Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Double Minors (Multidisciplinary and Specialization Minors)

(Major: Semester – III)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EEDO-0301	DC Machines and Transformers	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – IV)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EEDO-0401	AC Machines	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – V)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EEDO-0501	Basics of Power System	03	--	03	03	50	50	100
2	EEDO -0502	Elecrical Machine Lab	--	02	02	01	50	-	50
		Total	**03**	**02**	**05**	**04**	**100**	**50**	**150**

(Major: Semester – VI)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EEDO-0601	Electrical Drives	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EEDO-0701	- Switchgear and Protection	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	EEDO -0801	Energy Management and Audit	02	--	02	02	50	50	100
2	EEDO-0802	Major Capstone Project (Design & Development)	--	08	08	04	50	50	100
		Total	**--**	**08**	**10**	**06**	100	100	200

L- Lecture P-Practical

FA- Formative Assessment SA - Summative Assessment (For Laboratory End Semester performance)

PBE-I– Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

DEPARTMENT OF ELECTRICAL ENGINEERING Board Of Studies Year GCE KARAD

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Guidelines:- Students will take up 5-6 addittional courses in another Engineering/ Technology/ Emerging Area of Specialization of 18 credit distributed over semester III –VIII. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program.

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Government College of Engineering, Karad				
Second Year (Sem – IV) B. Tech. Electrical Engineering				
EEDO-0301: DC Machines and Transformer(Double Minor - 01)				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	00 Hrs/week		SA	50
Total Credits	02		Total	100
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic of Electrical engineering

Course Outcomes (CO): Students will be able to

CO1	Acquire knowledge about constructional details of DC generator
CO2	Understand the concept of DC Motor
CO3	Acquire knowledge about constructional details of single-phase transformer
CO4	Understand the concept of different type transformers

	Course Contents	CO	Hours
Unit 1	**DC generator:** Constructional details of dc machines - armature winding- single layer winding, double layer winding- lap and wave principle of operation, EMF equation, excitation, armature reaction demagnetizing and cross magnetizing ampere turn, compensating windings, interpoles, commutation, voltage build up and load characteristics, parallel operation. Power flow diagram	**CO1**	**(10)**
Unit 2	**DC Motor:** Types, back emf, generation of torque, torque equation, performance characteristics, Starting of dc motors- starters 3-point and 4-point starters (principle only). Speed control of dc motors - field control, armature control. Braking of dc motors. Power flow diagram – losses and efficiency, applications	**CO2**	**(08)**
Unit 3	**Single phase Transformer**: working principle, types of Transformer, construction, EMF equation, Phasor diagrams, Voltage regulation of a Transformer, Losses in a transformer, Efficiency of a Transformer, Condition for maximum efficiency, All day efficiency, Application	**CO3**	**(07)**
Unit 4	**Three–phase Transformer**: Advantages of three phase Transformer, Principle of operation, Construction of three phase transformers, three–phase transformer connections, Rating of Transformers, Potential transformer, Current transformer, Autotransformer: Autotransformer Working, Advantages of Autotransformer over Two winding Transformer, application	**CO4**	**(09)**

Text Books

1.	Kothari D.P, Nagrath I.J., Electric Machines, TMH Publications, 4th Edition
2.	Dr. Bimbhra P.S., "Electric Machinery", Khanna Publisher, Fifth Edition
3.	B. L. Theraja, Electrical Technology Vol II,S.Chand Publications.

Reference Books

1.	Deshpande M. V., Electrical Machines, Prentice Hall India, New Delhi
2.	Irving L Koskow, Electric Machinery and transformer, 2nd Edition, Prentice Hall Indi

Useful Links

1.	NPTEL :: Electrical Engineering - Electrical Machines -I
2.	https://nptel.ac.in/courses/108102146

Mapping of COs and POs

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

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

DEPARTMENT OF ELECTRICAL ENGINEERING ★ GCE KARAD ★ Board Of Studies Year

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Department Of Electrical Engineering
Government College of Engineering, Karad

Government College of Engineering, Karad				
Second Year (Sem – IV) B. Tech. Electrical Engineering				
EEDO-0401: AC Machines(Double Minor - 02)				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	00 Hrs/week		SA	50
Total Credits	02		Total	100
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic of Electrical engineering

Course Outcomes (CO): Students will be able to

CO1	Utilize the concept of AC machines and their industrial applications
CO2	Analyse the equivalent circuit of machines in different application
CO3	Acquire knowledge about constructional details of single-phase Induction motor
CO4	Evaluate the performance analyses of different AC machines

	Course Contents	CO	Hours
Unit 1	**Three phase Induction Motor** Construction & types of 3 ph. Induction motors, torque equation, starting torque, running torque, condition of maximum torque ,torque slip characteristics, Need of starters for 3 phase Induction motors, types of starters, Speed control methods from stator side (Stator voltage control ,Stator Frequency control, Pole changing) & rotor side (rotor resistance control), Applications of 3 ph. Induction motors.	**CO1**	**(10)**
Unit 2	**Equivalent circuit analysis of three phase induction motor** Losses & efficiency of 3 phase induction motor, power flow diagram with numerical treatment, No load & blocked rotor test, equivalent circuit of 3 phase induction motor, Phasor diagram of 3 phase induction motor, performance of 3 phase induction motor using circle diagram, Cogging & crawling of 3 phase induction motor.	**CO2**	**(08)**
Unit 3	**Single Phase Induction Motor** Construction, Working and types of single phase induction motors (Split phase, capacitor start/run, shaded pole motors), Double field revolving theory, Characteristics & Applications.	**CO3**	**(07)**
Unit 4	**Synchronous motor** Synchronous motor, starting methods, Phasor Diagram, Effect of excitation on power factor and armature current, V and inverted V Curves, Operation of Synchronous motor as Synchronous Condenser, Applications of three phase synchronous motor. Permanent Magnet Machines, Principle, operation and applications of Brushless motors	**CO4**	**(09)**

Text Books

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

Reference Books

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

Useful Links

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

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Mapping of COs and POs

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

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

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Government College of Engineering, Karad				
Second Year (Sem – IV) B. Tech. Electrical Engineering				
EEHO-0401: Programmable Logic Controllers (PLC)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	20
Tutorials	00 Hrs/week		SA	30
Total Credits	03		Total	50

Prerequisite : semiconductor physics

Course Outcomes (CO): Students will be able to

CO1	Operate PLC and use PLC memory
CO2	Use Boolean algebra to simplify designs.
CO3	Use Ladder Logic Function and advance function for PLC programming.
CO4	Select PLCs for relevant applications

	Course Contents	CO	Hours
Unit 1	**PLC Overview:** principle of operation of PLC, difference- PLC and computer controlled systems, hardware components of PLC, block diagram of PLC.	**CO1**	**(04)**
Unit 2	**PLC Memory and Logical Sensor:** types of memories available for PLC, various data files: User Bits Memory, Timer Counter Memory, PLC Status Bits, User Function Control Memory, Integer Memory, Floating Point Memory, Use addresses for locations in memory, Switches, TTL, Sinking and sourcing.	**CO1, CO2**	**(08)**
Unit 3	**Boolean Logic Design:** logic design for a given application, designs with Boolean algebra. Boolean algebra: Rules of Boolean Algebra, Logic Design for a given application Common Logic Forms: Complex gate forms, Multiplexer.	**CO2, CO3**	**(07)**
Unit 4	**Timers, Counter , Latch Concept:** counter as per requirement latch in ladder logic, counter as per requirement latch in ladder logic, Timers: On-delay timer, Off- delay timer, Retentive timer. Counters: Up-Counters, Down- Counter, Up-Down Counter. Master Control Relay.	**CO2, CO3**	**(08)**
Unit 5	**Ladder Logic Function and Advance Function:** Data handling Function: Move Function, Mathematical Function, Conversion Function, Logic Function: Comparison of Value, Boolean Function. List Function: Shift registers, Stacks, Sequencer Program Control: Branching and looping.	**CO2, CO3**	**(08)**
Unit 6	**Selecting PLC:** Analog Input – Output Module. Discrete Input – Output Module. PLC selection criteria. PLC specifications	**CO4**	**(04)**

Text Books

1. Programmable Logic Controller,5th Edition, John W. Webb and Ronald A. Reis, PHI Learning, New Delhi
2. Programming Language Concept, Peter sestoft, Springer
3. Automating Manufacturing System, Hugh Jack, Mc. Graw Hill, New Delhi

Reference Books

1. Programmable Logic Controllers,5th Edition, W. Bolton, Newnes

Useful Links

1. https://nptel.ac.in/courses/108105088

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Mapping of COs and POs

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

DEPARTMENT OF ELECTRICAL ENGINEERING
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Government College of Engineering, Karad

Government College of Engineering, Karad				
Second Year (Sem – IV) B. Tech. Electrical Engineering				
EEHO-0402: Competency Lab-1				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		FA	-
Total Credits	01		SA	50

Prerequisite : Digital Electronics

Course Outcomes (CO): Students will be able to

CO1	Examine the function of bit logic and program control instruction
CO2	Identify the different types of the TIMER and COUNTER
CO3	Develop ladder programming for given statement.
CO4	Design a ladder and interface with hardware to operate different application.

Course Contents		CO
Implementation of following concepts		
Experiment 1	Exposure to programming examines the function of Bit Logic Instructions	**CO1**
Experiment 2	Explore programming examines of the Program Control Instructions.	**CO1**
Experiment 3	Test and Identify different types of TIMER and COUNTER	**CO2**
Experiment 4	Develop ladder programming for a given statement - To on the bulb1 after 5sec of switch1 on. Turn the bulb2 on after the 5 sec of bulb1 on and test.	**CO2**
Experiment 5	Develop ladder programming for a given statement - To watch the on time of switch if total time excludes the limit, turn the bulb off and test. (Retentive Timer)	**CO2**
Experiment 6	Develop ladder programming for a given statement -To count a car and give signal for empty space and test.	**CO2**
Experiment 7	Develop ladder programming for a given statement - To on or off the motor via one switch and test.	**CO2**
Experiment 8	Develop ladder programming for a given statement -To operate four bulbs in series and test.	**CO2**
Experiment 9	Develop ladder programming for a given statement – To operate three floor elevators and test.	**CO3**
Experiment 10	Design a ladder to operate bottler filling plan and test	**CO4**
List of Submission:		
	Minimum number of Experiments: 08	

Mapping of COs and POs

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

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Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Electrical Engineering				
EEDO-0501: Basic Power System (Double Minor-03)				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	50
Tutorials	-		SA	50
Total Credits	03		Total	100
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basic knowledge of electrical concepts.

Course Outcomes (CO): Students will be able to

CO1	Illustrate generation of electricity and energy storage methods.
CO2	Analyse the different parameters of transmission line.
CO3	Discuss the economic aspects of power system.
CO4	Analysis of components of power grid.

	Course Contents	CO	Hours
Unit 1	**Generation of Electrical Power** India's electricity scenario, working of steam power plant, hydro power plant and wind power plant, turbines, generator, pump.	**(CO1)**	**(06)**
Unit 2	**Renewable Energy System** Basic concepts- solar energy, solar thermal systems, solar photovoltaic systems, biomass energy, geothermal energy, ocean energy and small hydro resources, emerging technologies, Integration of renewable energy system.	**(CO1)**	**(06)**
Unit 3	**Power transmission and distribution** Difference of AC and DC transmission, AC power system single line diagram, power factor, Step-up, step-down, auto transformer.	**CO2**	**(08)**
Unit 4	**Economic Aspects of Power Generation** Load curve, load duration and integrated load duration curves-load, demand, diversity, capacity, Utilization and plant use factors. Costs of Generation and their division into Fixed, Semi-fixed and Running Costs. Concept of tariff, Desirable Characteristics of a Tariff, Types of the tariff.	**CO3**	**(08)**
Unit 5	**Energy Storage** Introduction, necessity of energy storage, specifications of energy storage devices, energy storage methods.	**(CO1)**	**(06)**
Unit 6	**Power Grid** Introduction to power grid, electricity generation, electric power transmission, electricity distribution, need of grid, challenges of the grid, regional power grids in India.	**(CO4)**	**(06)**

Text Books

1. V.K.Mehata and Rohit Mehata " Principles of power system" S. Chand publications.
2. B.H.Khan, "non-conventional energy resources", McGraw Hill International, third edition

Reference Books

1. J. D. Glover and M. Sarma, Power System Analysis and Design, 3rd Edition, Brooks/ Cole Publishing, 2002
2. Weedy B M, Cory B J, John, Electric Power Systems, Wiley Publication
3. Hadi Sadat, Power System Analysis, McGraw Hill International, fifth edition

Useful Links

1. https://nptel.ac.in/courses/108/105/108105067/
2. https://nptel.ac.in/courses/108/102/108102047/
3. https://nptel.ac.in/courses/108/104/108104051/

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Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1
CO 1	1	1	1	2	1	2	-	-	-	-	-	-	2
CO 2	2	3	3	1	2	1	-	-	-	-	-	-	2
CO 3	2	3	3	1	2	1	-	-	-	-	-	-	2
CO 4	2	1	1	2	1	2	-	-	-	-	-	-	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

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Government College of Engineering, Karad.					
Third Year (Sem – V) B. Tech. Electrical Engineering					
EEDO -0502 :Electrical Machine Lab (Double Minor -04)					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week		FA	50	
Total Credits	01		SA	-	
Prerequisite : DC Machines and Transformers, AC machines					
Course Outcomes (CO): Students will be able to					
CO1	Deduce conclusions about the performance using obtained readings.				
CO2	Adopt the appropriate DC machines for the application.				
CO3	Evaluate circuit parameters of single phase and three phase transformer.				
CO4	Adopt the appropriate AC machines for the application.				

Course Contents		**CO**
Implementation of following concepts		
Experiment 1	Study of characteristics of separately excited DC generator.	**(CO4)**
Experiment 2	Load test on DC Shunt Motor.	**(CO4)**
Experiment 3	Load test on DC Series Motor.	**(CO4)**
Experiment 4	Study of methods of speed control of DC series motor as a function of load torque.	**(CO3)**
Experiment 5	Swinburne's Test.	**(CO2)**
Experiment 6	Hopkinson's Test.	**(CO2)**
Experiment 7	To Find equivalent circuit parameters from O.C and S.C Test on single phase Transformer.	**(CO3)**
Experiment 8	Polarity test on a single phase transformer and study of different connections of three phase transformers.	**(CO3)**
Experiment 9	Scott connection.	**(CO1)**
Experiment 10	Study of performance of wound rotor induction motor under load.	**(CO4)**
	Minimum 08 number of Experiments (Including all CO's)	

Mapping of COs and POs

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	1	1	-	-	-	1	2	-	-	-	-	1	3
CO 2	1	-	1	-	1	1	1	-	-	-	-	2	3
CO 3	1	-	1	1	1	1	-	-	-	-	-	1	3
CO 4	1	2	-	2	1	-	1	-	-	-	-	-	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Government College of Engineering, Karad				
Third Year (Sem – V) B. Tech. Electrical Engineering				
EEHO-0501: Internet of Things				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	20
Tutorials	--		SA	30
Total Credits	03		Total	50

Prerequisite : Signal and system, communication system, basic electronics.

Course Outcomes (CO): Students will be able to

CO1	Determine impact of IOT in engineering applications.
CO2	Select appropriate sensors and network components for given application
CO3	Design and develop IOT Systems for given application
CO4	Illustrate cloud computing and data analytics for interpretation of collected data

	Course Contents	CO	Hours
Unit 1	**IOT Introduction and Fundamentals:** Deciphering the term IOT, Applications where IOT can be deployed, Benefits/challenges of deploying an IOT. IOT components: Sensors, front-end electronics (amplifiers, filtering, and digitization), digital signal processing, data transmission, choice of channel (wired/wireless), back-end data analysis. Understanding packaging and power constraints for IOT implementation	**CO1**	**(04)**
Unit 2	**Signals, Sensors, Actuators, Interfaces:** Sensors: types, signal types, shape and strength, Sensor non-idealities: Sensitivity and offset drift, noise, minimum detectable signal, non-linearity, Read-out circuits: Instrumentation-amplifier, SNR definition, noise-bandwidth-power trade-off, Circuit component mismatch and mitigation techniques (calibration, chopping, auto zeroing etc.), Power/energy considerations, Basic signal processing (filtering, quantization, computation, storage)	**CO2**	**(08)**
Unit 3	**Networking and Cloud Computing in IOT:** Review of Communication Networks, Challenges in Networking of IOT Nodes, range, Bandwidth, Machine-to-Machine (M2M) and IOT Technology Fundamentals, Medium Access Control (MAC) Protocols for M2M Communications, Standards for the IOT, Basics of 5G Cellular Networks and 5G IOT Communications, Low-Power Wide Area Networks (LPWAN) Wireless communication for IOT: channel models, power budgets, data rates, IOT Security and Privacy, MQTT Protocol, Publisher and Subscriber Model, Cloud computing platform (open source) and local setup of such environment, Embedded software relevant to microcontroller and IOT platforms (enterprise or consumer), user interfaces	**CO2**	**(10)**
Unit 4	**Data Analysis for IOT applications:** Statistics relevant to large data, Linear regression, Basics of clustering, classification.	**CO3**	**(06)**
Unit 5	**Security, Privacy & Trust:** IOT security challenge, Spectrum of security considerations, Unique security challenges of IOT devices, Internet of things privacy background, Unique privacy aspects of internet of things, Trust for IOT.	**CO4**	**(06)**
Unit 6	**Case studies Illustrating IOT design:** Home automation: Smart lighting, Home intrusion detection, Cities: Smart parking, smart logistics and transportation Agriculture: Smart irrigation, Electrical Engineering: Smart grid. Remote metering and monitoring. Energy management	**CO4**	**(06)**

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach", UniversitiesPress (India) Private Limited, 2016, ISBN: 978 81 7371 954 7
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, StamatisKarnouskos, Stefan Avesand&David Boyle "From Machine-to-Machine to the Internet of Things", Academic Press,Elsevier, 2014, ISBN: 978-0-12-407684-6

Reference Books

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1.	Karen Rose, Scott Eldridge, Lyman Chapin, "The Internet of Things: An Overview", Internet Society, 2015
2.	Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014, ISBN 978-1-118-43062-0
3.	Daniel Kellmereit, "The Silent Intelligence: The Internet of Things", 2013, ISBN 0989973700
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc20_cs66/preview
2.	https://www.coursera.org/specializations/iot
3.	https://nptel.ac.in/courses/106/105/106105166/

Mapping of COs and POs

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

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

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Government College of Engineering, Karad					
Third Year (Sem – V) B. Tech. Electrical Engineering					
EEHO-0502 : Competency Lab-1I					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week		FA	-	
Total Credits	01		SA	50	
Prerequisite : Signal and system, communication system, basic electronics.					
Course Outcomes (CO): Students will be able to					
CO1	Demonstrate interfacing of sensors and actuators for IOT systems.				
CO2	Create the microcontroller assembly using appropriate tool.				
CO3	Set up the communication interface to transfer and receive data from storage devices and cloud.				
CO4	Design the IOT system for given application.				

Course Contents		CO
Implementation of following concepts		
Experiment 1	Study of IOT (Microcontroller) Arduino/ STM and R"pi.	**CO1**
Experiment 2	Study of different types of sensors, actuators, transducers.	**CO1**
Experiment 3	Experiment based on IR sensor. Write an application to detect obstacle and notify user using LED.	**CO1**
Experiment 4	Experiment based on FIRE sensor. Write an application to detect Fire and notify users using LED.	**CO2**
Experiment 5	Experiment based on Ultrasonic sensor. Write an application to find out distance between obstacles.	**CO2**
Experiment 6	Experiment based on DHT11 (Temperature and humidity) sensor. Write an application to find out the temperature and humidity.	**CO2**
Experiment 7	Experiment based on interfacing to control the operation of stepper motor remotely.	**CO3**
Experiment 8	Create a simple web interface to control the connected LEDs remotely through the interface.	**CO3**
Experiment 9	Control the operation of elevator operations.	**CO4**
Experiment 10	Study and implement clustering and configuring devices using MPI library.	**CO4**
	Minimum number of Experiments : 08	

Mapping of COs and POs

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Government College of Engineering, Karad

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

EEDO-0601: Electrical Drives (Double Minor - 05)

Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	00 Hrs/week		SA	50
Total Credits	02		Total	100
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Electrical machine-II, Power Electronics

Course Outcomes (CO): Students will be able to

CO1	Discuss the concepts in electrical drives with respect to its torque equations.
CO2	Analyse dynamics of electrical drives and its stability.
CO3	Analyse and evaluate advanced control schemes for torque and speed control of electrical AC and DC motors drives.
CO4	Apply the knowledge of electrical drives for various industrial applications

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction:** Drive concepts, parts of Electrical Drives, choice of Electrical Drives, advantages, fundamental torque equations, Equivalent values of drive parameters. open-loop, closed-loop, torque, speed, and current control of electrical drive, IP protection (ingress protection)	**CO1**	**05**
Unit 2	**Dynamics of Electrical Drive** : Modes of operation (Steady state, acceleration, deceleration), multi-quadrant operation of electrical drives, nature and classification of load torques, control & stability of electrical drive,thermal effects in electrical machines. Classes of motor duty, criteria for selection of motor for various applications.	**CO2**	**08**
Unit 3	**DC Motor Drives:** Review of basic characteristics of DC motors, classical control schemes (starting, braking, speed, torque), starting methods of DC motor drives , braking methods of DC motor drive: Regenerative braking, dynamic braking, plugging,dual converter control, chopper-controlled dc drives, Brushless DC motor drive, applications of DC drives.	**CO3**	**08**
Unit 4	**Induction Motor Drives:** Review of basic characteristics, classical control schemes (starting, braking, speed, torque), Stator voltage control, V/f control, Static rotor resistance control method,static slip power recovery control- Static Scherbius drive and Static Kramer drive, Voltage Source Inverter and its PWM strategy for motor control, applications of Induction drives. **Drives for Advanced Applications :** Textile Mill, Steel Rolling Mill, Cement Mill, Sugar Mill. Battery powered drives for electric vehicles.	**CO3, CO4**	**09**

Text Books

1. S.K.Pillai, "A first course in Electrical Drives",New Age International Publishers.
2. G.K.Dubey,"Fundamentals of Electrical Drives", Narosa Publishing house.
3. Piotr Wach, "Dynamics and Control of Electrical Drives," Springer Publications.

Reference Books

1. B. K. Bose, "Modern Power Electronics and AC Drives", Prentice Hall(I) Pvt. Ltd.
2. R.Krishnan, "Electrical Motor Drives: Modelling, Analysis and Control", Prentice Hall (I) Pvt. Ltd.

Useful Links

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

Mapping of COs and POs

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	3	3	3	2	1	-	-	-	-	2	2	3
CO 2	3	3	3	3	3	2	-	-	-	-	3	2	2
CO 3	3	3	3	3	3	2	-	-	-	-	3	2	2
CO 4	3	3	3	3	3	3	2	-	-	-	3	2	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

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Government College of Engineering, Karad

Government College of Engineering, Karad				
Third Year (Sem – VI) B. Tech. Electrical Engineering				
EEHO-3601: Human Machine Interface				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	20
Tutorials	--		SA	30
Total Credits	03		Total	50

Prerequisite : Signal and system, communication system, basic electronics

Course Outcomes (CO): Students will be able to

CO1	Implement ideas regarding human machine interface.
CO2	Analyse various designs and software knowledge regarding interface.
CO3	Achieve different goals regarding screen designing.
CO4	Develop mobile device interfacing with various applications.

	Course Contents	CO	Hours
Unit 1	**Foundations of HMI:** The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving. The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms.	**CO1**	**(08)**
Unit 2	**Design & Software Process:** Mistakes performed while designing a computer system, Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds .Interactive Design basics, process, scenarios, navigation, Iteration and prototyping. HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Recognize the goals, Goal directed design process. Evaluation Techniques: Universal Design.	**CO2**	**(08)**
Unit 3	**The Graphical User Interface:** Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics. Web user Interface: Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface design.	**CO2**	**(06)**
Unit 4	**Screen Designing:** Design goals , Screen planning and purpose, organizing screen elements, ordering of screen data and content , screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics, Technological consideration in interface design.	**CO3**	**(08)**
Unit 5	**Interface Design for Mobile Devices:** Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	**CO4**	**(05)**
Unit 6	**Interaction Styles and Communication:** Windows: Characteristics, Components, Presentation styles, Types of Windows, Management, operations. Text messages: Words, Sentences, messages and text words, Text for web pages. Icons, Multimedia and colours.	**CO4**	**(05)**

Text Books

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —"Human Computer Interaction‖", 3rdEdition, Pearson Education, 2004.
2. Wilbert O. Galitz, —"The Essential Guide to User Interface Design‖", Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, —"About Face3: Essentials of Interaction design", Wiley publication.

Reference Books

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1.	Rogers Sharp Preece, "Interaction Design:Beyond Human Computer Interaction",,Wiley.
2.	Guy A. Boy —"The Handbook of Human Machine Interaction", Ashgate publishing Ltd.
3.	Kalbnde,Kanade,Iyer,"Galitz's Human Machine Interaction", Wiley Publications.
Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc22_cs125/preview
2.	https://onlinecourses.nptel.ac.in/noc19_cs86/preview
3.	https://onlinecourses.swayam2.ac.in/ntr24_ed76/preview

Mapping of COs and POs

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

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

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Government College of Engineering, Karad				
Third Year (Sem – III) B. Tech. Electrical Engineering				
EEHO 3602 : Competency Lab-III				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		FA	-
Total Credits	01		SA	50

Prerequisite : Signal and system, communication system, basic electronics

Course Outcomes (CO): Students will be able to

CO1	Analyse trouble of interaction with machine.
CO2	Designing principle of good screen.
CO3	Implementing different menus and windows.
CO4	Study of human robot interaction.

Course Contents		CO
Implementation of following concepts		
Experiment 1	Understand trouble of interacting with machine.	**CO1**
Experiment 2	Design a system of user cantered approach.	**CO2**
Experiment 3	Understand principle of good screen design.	**CO2**
Experiment 4	Redesign existing graphical interface.	**CO2**
Experiment 5	Implementation of different kinds of menus.	**CO3**
Experiment 6	Implementation of different kinds of windows.	**CO3**
Experiment 7	Design a system with proper guideline of icons.	**CO3**
Experiment 8	Studying interaction between human and robots	**CO4**

Mapping of COs and POs

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Government College of Engineering, Karad

Government College of Engineering, Karad				
Final Year Sem-VII B. Tech. Electrical Engineering				
EEDO 0701: Switchgear and Protection (Double Minor)				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	---		SA	50
Total Credits	02			

Prerequisite: Basics of Power System

Course Outcomes (CO): Students will be able to

CO1	Acquire the principle of protective schemes and various faults in the Power System Scenario.
CO2	Apply protective relay principles for the protection of various equipments.
CO3	Analyze the operation and performance of circuit breakers.
CO4	Understand surge protection, earthing methods for system safety and reliability.

	Course Contents	CO	Hours
Unit 1	**Basics of protection:** Principles and need for protective schemes, nature and cause of fault, types of fault, per unit representation, current transformers and potential transformers and their applications in their protection schemes.	**CO1, CO2**	**05**
Unit 2	**Circuit Breakers:** Functions of switchgear, MCB, ELCB, HRC fuses, elementary principles of arc extinction, arc control devices, types of various circuit breakers.	**CO1, CO3**	**08**
Unit 3	**Protective Relays, Apparatus & Line Protection:** Definition, principle of relay operation, requirement of relays, types of relays. Protection of home and industrial appliances, introduction to protection of alternator, transformer and motor.	**CO1, CO2**	**05**
Unit 4	**Surge Protection& Earthing:** Switching surges, lightning phenomenon, overvoltage due to lightning, protections against lightning, lightning arresters, types of lightning arrester, surge absorbers. Necessity and various types of earthings.	**CO4**	**08**

Text Books

1. Badri Ram, Vishwakarma D N., "Power System Protection and Switchgear" Tata McGraw Hill Publishing House Limited, New Delhi, 2005.(Unit 1-4)
2. Soni, M.L., Gupta, P.V., Bhatnagar, U.S. and Chakrabarti, A., "A Text Book on Power Systems Engineering", Dhanpat Rai & Sons Company Limited, New Delhi, 2008.

Reference Books

1. Sunil, S.Rao, "Switchgear Protection and Power Systems (Theory, Practice & Solved Problems", Khanna Publishers Limited, New Delhi, 12th Edition, 2008.

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2.	Paithankar Y. G., Bhide S. R, "Fundamentals of Power System Protection" Prentice Hall of India Limited, New Delhi, 2nd Edition, 2010.
3.	Wadhwa, C.L., "Electrical Power Systems", New Age International Publishers Limited, 2006, New Delhi,6th Edition, 2010

Useful Links			
1.	https://nptel.ac.in/courses/108101039		

Mapping of COs and POs

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Government College of Engineering, Karad				
Final Year (Sem– VII) B. Tech. Electrical Engineering				
EEHO-0701 : Professional Training & Mini- Project-I				
Laboratory Scheme:			**Examination Scheme:**	
Practical	**6 Hrs/week**		**PBE-I**	**50**
Total Credits	**03**		**PBE-II**	**50**

Course Outcomes (CO): Students will be able to	
CO1	Identify and define a simple engineering problem through need analysis, professional exposure, or field/industry interactions.
CO2	Apply basic electrical concepts to design and plan a workable solution using appropriate tools, components, and simulation methods.
CO3	Develop a small prototype or experimental setup and test its functionality by following standard laboratory and troubleshooting practices
CO4	Demonstrate professional behaviour, and effective communication through documentation and presentation of the capstone-project.

Guidelines for Capstone-Project - I

1. Students are encouraged to address real-world, industry-relevant, or societal problems, with scope for product development, startups, or patentable outcomes.
2. This course is a skill-building and practice-oriented laboratory that integrates professional training with Capstone Project-I.
3. Students are encouraged to undergo professional training through NPTEL/SWAYAM or equivalent online platforms based on prior permission from BoS chairman in Electrical Industrial Engineering to acquire foundational knowledge required for successful implementation of mini project.
4. A faculty mentor/guide will be assigned to each student. Students shall carry out mini project individually. Interdisciplinary consultation for fulfillment of the project objectives.
5. After completion of prescribed professional training with required skill and knowledge, students are expected to complete mini project. The project may include hardware-based designs, hardware with minimal software integration, simulation-based implementations, or analytical and review-based studies relevant to industrial electrical engineering applicatins.
6. The project shall be executed through defined phases including problem identification, conceptual design, system or circuit design, implementation or simulation, testing and troubleshooting with final documentation and presentation.

Assessment Pattern

Project Based Evaluation – I (PBE-I)

(Mid-Semester Evaluation – 50 Marks)

PBE-I focuses on planning, problem identification, professional training outcomes, and initial design

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readiness.

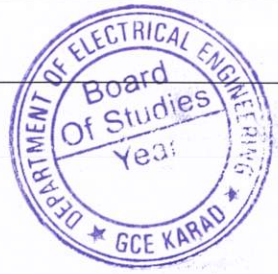
Sr. No.	Evaluation Component	Marks	CO
1	Professional Training completion/progress (NPTEL/SWAYAM or equivalent)	30	CO1
2	Subject clarity and understanding of concepts	5	CO1
3	Depth and clarity of problem formulation	5	CO1
4	English proficiency and technical communication	5	CO1
5	Professionalism (time management, logbook maintenance, discipline)	5	CO2
Total		50	

Project-Based Evaluation – II (PBE-II) : CO Mapping

(End-Semester Evaluation – 50 Marks)

PBE-II focuses on implementation, demonstration, documentation, and technical understanding

Sr. No.	Evaluation Component	Marks	CO
1	Working prototype / simulation model	15	CO3
2	Implementation quality and testing	10	CO3
3	Project report (content, clarity, format)	10	CO4
4	Demonstration and presentation	05	CO4
5	Viva-voce (concepts, design justification)	5	CO2
6	Logbook and professional conduct	5	CO4
Total Marks		50	



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	Professional Training Students are encouraged to use the free or optional online learning resources like NPTEL/SWAYAM to strengthen their understanding of industrial electrical enigineering for successful completion of mini project.

Mapping of COs and POs

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

1: Slight (Low) **2: Moderate (Medium)** **3: Substantial (High)**

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Government College of Engineering, Karad				
Final Year (Sem– VIII) B. Tech. Electrical Engineering				
EEHR 3701 : **Research Project Phase -I**				
Laboratory Scheme:			**Examination Scheme:**	
Practical	18 Hrs/week		PBE-I	100
Total Credits	09		PBE-II	100

Course Outcomes (CO): Students will be able to

CO1	Analyze societal, industrial, and environmental needs to identify a relevant engineering research problem.
CO2	Develop system architecture, modelling diagrams, and identify optimized hardware/software requirements.
CO3	Formulate a structured methodology with milestones, activity charts, and suitable tools.
CO4	Initiate project implementation and document progress using standard research documentation tools.

Course Contents – Phase I

1. Problem Identification & Need Analysis
- Societal/industrial/environmental relevance
- Domain selection, problem definition, scope
- Literature survey (minimum 5 years), gap analysis

2. System Modelling & Requirement Specification
- System architecture, block diagram
- Hardware/software requirement analysis
- Algorithm, flowchart, functional modelling
- Bill of materials, cost estimation, and feasibility

3. Research Methodology & Planning
- Project roadmap and work breakdown
- Tools, platforms, coding/simulation environments
- Identification of innovative aspects

4. SoftwarevImplementation & Documentation
- Softaware implementation /Simulation
- Weekly progress diary (guide-verified)
- Phase-I technical report (standard format)

Project Based Evaluation – I (PBE-I)
(Mid-Semester Evaluation – 100 Marks)

PBE-I focuses on problem identification, research relevance, system modelling, methodology planning, and initial implementation readiness.

Sr. No.	Evaluation Component	Marks	CO
1	Literature review of the last five years, identification of research gap, and publication of a review paper	**30**	CO1
2	Problem formulation, system architecture, block diagram, and requirement specification	**25**	CO2
3	Research methodology, work plan, milestones, tool selection, and software-based simulation	**30**	CO3
4	Project diary maintenance, documentation quality, and professionalism	**15**	CO4
Total		**100**	

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Project-Based Evaluation – II (PBE-II)
(End Semester Evaluation – 100 Marks)

PBE-II focuses on implementation depth, documentation quality, technical understanding, and research presentation.

Sr. No.	Evaluation Component	Marks	CO
1	Functional implementation/working model / experimental results	30	CO4
2	Implementation quality, validation, and technical correctness	20	CO4
3	Research documentation (Phase-I report: content, clarity, format)	20	CO4
4	Demonstration and research presentation	10	CO3
5	Viva-voce (concepts, modelling, and methodology justification)	10	CO2
6	Project diary verification, professional conduct	10	CO4
Total Marks		**100**	

Mapping of COs and POs

PO →	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO1	3	2	2	1	1	1	2	1	1	1	1	2	2
CO2	2	2	3	2	2	–	–	–	1	1	1	2	2
CO3	2	2	2	2	2	–	–	–	1	1	1	2	2
CO4	2	2	1	1	1	–	2	–	1	2	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Government College of Engineering, Karad				
Final Year (Sem – VIII) B. Tech. Electrical Engineering				
EEDO 0801: Energy Management and Audit (Double Minor)				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		FA	50
Tutorials	----		SA	50
Total Credits	02			

Prerequisite: Basics of Power System

Course Outcomes (CO): Students will be able to

CO1	Acquire the basic concepts of energy audit, energy management and energy policies.
CO2	Analyze the energy audit instruments, procedures and techniques.
CO3	Illustrate the energy management need, different aspects of it and financial analysis.
CO4	Adapt the knowledge for energy saving potential of thermal and electrical systems for maximizing and optimizing system efficiency.

	Course Contents	CO	Hours
Unit 1	**General Aspects:** Review of energy scenario in India, general philosophy and need of energy audit and management, basic elements and measurements, mass and energy balances, scope of energy auditing industries, evaluation of energy conserving opportunities, energy performance contracts, fuel and energy substitution, need for energy policy for industries, national & state level energy policies	**CO1**	**06**
Unit 2	**Energy Audit Concepts:** Need of Energy audit, types of energy audit, energy management (audit) approach, understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, duties and responsibilities of energy auditors, energy audit instruments, procedures and techniques.	**CO2**	**07**
Unit 3	**Principles and Objectives of Energy Management:** Design of energy management programmes, development of energy management systems, importance, Indian need of energy Management, duties of energy manager, preparation and presentation of energy audit reports, monitoring and targeting, some case study and potential energy savings. Financial analysis: Introduction, fixed and variable costs, Interest charges, simple pay-back period, discounted cash flow methods, net present value method and internal rate of return method, factors	**CO3**	**07**

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	affecting analysis.		
Unit 4	**Energy Management methods:** Supply side methods to minimize supply, demand gap, renovation and modernization of power plants, reactive power management, demand side, conservation in motors, pumps and fan systems, energy efficient motors, energy conservation in boilers, steam turbines and industrial heating systems, cogeneration and waste heat recovery, thermal insulation, heat exchangers and heat pumps.	**CO4**	**06**

Text Books	
1.	De, B. K., "Energy Management audit & Conservation", (2nd Edition), Vrinda Publication, 2010. (Unit 1 to 4)
2.	Murphy, W. R., "Energy Management (1st edition)", Elsevier India Private Limited, 2007.
Reference Books	
1.	Elias P. Gyftopoulos, "Industrial Energy Conservation Manuals", (1st edition) MIT Press, 1982
2.	K. Smith, C.B. (Ed. 4), "Energy Management Principles: applications, benefits, savings", Amsterdam: Pergamon Press,1981.
Useful Links	
1.	https://nptel.ac.in/courses/112105221
2.	https://beeindia.gov.in/content/energy-auditors

Mapping of COs and POs

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Government College of Engineering, Karad				
Final Year (Sem– VII) B. Tech. Electrical Engineering				
EEDO 0802 : Major Capstone Project (Design & Development)				
Laboratory Scheme:			**Examination Scheme:**	
Practical	08 Hrs/week		PBE-I	50
Total Credits	04		PBE-II	50
Prerequisite :				

Course Outcomes (CO):Students will be able to	
CO1	Analyze a complex engineering problem through literature review and requirement analysis, considering technical, societal, environmental, and economic constraints.
CO2	Design an appropriate system architecture, methodology, or algorithm using modern engineering tools and domain-specific knowledge to address the identified problem.
CO3	Develop and implement a functional prototype / model / system by integrating hardware and/or software components and validating its functionality.
CO4	Evaluate and communicate project outcomes through systematic testing, performance analysis, technical documentation, and professional presentation while demonstrating ethical and professional responsibility.

Guidelines for Capstone Project

1. Students are encouraged to address real-world, industry-relevant, or societal problems, with scope for product development, startups, or patentable outcomes.
2. The project topic shall be aligned with at least one of the declared minor domains, and preferably demonstrate integration of both minor areas, wherever feasible.
3. The project shall involve design, development, and validation, and must go beyond conceptual or literature-only work.
4. Emphasis shall be placed on clear definition of the problem scope across domains, appropriate selection of tools, platforms, and technologies, and demonstration of innovation, complexity, and technical depth.
5. Students may develop a working prototype, a validated algorithm or model, or a software–hardware system or integrated framework, depending on the chosen domains.
6. Projects addressing emerging technologies, industrial challenges, sustainability, or societal needs are strongly encouraged.

Evaluation Criteria

Project Based Evaluation – I (PBE-I)

(Mid-Semester Evaluation – 50 Marks)

PBE-I focuses on advanced design readiness, implementation planning, and initial development progress of the individual capstone project.

Sr. No.	Evaluation Component	Marks	CO
1	Finalized problem definition with justification and constraints	10	CO1
2	Detailed literature review and gap identification	10	CO1
3	System architecture / algorithm design and methodology	10	CO2
4	Tool, platform, and technology selection with feasibility analysis	10	CO2

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5	Initial implementation progress and readiness review	05	CO3
6	Presentation, documentation quality, and professional conduct	05	CO4
Total Marks		50	

Project Based Evaluation – II (PBE-II)

(End-Semester Evaluation – 50 Marks)

PBE-II focuses on complete implementation, testing, validation, documentation, and individual technical understanding.

Sr. No.	Evaluation Component	Marks	CO
1	Fully developed working prototype / model / system	15	CO3
2	Implementation quality, testing, and validation results	10	CO3
3	Performance analysis, result interpretation, and discussion	05	CO4
4	Project report (technical content, clarity, format)	10	CO4
5	Demonstration and oral presentation	05	CO4
6	Viva-voce (design justification, tools, concepts)	05	CO2
Total Marks		50	

Mapping of COs and POs

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

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Government College of Engineering, Karad				
Final Year (Sem– VII) B. Tech. Electrical Engineering				
EEHO-0802 : Major Capstone Project (Design & Development)				
Laboratory Scheme:			**Examination Scheme:**	
Practical	06 Hrs/week		PBE-I	50
Total Credits	03		PBE-II	50
Prerequisite :				

Course Outcomes (CO):Students will be able to	
CO1	Analyze a complex engineering problem through literature review and requirement analysis, considering technical, societal, environmental, and economic constraints.
CO2	Design an appropriate system architecture, methodology, or algorithm using modern engineering tools and domain-specific knowledge to address the identified problem.
CO3	Develop and implement a functional prototype / model / system by integrating hardware and/or software components and validating its functionality.
CO4	Evaluate and communicate project outcomes through systematic testing, performance analysis, technical documentation, and professional presentation while demonstrating ethical and professional responsibility.

Guidelines for Capstone Project

1. Students are encouraged to address real-world, industry-relevant, or societal problems, with scope for product development, startups, or patentable outcomes.
2. The project topic shall be aligned with at least one of the declared minor domains, and preferably demonstrate integration of both minor areas, wherever feasible.
3. The project shall involve design, development, and validation, and must go beyond conceptual or literature-only work.
4. Emphasis shall be placed on clear definition of the problem scope across domains, appropriate selection of tools, platforms, and technologies, and demonstration of innovation, complexity, and technical depth.
5. Students may develop a working prototype, a validated algorithm or model, or a software–hardware system or integrated framework, depending on the chosen domains.
6. Projects addressing emerging technologies, industrial challenges, sustainability, or societal needs are strongly encouraged.

Evaluation Criteria

Project Based Evaluation – I (PBE-I)

(Mid-Semester Evaluation – 50 Marks)

PBE-I focuses on advanced design readiness, implementation planning, and initial development progress of the individual capstone project.

Sr. No.	Evaluation Component	Marks	CO
1	Finalized problem definition with justification and constraints	10	CO1
2	Detailed literature review and gap identification	10	CO1
3	System architecture / algorithm design and methodology	10	CO2

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4	Tool, platform, and technology selection with feasibility analysis	10	CO2
5	Initial implementation progress and readiness review	05	CO3
6	Presentation, documentation quality, and professional conduct	05	CO4
Total Marks		50	

Project Based Evaluation – II (PBE-II)

(End-Semester Evaluation – 50 Marks)

PBE-II focuses on complete implementation, testing, validation, documentation, and individual technical understanding.

Sr. No.	Evaluation Component	Marks	CO
1	Fully developed working prototype / model / system	15	CO3
2	Implementation quality, testing, and validation results	10	CO3
3	Performance analysis, result interpretation, and discussion	05	CO4
4	Project report (technical content, clarity, format)	10	CO4
5	Demonstration and oral presentation	05	CO4
6	Viva-voce (design justification, tools, concepts)	05	CO2
Total Marks		50	

Mapping of COs and POs

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CO 1	3	3	2	2	1	2	-	2	1	-	2	3	2
CO 2	2	2	3	2	3	1	-	2	-	-	2	3	3
CO 3	2	2	3	3	3	-	-	2	-	1	2	3	2
CO 4	1	1	2	2	1	2	3	2	3	1	3	2	1

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Final Year (Sem– VIII) B. Tech. Electrical Engineering				
EEHR 3802 : Research Project Phase -II				
Laboratory Scheme:			**Examination Scheme:**	
Practical	18 Hrs/week		PBE-I	100
Total Credits	09		PBE-II	100

Course Outcomes (CO): Students will be able to

CO1	Complete system implementation through hardware/software integration using modern tools.
CO2	Analyze system performance considering power, cost, sustainability, scalability, and benchmarks.
CO3	Validate, optimize, and refine design using engineering judgment and relevant standards.
CO4	Prepare the full dissertation, perform a plagiarism check, publish the research, and effectively demonstrate the final prototype.

Course Contents – Phase II

1. Complete System Implementation
- Full integration of hardware/software
- Debugging, refinement, progressive logs

2. Performance Evaluation & Optimization
- Power analysis, technical metrics
- Sustainability, scalability, economic feasibility
- Comparison against benchmarks

3. Validation & Result Interpretation
- Result tables, graphs, and analysis
- Verification and validation studies

4. Final Documentation & Publication
- Complete thesis (Word/LaTeX)
- Turnitin report (≤10%)
- Mandatory publication (journal/conference)
- Final presentation, poster & demonstration

5. Project Diary
- Mandatory, guide-signed
- Submitted during PBE-II

Project Based Evaluation – I (PBE-I)

(Mid-Semester Evaluation – 100 Marks)

PBE-I focuses on complete system integration, performance evaluation, validation readiness, and progress toward final outcomes.

Sr. No.	Evaluation Component	Marks	CO
1	Complete hardware–software integration and functional completeness of the system	25	CO1
2	Performance analysis considering power, cost, scalability, sustainability, and benchmarks	20	CO2
3	Design validation strategy, standards compliance, and optimization approach	20	CO3
4	Result generation, interpretation plan, and analytical readiness (tables/graphs)	15	CO3

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5	Progress toward final documentation and publication readiness	10	CO4
6	Project diary maintenance, progress logs, and professional practices	10	CO4
Total Marks		**100**	

Project Based Evaluation – II (PBE-II)

(End-Semester Evaluation – 100 Marks)

PBE-II focuses on final implementation quality, result validation, research dissemination, and professional demonstration.

Sr. No.	Evaluation Component	Marks	CO
1	Final functional system / optimized prototype / validated experimental results	30	CO1
2	Performance benchmarking, result validation, and technical accuracy	20	CO2
3	Final dissertation quality (content, analysis, format, standards compliance)	20	CO4
4	Research publication status (journal/conference) and plagiarism compliance (≤10%)	10	CO4
5	Final demonstration, presentation, and viva-voce (design justification and outcomes)	10	CO3
6	Project diary verification, ethics, and professional conduct	10	CO4
Total Marks		**100**	

Mapping of COs and POs

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CO 1	3	3	2	2	1	2	-	2	1	-	2	3	2	1
CO 2	2	2	3	2	3	1	-	2	-	-	2	3	3	2
CO 3	2	2	3	3	3	-	-	2	-	1	2	3	2	3
CO 4	1	1	2	2	1	2	3	2	3	1	3	2	1	3

Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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