727

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2727 : Special Electrical Machines Lab.

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Select proper electrical motor with control technique 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 motors.

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad				
Final Year (Sem. –VII) B. Tech. Electrical Engineering				
EE2737: Industrial Automation and Control Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	--
Tutorials	---		CT – 2	--
Practicals	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	

Course Outcomes (CO)	
Student will be able to	
1.	Simulate the ladder diagram for the given application using different instruction.
2.	Design logic base to control the various devices.
3.	Develop and test ladder program for the given applications.
4.	Create mimic diagram in SCADA system for the given application.

	Experiments	
Experiment 1	Use PLC to test START-STOP logic for two inputs and one output system	
Experiment 2	Develop/Execute a ladder program for the given application using following- timer, counter, comparison, logical, arithmetic instructions.	
Experiment 3	Use PLC to control the following devices: lamp, motor, push button switches, proximity sensor	
Experiment 4	Measure temperature of the given liquid using RTD or Thermocouple and PLC.	
Experiment 5	Develop and test ladder program for pulse counting using limit switch / proximity sensor.	
Experiment 6	Develop and test ladder program for automated car parking system	
Experiment 7	Develop and test ladder program for automated elevator control	
Experiment 8	Develop and test ladder program for tank level control	
Experiment 9	Develop and test ladder program to control speed of stepper motor with suitable drivers	
Experiment 10	a. Identify various front panel controls of Variable Frequency Drive (VFD) (smart drive) b. Control speed of AC/DC motor using VFD	
Experiment 11	Develop a SCADA mimic diagram for tank level control	
Experiment 12	Simulate tank level control using available SCADA system	

Government College of Engineering, Karad
Final Year (Sem. –VII) B. Tech. Electrical Engineering
EE2737 : Industrial Automation and Control Lab
Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Simulate the ladder diagram for the given application using different instruction.
2.	Design logic base to control the various devices.
3.	Develop and test ladder program for the given applications.
4.	Create mimic diagram in SCADA system for the given application.

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

Assessment Pattern

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

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

EE 2747

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2747: Smart Grid Laboratory

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	appreciate the difference between smart grid & conventional grid.
2.	apply smart metering concepts to industrial and commercial installations.
3.	formulate solutions in the areas of smart substations, distributed generation, and wide area measurements.
4.	provide smart grid solutions using modern communication technologies.

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

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

EE 2718 : Generation Planning and Load Forecasting Lab

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

Course Outcomes (CO)

Student will be able to

1.	To design, analyze and evaluate distribution system based on forecasted data
2.	Inculcate the concepts of evaluation of generation, transmission and distribution system reliability and their impacts on system planning.
3.	use the tools required to analyze and evaluate an electric power system for generation planning and load forecasting

	Experiments	
Experiment 1	To study Hydro power station characteristics	
Experiment 2	To study Nuclear power station characteristics	
Experiment 3	To study Components of Structure of Power System.	
Experiment 4	To identify the Status of National and Regional Planning, for Power system	
Experiment 5	Case study on fuel saving cost.	
Experiment 6	Economic load distribution problems.	
Experiment 7	To study Gradient method of Economic dispatch.	
Experiment 8	To list and examine the Methods of short term, medium term and long term load forecasting	
Experiment 9	To determine Transmission and distribution planning.	
Experiment 10	To analyse cost analysis in generation system	
Experiment 11	To study Electrical Forecasting technique	
Experiment 12	Power generation, distribution Data collection of state.	

Any eight experiments from above list.

EE2718

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2718 : Generation Planning and Load Forecasting Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	To design, analyze and evaluate distribution system design based on forecasted data
2.	Inculcate the concepts of evaluation of generation, transmission and distribution system reliability and their impacts on system planning.
3.	use the tools required to analyze and evaluate an electric power system for generation planning and load forecasting

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1
CO 1	2	2	2	1	1	2	2					2	3
CO 2	3	2	2	1	2	3							2
CO 3	3	1	1	2	3	2	1					1	3
CO 4	2	2	2	1	2	1							2

Assessment Pattern

1.Assessment for laboratory work will be based on skills acquired by students during the course.

2.Continuous Assessment Sheet (CAS) will be maintained for each student.

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

Government College of Engineering, Karad

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

EE 2848 : Power System Operation and Control Lab

Teaching Scheme			Examination Scheme	
Lectures	---		CT – 1	---
Tutorials	---		CT – 2	---
Practicals	02Hrs/week		CA	25
Total Credits	01		ESE	50
			Duration of ESE	3 hrs

Course Outcomes (CO)

Student will be able to

1.	Determine critical clearing angle for given system using software tool.
2.	Perform automatic generation control using software tool.
3.	Perform insulation, earth resistance and power factor improvement test
4.	Analyse optimum loading in power system.

	Experiments	
Experiment 1	Find the critical clearing angle by applying equal area criterion for any power system network and verify the same using any dedicated software	
Experiment 2	Determine the change in speed, frequency and steady state error corresponding to a load disturbance in a single area and a two area power system, with and without supplementary control using software.	
Experiment 3	To test the given power system component (HIGH VOLTAGE TESTING)	
Experiment 4	Determine the insulation resistance of the given LT &HT cable by using appropriate testing equipment	
Experiment 5	Determine the resistance to earth of the given earthing system and design an earthing system from soil resistivity of the given area.	
Experiment 6	Calculate rating of capacitors for power factor correction for a load and verify it experimentally.	
Experiment 7	Check the specifications of the given Current Transformer and Potential Transformer.	
Experiment 8	a)Determine Power transfer capability of the transmission line with and without series compensation b)Effects of series compensation on power transfer capability and system stability	
Experiment 9	Optimum loading of generators neglecting transmission losses	
Experiment 10	Optimum loading of generators with penalty factors	
Note: Use different software tool to perform some of the experiment.		

EE2848

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2848 : Power System Operation and Control Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Determine critical clearing angle for given system using software tool.
2.	Perform automatic generation control using software tool.
3.	Perform insulation, earth resistance and power factor improvement test
4.	Analyse optimum loading in power system.

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

Assessment Pattern

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

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

Government College of Engineering, Karad

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

EE2709: Switchgear and Protection Lab

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

Course Outcomes (CO)

Student will be able to

1.	Demonstrate tests on various equipments e. g. fuse, MCB,relays etc. and analyze the test results.
2.	Understand operation & working principle of relay.
3.	Perform simulation and modeling of protection system using ETAP/PSCAD/ATP.

	Experiments
Experiment 1	Substation single line diagram drawing using ATP.
Experiment 2	Protective zone coordination using ETAP.
Experiment 3	To study various fuses and plot inverse time characteristic of fuse.
Experiment 4	To demonstrate the operation of various MCBs, ELCBs and plot inverse time characteristics of MCBs. Study of MCB protection co-ordination.
Experiment 5	Study of Construction and working of Induction Disc Relays.
Experiment 6	IDMT relay characteristics.
Experiment 7	Operation and characteristics of over voltage Relay.
Experiment 8	Operation and characteristics of under voltage Relay.
Experiment 9	Operation and characteristics of over current Relay.
Experiment 10	Operation of Buchholz Relay.
Experiment 11	Operation and working of feeder protection.
Experiment 12	Operation and working of Differential protection of Alternator
Experiment 13	Operation and working of Differential protection of Transformer

EE2709

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE2709: Switchgear and Protection Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Demonstrate tests on various equipments e. g. fuse, MCB,relays etc. and analyze the test results.
2.	Understand operation & working principle of relay.
3.	Perform simulation and modeling of protection system using ETAP/PSCAD/ATP.

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

Assessment Pattern

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

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

Government College of Engineering, Karad

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

EE 2710 : Electrical Drives Laboratory

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

Course Outcomes (CO)

Student will be able to

1.	Select proper electrical drive motor for required applications.
2.	Analyse the advanced control technique applicable for A C and DC motors in practice.
3.	Simulate, Design and Develop advanced control schemes for electrical drives.

	Experiments	
Experiment 1	Obtaining moment of inertia (MI) of laboratory motor (AC, DC) (performance based)	
Experiment 2	Performance based experiments for DC motor a. ControlofDCmotorusing1-phconverters b. ControlofDCmotorusing3-phconverters c. Control of DC motor using dual converters	
Experiment 3	Simulation based experiments for DC motor a. Modelling of DC motor (separately excited motor, series motor) b. DC – DC converter fed DC motor Drive (open-loop, closed-loop) c. Dual Converter-fed (1-ph, 3-ph) separately excited motor drive	
Experiment 4	Performance based experiments for 3-ph induction motor a. T-N characteristics using voltage control b. T-N characteristics using V/F control (open-loop, closed-loop)	
Experiment 5	Simulation based experiments for 3-ph induction motor a. DTC of 3-ph induction motor b. FOC of 3-ph induction motor	
Experiment 6	Performance / Simulation based experiments for permanent magnet synchronous motor	
Experiment 7	Performance / Simulation based experiments for reluctance motor	
Experiment 8	Study experiment(s) based on applications(unit 6) of motor (design, calculations, simulations, industry visits)	

Above list of experiment list is for guidelines, concern faculty can add / change the experiments based on advanced technology applications in electrical drives.

ESE exam shall be based on the experiments performed / simulated during laboratory hrs to check the ability of the students to analyse and evaluate the drive performance.

EE2710

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2710 : Electrical Drives Laboratory

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Select proper electrical drive motor for required applications.
2.	Analyse the advanced control technique applicable for A C and DC motors in practice.
3.	Simulate, Design and Develop advanced control schemes for electrical drives.

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

Assessment Pattern

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

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

Government College of Engineering, Karad

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

EE 2711:Case Study

Teaching Scheme			Examination Scheme	
Lectures	00		CT – 1	---
Practical	02Hrs/week		CT – 2	---
Total Credits	01		TA	50
			ESE	--
			Duration of ESE	01 Hr

Course Outcomes (CO)

Students will

1.	Demonstrate knowledge of the state of the art in the relevant subjects of Electrical engineering.
2.	Investigate technical area beyond curriculum.
3.	Analyse the work in the literature to define scope of proposed.
4.	Apply knowledge for detailed analysis and disseminate it.

	Course Contents	Hours
	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	

EE2711

Government College of Engineering, Karad
Final Year (Sem. – VII) B. Tech. Electrical Engineering
EE 2711:Case study

Mapping of COs and POs

Course Outcomes (CO)	
Students will	
1.	Demonstrate knowledge of the state of the art in the relevant subjects of Electrical engineering.
2.	Investigate technical area beyond curriculum.
3.	Analyse the work in the literature to define scope of proposed.
4.	Apply knowledge for detailed analysis and disseminate it.

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

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand			10	
Apply			10	
Analyse			20	
Evaluate			10	
Create				
TOTAL			25	

Government College of Engineering, Karad

B. Tech. (Sem. – VII) Electrical Engineering

EE 2712:Industrial Training & Technical Presentation

Teaching Scheme			Examination Scheme	
Lectures	00		CT – 1	---
Tutorials	01Hr./week		CT – 2	---
Total Credits	01		TA	50
			ESE	--
			Duration of ESE	01 Hr.

Course Outcomes (CO)

Students will be able to

1.	demonstrate knowledge of processes and functionality of industry wherein the training is sought
2.	Analyse recent trends and technologies used in industry.
3.	Improve communication skills.
4.	Analyse relation between theory and practice.

	Course Contents	Hours
	Students will undergo four weeks industrial training in industry (preferably related to Electrical Engineering) 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. Also, they will submit comprehensive report on training in softcopy/ hard copy.	

EE2712

Government College of Engineering, Karad
B. Tech. (Sem. – VII) Electrical Engineering
EE 2712:Industrial Training & Technical Presentation

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	demonstrate knowledge of processes and functionality of industry wherein the training is sought
2.	Analise recent trends and technologies used in industry.
3.	Improve communication skills.
4.	Analyse relation between theory and practice.

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

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand			10	
Apply			10	
Analyse			20	
Evaluate			10	
Create				
TOTAL			50	

SEMESTER VIII

Government College of Engineering, Karad				
Final Year (Sem. – VIII) B. Tech. Electrical Engineering				
EE2801: Laws for Engineers				
Teaching Scheme			**Examination Scheme**	
Lectures	03Hrs/week		CT – 1	15
Tutorials	00Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Familiarise with basic laws that would help in their profession.
2.	Utilize the professional competence for augmenting universal human order.
3.	Identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models
4.	Identify the rights of Elections and IPR, Copyright.

	Course Contents	Hours
Unit 1	**Constitutional Law:** Constitutional Law Preamble; Fundamental Rights, Judicial Activism including Equality and Social Justice, Life and Personal Liberty and Secularism and Religious freedoms; Directive principles of State policy; Fundamental Duties; Emergency provisions – kinds, legal requirements and legal effects	**(6)**
Unit 2	**Labour Laws**: -Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; **Corporate Law: -** Meaning of corporation; Law relating to companies, public and private (Companies Act, 1956) general provisions; Law and multinational companies – International norms for control, FEMA 1999, collaboration agreements for technology transfer; Corporate liability, civil and criminal.	**(8)**
Unit 3	**General Principles of Contract under Indian Contract Act, 1872:** General principles of contract – Sec. 1 to 75 of Indian Contract Act and including Government as contracting party, Kinds of government contracts and dispute settlement, Standard form contracts; nature, advantages, unilateral character, principles of protection against possibility of exploitation, judicial approach to such contracts, exemption clauses, clash between two standard form contracts.	**(6)**
Unit 4	**IPR & Copyrights:** Introduction–meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; International instruments on IP – Berne convention, Rome convention, TRIPS, Paris convention and international organizations relating IPRs, WTO etc. **Law relating to Copyright in India:-** Meaning of copyright literary, dramatics and musical works, sound records and cinematographic films, computer programs, Ownership of copyrights, Criteria of infringement, Piracy in Internet – Remedies and procedures in India.	**(8)**
Unit 5	**Election provisions under Indian Constitution (Art.324–329**): Representation of Peoples Act and Prevention of Corruption Act, 1988; Superintendence, directions and control of elections to be vested in Election Commission; Election to the house of people and to the legislative assemblies of States to be on the basis of adult suffrage. Candidate electoral rights.	**(6)**
Unit 6	**Human Rights and Public International Law** covering Human Rights in International Law-Theoretical foundation, human rights and international law; Historical development of human rights; Human Rights in Indian tradition and Western tradition; Covenant on Civil &	**(6)**

	Political Rights 1966 including Optional Protocol – I (Individual Complaint Mechanism) & Optional Protocol – II (Abolition of Death Penalty); Covenant on Economic, Social and Cultural Rights 1966 including Optional Protocol – I (2002); UN Mechanism and specialized agencies, (UNICEF, UNESCO, WHO, ILO, FAO, etc.)	

Text Books	
1.	P.M. Bakshi (2003), Constitution of India, Universal Law Publishing Co.
2.	S.K. Awasthi& R.P. Kataria(2006), Law relating to Protection of Human Rights, Orient Publishing
3.	MeenaRao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
4.	T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
5.	Bare text (2005), Right to Information Act
6	O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
Reference Books	
1.	Cornish W. R. (2008), Intellectual Property Rights, Patents, Trademarks, Copyrights & Allied Rights, Sweet & Maxwell
2.	H.M. Seervai (1993), Constitutional Law of India, Tripathi Publications
3.	Sethna, Indian Company Law
4.	Agarwal H.O.(2008), International Law and Human Rights, Central Law Publications
5.	Cornish W. R. (2008), Intellectual Property Rights, Patents, Trademarks, Copyrights & Allied Rights, Sweet & Maxwell
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc20_hs55/preview
2.	http://www.mca.gov.in/MinistryV2/companiesact2013.html
3.	https://legalaffairs.gov.in/

EE2801

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE2801: Laws for Engineers

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Familiarise with basic laws that would help in their profession.
2.	Utilize the professional competence for augmenting universal human order.
3.	Identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models.
4.	Identify the rights of Elections and IPR, Copyright.

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

Final Year (Sem. – VIII) B. Tech. Electrical Engineering

EE2802: Embedded System

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

Course Outcomes (CO)

Students will be able to

1.	Suggest design approach using ARM controllers to real-life situations..
2.	Design interfacing of the systems with other data handling / processing systems..
3.	Appreciate engineering constraints like energy dissipation, data exchange speeds etc
4.	Program, test and debug code using Keil software.

	Course Contents	Hours
Unit 1	**ARM Embedded Systems:** Overview of Microcontroller, The RISC Design Philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software.	**(8)**
Unit 2	**ARM Processor Fundamentals:** Registers, Current Program Status Registers (CPSR), Pipeline, exceptions, Interrupts and the vector table, core extensions, architecture revision, Arm Processor Families.	**(8)**
Unit 3	**Efficient C Programming** Overview of C Compilers and Optimization, Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing, Structure Arrangement, Bit-fields, Unaligned Data and Endianness, Division, Floating Point, Inline Functions and Inline Assembly, Portability Issues.	**(4)**
Unit 4	**Exception and Interrupt Handling** Exception Handling, Interrupts, Interrupt Handling Schemes	**(7)**
Unit 5	**Interprocess Communication and Synchronization of Processes, Threads and Tasks** Multiple Processes in an application, Multiple Threads in an application, Tasks, Task States, Task and Data, Clear-cut distinction between Functions, ISRS and tasks by their Characteristics, Concept of Semaphores, Shared Data, Interprocess Communication, Signal Function, Semaphore Functions, Message Queue Functions, Mail Box Functions, Pipe Functions, Socket Functions, Message Queue Functions, Mail Box Functions, Pipe Functions, Socket Functions, RPC Functions.	**(6)**
Unit 6	**Real world interfacing using LPC 21XX** LED interfacing, switch interfacing, stepper motor interfacing, digital -input output interfacing, Programming on I2c & SPI bus Protocol.	**(7)**

Text Books

1.	Andrew Sloss, “ARM System Developer’s Guide”, Elsevier Inc., Morgan Kaufmann publication, Student Edition, 2004.
2.	Raj Kamal, “Embedded Systems- Architecture, Programming and Design”, The McGraw-Hill companies, 2nd Edition, 2011.
3.	Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.

Reference Books

1.	J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000
2.	Programming technique ARM DUI 0021A.

3.	David Simon, "An Embedded Software Primer", Addison Wesley, 2000..
4.	K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.
5.	By Frank Vahid, Tony Givargis, “Embedded System Design”, Wiley Publication, 2nd Edition, 2002.
Useful Links	
1.	http://nptel.ac.in/courses/108102045/
3.	https://www.youtube.com/watch?v=y9RAhEfLfJs

EE2802

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE2802: Embedded System

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Suggest design approach using ARM controllers to real-life situations.
2.	Design interfacing of the systems with other data handling / processing systems.
3.	Appreciate engineering constraints like energy dissipation, data exchange speeds etc
4.	Understand and implement the instruction set for ARM processor.

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

ELECTIVE V

Government College of Engineering, Karad				
Final Year (Sem. –VIII) B. Tech. Electrical Engineering				
Elective V- EE 2813:FACTS				
Teaching Scheme			**Examination Scheme**	
Lectures	03Hrs/week		CT – 1	15
Tutorials	00Hrs/week		CT – 2	15
Total Credits	03		TA	10
			ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO)

Students will be able to

1.	Apply knowledge to learn FACTS concepts.
2.	Analyse power system compensation requirements.
3.	Analyse specific use of FACTS devices
4.	Analyse compensation need in power system.

	Course Contents	Hours
Unit 1	Interconnections of Transmission Lines, Power Flow in an AC System, Loading Capability, Power Flow and Dynamic Stability Considerations of a Transmission Interconnection, Relative Importance of controllable Parameters.	**(8)**
Unit 2	FACTS Controllers, Benefits from FACTS technology, HVDC vs. FACTS Static Shunt Compensators	**(6)**
Unit 3	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 4	Objectives of Series Compensation, Variable Impedance Type Series Compensators, Switching Converter Type Series Compensators	**(6)**
Unit 5	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 6	Unified Power Flow Controller (UPFC) and Interline Power Flow Controller (IPFC), Introduction, The Unified Power Flow Controller, The Interline Power Flow Controller (IPFC)	**(6)**

Text Books

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

Reference Books

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.	Introduction To Facts Controllers Theory, Modeling, and Applications,Kalyan K. SenMey Ling Sen,IEEEPress,A JOHN WILEY & SONS, INC., Publication
3.	Flexible AC Transmission System (FACTS) Devices,ErnestNkusi, AV Akademikerverlag publication
4.	Flexible AC transmission systems (FACTS) , Yong Hua Song IEE Press, 1999

Useful Links

1.	https://nptel.ac.in/courses/201/106/201106034/

EE2813

Government College of Engineering, Karad
Final Year (Sem. –VIII) B. Tech. Electrical Engineering
Elective V- EE 2813:FACTS

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Apply knowledge to learn FACTS concepts.
2.	Analyse power system compensation requirements.
3.	Analyse specific use of FACTS devices
4.	Analyse compensation need in power system.

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

Final Year (Sem. – VIII) B. Tech. Electrical Engineering

Elective IV - EE2823: Electric and Hybrid Vehicles

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

Course Outcomes (CO)

Students will be able to

1.	Acquire knowledge about fundamental concepts, principles, analysis of electricand hybrid vehicles.
2.	Learn electric drives in vehicle applications.
3.	Demonstrate the skill for battery charging/discharging and energy management in electric vehicles.
4.	Compare and contrast characteristics matching of electric machine and the internal combustion engine.

	Course Contents	Hours
Unit 1	• History of hybrid and electric vehicles. • Social and environmental importance of hybrid and electric vehicles • Impact of modern drive-trains on energy supplies. • Basics of vehicle performance, vehicle power source characterization –transmission characteristics.	7
Unit 2	• Basic concept of hybrid traction. • Introduction to various hybrid drive-train topologies. • Power flow control in hybrid drive-train topologies.	7
Unit 3	• Basic concept of electric traction. • Introduction to various hybrid drive-train topologies.	6
Unit 4	• Introduction to electric components used in hybrid and electric vehicles • Configuration and control of DC Motor drives. • Configuration and control of Induction Motor drives, Permanent Magnet Brushless dc motor & Synchronous motor drives and Switch Reluctance Motor drives.	7
Unit 5	• Matching the electric machine and the internal combustion engine (ICE) characteristics. • Sizing the propulsion motor, sizing the power electronics ,Selecting the energy storage technology	7
Unit 6	• Introduction to energy management and their strategies used in hybrid and electric vehicles. • Classification of different energy management strategies,Comparison of different	7

Text Books

1.	Electric And Hybrid Electric Vehicles BrakingSystems & NVH considerations, Author Jurgen R.K., Publisher - Sae International

Reference Books

1.	Eectric And Hybrid Vehicles Design Fundamentals, Author Husain Iqbal.
2.	Modern Electric, Hybrid Electric and Fuel Cell Vehicles ,Fundamentals Theory and Design Author Ehsani M.,Gao Yimin , Emadia A. Crc Press Newyork.

EE2823

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE2823: Electric and Hybrid Vehicles

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Acquire knowledge about fundamental concepts, principles, analysis of electricand hybrid vehicles.
2.	Learn electric drives in vehicle applications.
3.	Demonstrate the skill for battery charging/discharging and energy management in electric vehicles.
4.	Compare and contrast characteristics matching of electric machine and the internal combustion engine.

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

Assessment Pattern (with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

Final Year (Sem. – VIII) B. Tech. Electrical Engineering

Elective V - EE 2833 : Advanced Control System

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

Course Outcomes (CO)

Students will be able to

1.	Demonstrate knowledge of feedback linearization for the nonlinear control system
2.	Demonstrate knowledge of sliding mode control for linear and nonlinear systems
3.	Design Sliding Mode Control
4.	Design linear and nonlinear observers for implementing advanced controllers

	Course Contents	Hours
Unit 1	**Introduction to Linear and Nonlinear System:** Review of features of linear and nonlinear systems. Stability analysis of linear and nonlinear systems using Lyapunov approach. Concept of feedback linearization. Conditions of feedback linearization. Partial feedback linearization. Control system design using feedback linearization.	**(7)**
Unit 2	**Variable structure system and sliding mode control system:** Notion of Variable structure system and variable structure control system. Features of VSC and Sliding mode control (SMC) Concept of existence of sliding modes.	**(7)**
Unit 3	**Design of sliding mode controller for linear and nonlinear system:** Design of SMC for linear systems using regular form of state space system. Design of SMC for nonlinear system using its representation as linear uncertain system.	**(6)**
Unit 4	**Robust control design using higher order sliding modes:** Chattering analysis of First Order SMC. Concept of Second order and higher order sliding modes. Design of SOSMC using Twisting and super twisting algorithm	**(8)**
Unit 5	**Design of observers for linear and nonlinear system for implementing advanced controllers:** Luenberger observer, High gain observers, Observers using SMC.	**(5)**
Unit 6	**Advanced controller design for electrical system case studies**: Advanced Controller design for any power electronic system. Controller design for PMSM/BLDC motor. Advanced controller design for Power electronic systems-buck/boost converter.	**(7)**

Text Books

1.	Jean-Jacques E. Slotine, Weiping Li , "Applied Nonlinear Control Systems", Prentiss hall Press, 1991.
2.	C. Edword and Sarha Spugeon , "Sliding mode control Theory and Applications", Pearson, 2010.

Reference Books

1.	Yuri Shtessel, Christopher Edwards, Leonid Freidman, " Sliding Mode Control and Observation" Springer Publisher
2.	Hassan K. Khalil, "Nonlinear Control" Pearson Publisher 2015

EE2833

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
Elective V - EE 2833 : Advanced Control System

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Demonstrate knowledge of feedback linearization for the nonlinear control system
2.	Demonstrate knowledge of sliding mode control for linear and nonlinear systems
3.	Design Sliding Mode Control
4.	Design linear and nonlinear observers for implementing advanced controllers

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

Assessment Pattern(with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

Final Year (Sem. – VIII) B. Tech. Electrical Engineering

Elective – V EE 2843 : Power Quality & Harmonics

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

Course Outcomes (CO)

Students will be able to

1.	Understand the different power quality indices.
2.	Interpret the ill effects of all power quality problems in power system.
3.	Solve wiring and grounding problems.
4.	Analyse harmonics and filters in power system.

	Course Contents	**Hours**
Unit 1	Introduction to Power Quality (PQ) : Classification of PQ problems, Causes PQ problems, Effects of PQ problems on users, Classification of mitigation techniques, Responsibilities of suppliers and users	**(4)**
Unit 2	Power Quality Standards and Monitoring : Power Quality Terminologies, Definitions, Standards, Monitoring, Numerical(s)	**(6)**
Unit 3	Application of power electronic controllers in power system, Distribution Static compensators, DSTATCOM), Dynamic Voltage Restores (DVR), Unified Power Quality Conditioner (UPQC), Static Power Transfer Switches (SPTS)	**(6)**
Unit 4	Harmonics : Harmonic distortion, Power system quantities under non-sinusoidal conditions, Harmonic indices, Harmonic sources from industrial / various loads, Harmonic Assessment (various methods), Effects of harmonic distortion, Devices for controlling harmonic distortion, Standards on harmonics	**(8)**
Unit 5	Filters : Passive Power Filters, Active Power Filters, Hybrid Power Filters, Numerical(s)	**(8)**
Unit 6	Case Studies on Power Quality Issues	**(4)**

Textbooks

1.	Power Quality Problems and Mitigation Techniques by Bhim Singh, Ambrish Chandra, Kamal Al-Haddad; John Wiley & Sons Ltd
2.	Electrical Power System Quality, by Roger C. Dugan; 3rd Ed., 2012, McGraw Hill
3.	Electric Power Quality by G.T.Heydt; 2nd Ed., Stars in a Circle Publications

Reference Books

1.	Electric Power Quality by Surajit Chattopadhyay, MadhuchhandaMitra, SamarjitSengupta; Springer Dordrecht Heidelberg London NewYork
2.	Power Quality Solutions : Case Studiesfor Trouble-shooters by Porter, Gregory J., Van Sciver, J. Andrew; The Fairmont Press
3.	Power System Quality Assessment by J. Arrillaga, N. R. Watson; 3rd Ed., John Willey & Sons

Useful Links

1.	https://nptel.ac.in/courses/108/102/108102179/	(Prof Bhim Singh – IIT Delhi)
2.	https://nptel.ac.in/courses/108/107/108107157/	(Prof Avikbhattacharya – IIT Roorkee)
3.	https://nptel.ac.in/courses/108/106/108106025/#	(Prof Mahesh Kumar – IIT Chennai)

EE2843

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
Elective V- EE 2843 : Power Quality & Harmonics

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Understand the different power quality indices.
2.	Interpret the ill effects of all power quality problems in power system.
3.	Solve wiring and grounding problems.
4.	Analyse harmonics and filters in power system.

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

Assessment Pattern (with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

Final Year (Sem. – VIII) B. Tech. Electrical Engineering

EE2804: Embedded System Lab

Teaching Scheme			Examination Scheme	
Lectures	---		CT – 1	---
Tutorials	---		CT – 2	---
Practicals	02Hrs/week		CA	25
Total Credits	01		ESE	50
			Duration of ESE	3 hrs.

Course Outcomes (CO)

Student will be able to

1.	Analyse and interpret various communication protocols in Embedded Systems.
2.	Identify hardware configuration of LPC21XX
3.	Program, test and debug code using Keil software.
4.	Apply the knowledge of Embedded Systems to build small Embedded applications.

	Experiments	
Experiment 1	To write embedded C program for interfacing Seven Segment display with LPC 21XX.	
Experiment 2	To write embedded C program for interfacing Relay with LPC 21XX.	
Experiment 3	To write embedded C program for interfacing ADC with LPC 21XX.	
Experiment 4	To write embedded C program for interfacing UART with LPC 21XX.	
Experiment 5	To write embedded C program for interfacing Keyboard with LPC 21XX..	
Experiment 6	LED interfacing with LPC 21XX.	
Experiment 7	I2C EEPROM interfacing with LPC 21XX	
Experiment 8	RTC interfacing with LPC 21XX.	
Experiment 9	Stepper Motor interfacing with LPC 21XX	
Experiment 10	Zigbee interfacing with LPC 21XX.	

EE2805

Government College of Engineering, Karad
Final Year (Sem – VIII) B. Tech. Electrical Engineering
EE2804: Embedded System Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Analyse and interpret various communication protocols in Embedded Systems.
2.	Identify hardware configuration of LPC21XX
3.	Program, test and debug code using Keil software.
4.	Apply the knowledge of Embedded Systems to build small Embedded applications.

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

Assessment Pattern

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

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

Government College of Engineering, Karad				
Final Year (Sem. –VIII) B. Tech. Electrical Engineering				
EE 2815: FACTS Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	---
Tutorials	---		CT – 2	---
Practicals	02 Hrs/week		CA	25
Total Credits	01		ESE	50
			Duration of ESE	3 hrs

Course Outcomes (CO)

Student will be able to

1.	Apply FACTS controllers for reactive power compensation using.
2.	Evaluate series and shunt compensators applications.
3.	Analyse proper selection of FACTS controller.
4.	Create MATLAB/Scilab simulations.

Experiments
Minimum eight experiments using MATLAB/ Scilabsimulationfrom List given below
1. Application of TCR for VAR compensation
2. Application of TSC for VAR compensation
3. Application of FC-TCR for VAR compensation
4. Application of TSC-TCR for VAR compensation
5. Application of STATCOM for VAR compensation
6. Application of SVC and STATCOM combination for VAR compensation
7. Application of GCSC for VAR compensation
8. Application of TSSC for VAR compensation
9. Application of TCSC for VAR compensation
10. Application of SSSC for VAR compensation
11. Application of UPFC for VAR compensation

EE2815

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE2815 : FACTS Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Apply FACTS controllers for reactive power compensation using.
2.	Evaluate series and shunt compensators applications.
3.	Analyse proper selection of FACTS controller.
4.	Create MATLAB simulations.

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

Assessment Pattern

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

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

Government College of Engineering, Karad				
Final Year (Sem. – VIII) B. Tech. Electrical Engineering				
EE2825: Electric and Hybrid Vehicles Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	---
Tutorials	---		CT – 2	---
Practicals	02 Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 hrs

Course Outcomes (CO)

Student will be able to

1.	Implement and Demonstrate the various electric drives for electric vehicle application.
2.	Comprehend the basics of electric & hybrid vehicle fundamentals for practical implementation using MATLAB.
3.	Develop/Create Simulation models of energy management & battery charging/discharging-SOC, for electric & hybrid vehicle application using MATLAB.
4.	Develop/Create Simulation models of electric drives for electric & hybrid vehicle application using MATLAB.

	Experiments	
Experiment 1	Simulation of brushless d.c. motor drive for EV application, using MATLAB.	
Experiment 2	Simulation of Induction motor drive for EV application, using MATLAB.	
Experiment 3	Simulation of permanent magnet synchronous motor drive for EV application, using MATLAB.	
Experiment 4	Simulation of DC motor drive for EV application, using MATLAB.	
Experiment 5	Simulation of switched reluctance motor drive for EV application, using MATLAB.	
Experiment 6	Simulation of battery operated electric vehicle using MATLAB.	
Experiment 7	Simulation of energy management for EV application, using MATLAB.	
Experiment 8	Simulation of battery chaging/discharging-SOC, characteristics for EV application using MATLAB.	
Experiment 9	Simulation of regenerative braking for EV application, using MATLAB.	
Experiment 10	Simulation of speed control of different motors for EV application, using MATLAB.	

EE2825

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE2825: Electric and Hybrid Vehicles Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Impliment and Demonstrate the various electric drives for electric vehicle application.
2.	Comprehend the basics of electric & hybrid vehicle fundamentals for practical implementation using MATLAB.
3.	Develop/Create Simulation models of energy management & battery charging/discharging-SOC, for electric & hybrid vehicle application using MATLAB.
4.	Develop/Create Simulation models of electric drives for electric & hybrid vehicle application using MATLAB.

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

Assessment Pattern

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

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

Government College of Engineering, Karad				
Final Year (Sem. – VIII) B. Tech. Electrical Engineering				
EE 2835 : Advanced Control System Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	---
Tutorials	---		CT – 2	---
Practicals	02Hrs/week		CA	25
Total Credits	01		ESE	25
			Duration of ESE	3 hrs

Course Outcomes (CO)

Student will be able to

1.	Implement advanced controller in simulation
2.	Implement advanced controller in experiment using RTI

	Experiments	
Experiment 1	To implement controller using feedback linearization in simulation	
Experiment 2	To implement FOSMC in simulation	
Experiment 3	To Implement SOSMC in simulation	
Experiment 4	To implement Observer in simulation	
Experiment 5	To validate controller in experiment	
Experiment 6	To validate observer in experiment	
Note	Each group will work on different practical systems (Buck Converter, Boost Converter, PMSM Motor, Industrial drive system, Coupled tank system, etc)	

EE2835

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE 2835 : Advanced Control System Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Implement advanced controller in simulation
2.	Implement advanced controller in experiment using RTI

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1
CO 1	2	2	2	1	3							1	1
CO 2	2	2	0	1	3							1	1

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

Government College of Engineering, Karad

Final Year (Sem. – VIII) B. Tech. Electrical Engineering

EE 2845 : Power Quality & Harmonics Lab

Teaching Scheme			**Examination Scheme**	
Lectures	---		CT – 1	-
Tutorials	---		CT – 2	-
Practical	02 Hrs/week		CA	25
Total Credits	01		ESE	50
			Duration of ESE	3 hrs

Course Outcomes (CO)

Student will be able to

1.	Monitor Power Quality problems using PQ monitoring instruments.
2.	Analyse Power Quality problems using PQ monitoring instruments.
3.	Evaluate PQ problems with suitable solution.

	Experiments	
Experiment 1	Effect of non-linear loads on power quality.	
Experiment 2	Demonstrate voltage and current distortion / harmonics. (experimental / simulation based)	
Experiment 3	Demonstrate voltage and current distortion / sag & swell. (experimental / simulation based)	
Experiment 4	Effect of load on neutral current. (experimental / simulation based)	
Experiment 5	DSTATCOM for mitigation of harmonics.	
Experiment 6	DVR for mitigation of voltage quality.	
Experiment 7	UPQC for mitigation of harmonics.	
Experiment 8	Mitigation of harmonics using filters. (active, passive, hybrid)	

- List of experiments for reference.
- Minimum 05 experiments / simulations based on contents in theory course to be designed and executed.
- At least 01 case study based on industrial / commercial / domestic problems.

ESE exam shall be based on the experiments performed / simulated during laboratory hrs and/or oral examination to check the ability of the students to analyse and evaluate the Power Quality issues.

EE2845

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE 2845 : Power Quality & Harmonics Lab

Mapping of COs and POs

Course Outcomes (CO)	
Student will be able to	
1.	Monitor Power Quality problems using PQ monitoring instruments.
2.	Analyse Power Quality problems using PQ monitoring instruments.
3.	Evaluate PQ problems with suitable solution.

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

Assessment Pattern

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

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

Government College of Engineering, Karad

Final Year (Sem. – VIII) B. Tech. Electrical Engineering

EE 2806: Project (Academic Mode)

Teaching Scheme			Examination Scheme	
Lectures	00		ISA– I	50
Tutorials	14 Hrs./wek		ISA-II	50
Total Credits	07		TA	50
			ESE	150
			Duration of ESE	03 Hrs

Course Outcomes (CO)

Students will be able to

1.	Evaluate innovative idea through literature and market survey; sight visits; interaction with community or industry, socio-economic survey etc.
2.	Analysis and design product, processes, methods and systems using multidisciplinary knowledge
3.	Create product, development of software and measurement methods
4.	Evaluate deployment, implementation and demonstration of project in group

	Course Contents	Hours
	1. Conceptualization of project theme (during winter vacation) 2. Learning state-of-the-art related to project idea through literaturereview /survey/ visits/interactions (2 weeks) 3. Designing of project theme and selection of components (2weeks) 4. Procurement of components (1week) 5. Assembly and Fabrication of project work (3 weeks) 6. Testing and modifications (2 weeks) 7. Report writing and conference ready paper based on project work (2 weeks) 8. Presenting project in front of departmental committee. 9. Submission of hard bound project report copy.	

EE2806

Government College of Engineering, Karad
Final Year (Sem – VIII) B. Tech. Electrical Engineering
EE 2806: Project (Academic Mode)

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Evaluate innovative idea through literature and market survey; sight visits; interaction with community or industry, socio-economic survey etc.
2.	Analysis and design product, processes, methods and systems using multidisciplinary knowledge
3.	Create product, development of software and measurement methods
4.	Evaluate deployment, implementation and demonstration of project in group

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

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	ISA-I	ISA-II	TA	ESE
Remember				
Understand	10			50
Apply	10	10	20	
Analyse	20	10	10	50
Evaluate	10	10	10	50
Create	0	20	10	
TOTAL	50	50	50	150

Government College of Engineering, Karad

Final Year (Sem. – VIII) B. Tech. Electrical Engineering

EE 2809: Project (Industry Mode)

Teaching Scheme			Examination Scheme	
Lectures	00		ISA– I	75
Practical	All Hrs/week		ISA-II	75
Total Credits	12		TA	100
			ESE	300
			Duration of ESE	02 Hrs

Course Outcomes (CO)

Students will be able to

1.	Communicate and familiarise with industry community.
2.	Apply theoretical knowledge to select project in industry.
3.	Evaluate problem statement.
4.	Create and design project in industry.

	Course Contents	Hours
	The scope, objectives and time frame of industry project will be decided by concerned internal guide and industry expert in tune with the academic requirements of the institute. The candidate pursuing industry project should maintain the work diary and present it to internal guide after every fortnight. The student has to present project work in front of departmental committee and submit hard bound project report.	

EE2809

Government College of Engineering, Karad
Final Year (Sem. – VIII) B. Tech. Electrical Engineering
EE 2809: Project (Industry Mode)

Mapping of COs and POs

Course Outcomes (CO)	
Students will be able to	
1.	Communicate and familiarise with industry community.
2.	Apply theoretical knowledge to select project in industry.
3.	Evaluate problem statement.
4.	Create and design project in industry.

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

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	CT 1	CT 2	TA	ESE
Remember				
Understand				
Apply			50	100
Analyse			50	100
Evaluate			50	100
Create			100	
TOTAL			250	300