Academic Program: UG

Academic Year 2024-25 Syllabus

VII & VIII Semester B. E.

Electrical & Electronics Engineering

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

An Autonomous Institution Approved by AICTE & Affiliated to VTU, Belagavi

Department Accredited by NBA under Tier-1 (July 2022-June 2025)

Ph: **0836-2447465Fax: 0836-2464638** **Web:** www.sdmcet.ac.in

SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for VII & VIII semester B.E. in Electrical & Electronics Engineering is recommended by the Board of Studies of Electrical and Electronics Engineering Department and approved by the Academic Council, SDM College of Engineering &Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2024-25 till further revision.

Principal Chairman BoS & HoD

SDM College of Engineering & Technology, Dharwad
Department of Electrical & Electronics Engineering
*(**Our motto:** Professional **C**ompetence with **P**ositive **A**ttitude)*

College Vision and Mission

Vision

To develop competent professionals with human values

Mission

- To have contextually relevant Curricula.
- To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
- To enhance Research Culture
- To involve Industrial Expertise for connecting classroom content to real life situations.
- To inculcate Ethics and impart soft-skill leading to overall Personality Development.

QUALITY POLICY:

In its quest to be a role model institution, committed to meet or exceed the utmost interest of all the stake holders.

CORE VALUES:

Competency

Commitment

Equity

Team work and

Trust

DEPARTMENT VISION AND MISSION

Vision:

To develop globally acceptable Electrical and Electronics Engineering professionals with human values.

Mission:

- Adopting the state of the art curricula
- Practicing effective and innovative teaching-learning methodologies
- Initiating complementary learning activities to enhance competence
- Inculcating positive attitude and commitment to society.

Program Educational Objectives (PEOs)

I. To impart the domain knowledge and soft skills to secure employment or become entrepreneur or pursue higher studies.
II. To provide training for teamwork, leadership qualities, lifelong learning and adaptability to achieve professional growth.
III. To develop sense of positive attitude and practice ethics to contribute positively to the society as a responsible citizen.

POs and PSOs

PO 1 **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO 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.

PO 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.

PO 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.

PO 5 **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 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 legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7 **Environment and Sustainability**: Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8 **Ethics:** Apply ethical principles and commit to professional ethics responsibilities and norms of the engineering practice.

PO 9 **Individual and Team work:** Function effectively as an individual and as a member or leader in diverse teams and individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 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, and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11 **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and 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.

PO 12 **Life-long Learning:** long learning: Recognize the need for and have the Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PSO 1 Enhancement of professional competence in cutting edge domain through value addition activities.

PSO 2 Ability to demonstrate the skill of carrying out operation and Maintenance of electrical distribution system effectively.

PSO 3 Design and implement the electronic circuits/programs for practical applications.

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, DHARWAD
Department of Electrical & Electronics Engineering
VII Semester
Scheme of Teaching and Examinations 2024 – 25

Course Code	*Course Category	Course Title	Teaching		Examination				
					CIE	Theory (SEE)		Practical (SEE)	
			L-T-P (Hrs/Week)	Credits	Max. Marks	**Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
21UEEC700	PC	Computer Application to Power Systems	3 - 0 - 0	3	50	100	3	-	-
21UEEE7XX	PE	Program Elective -4	3 - 0 - 0	3	50	100	3	-	-
21UEEE7XX	PE	Program Elective -5	3 - 0 - 0	3	50	100	3	-	-
21UEEE7XX	PE	Program Elective -6	3 - 0 - 0	3	50	100	3	-	-
21UEEO7XX	OE	Open Elective -2	3 - 0 - 0	3	50	100	3	--	--
21UHUC700	HU	Research Methodology	2 - 0 - 0	2	50	50	2	--	--
21UEEL701	PC	Relay, High Voltage and Power System Simulation Lab	0 - 0 - 2	1	50	--	--	50	3
21UEEL702	PC	Major Project Phase -1	0 - 0 - 4	2	50	--	--	50	3
		Total	**17 - 0 - 6**	**20**	**400**	**550**		**100**	

PC- Program Core, **PE**-Professional Elective and **OE**- Open Elective
**SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Program Elective-4

Course Code	Course Title
21UEEE741	Industrial Utilization of Electric Power
21UEEE742	Non-Linear Control Theory

Program Elective-5

Course Code	Course Title
21UEEE751	PLC and SCADA
21UEEE752	Embedded Systems

Program Elective-6

Course Code	Course Title
21UEEE761	Power System Operation and Control
21UEEE762	AI and its Applications to Power Systems

Open Elective-2

Course Code	Course Title
21UEEO721	Electric Vehicles

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY, DHARWAD
Department of Electrical & Electronics Engineering
VIII Semester
Scheme of Teaching and Examinations 2024 – 25

Course Code	Course Category	Course Title	Teaching		Examination				
					CIE	Theory (SEE)		Practical (SEE)	
			L-T-P (Hrs./Week)	Credits	Max. Marks	Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
21UEEL800	PC	Technical Seminar/Independent Study	0 - 0 - 2	1	50	--	--	--	--
21UEEL801	PC	Major Project Phase-2 (In Industry/College/ Through Internship)	0 - 0 -18	9	50	--	--	50	3
21UEEL802	PC	Internship -2	4 - 6 Weeks	3	50	--	--	50	3
		Total	**0 - 0 - 20**	**13**	**150**	**--**	**--**	**100**	**--**

PC- Program Core, PE-Professional Elective and OE- Open Elective
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Total credits offered during 2nd, 3rd and 4th year =120

VII Semester

21UEEC700	Computer Application to Power Systems	(3 - 0 - 0) 3

Contact Hours: 39

Course learning objectives (CLOs):

The students are expected to learn about the formation of different matrices to represent the power system network and load frequency control techniques. It is required to understand the load flow studies and use of various numerical techniques for the same. The student should get exposure to optimal distribution of load and economic operation. Further, must know to carry out steady and transient states analysis using different techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe importance of computer techniques in power system, form bus impedance and admittances matrices.	1, 2		
CO-2	Model single area and two area systems and analyse steady state and dynamic response of load frequency control,	1, 2		
CO-3	Analyse load flow using different techniques	1, 2		
CO-4	Determine Optimal distribution of load between the units with and without transmission line loss	1, 2		
CO-5	Analyse Transient stability studies using different methods.	1, 2		

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	3.0	3.0													

Prerequisites:1. Electrical Power generation 2. Electrical Power Distribution and Utilization 3. Power System Analysis and Stability 4. Switchgear and Protection

Contents:

Unit-I

Bus incidence matrix: Primitive admittance matrix, Y-Bus by singular transformation. Algorithm for formation bus impedance matrix of single-phase system and numerical examples. **08 Hrs.**

Unit-II

Power System Control: Load frequency control, turbine speed governing system modelling. Block diagram representation of single area, steady state and dynamic response and Two-area load frequency control. **07 Hrs.**

Unit-III

Load flow studies: static load flow equations, types of buses, Gauss – Seidel iterative method using Y bus including PV bus, acceleration of convergence. Newton Raphson method in polar co-ordinates. Fast Decoupled load flow method. Representation of transformer fixed tap setting transformer, tap changing under load transformer. **08 Hrs.**

Unit-IV

Economic operation of power system: Optimal distribution of loads between units within a plant, Transmission loss as a function of plant generation, determination of loss coefficient and economic load dispatch with and without transmission line loss and numerical problems. **08 Hrs.**

Unit-V

Transient stability studies: Swing equation, Numerical solutions of differential equations: modified Euler's method, Runge Kutta IV order method Representation of synchronous machine for transient stability studies, load representation, Network performance equation and. Solution techniques with flowcharts. **08 Hrs.**

Reference Books:

1) Stag and El-Abiad, "Computer Methods in Power System Analysis", 1/e, McGraw Hill International, 1965
2) Uma Rao, "Computer Techniques and Models in Power Systems", I.K. International Publishing House Pvt. Ltd, 2007
3) Nagrath & Kothari, "Modern Power system Analysis", Tata McGraw Hill, 3/e, 2003
4) M. A. Pai, "Computer Techniques in Power System', Tata McGraw Hill, 2/e, 2014.

21UHUC700 Research Methodology (2-0-0) 2

Contact Hours: 26

Course Learning Objectives (CLOs):

The students are expected to learn about the need and types of research, problem formulation, literature review, measurement, scaling, data collection, testing of hypothesis, result interpretation and report writing.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Formulate** the research problem, carryout literature survey and decide the methodology.	-	2	-
CO-2	**Importance** of Literature survey and need to identify gaps	5	2	
CO-3	**Describe** measurement and scaling and data collection &report writing		3	2
CO-4	**Test** the hypothesis, interpret &analyze the results and write the report.		4	
CO-5	**Explain** the need for interpretation and report writing	-	5	-

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level		1.66	2	2	2.5										

Pre-requisites:

Design and Analysis of Engineering subjects related issues

Contents:

Unit-I

Research Methodology: Introduction, meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology.

Defining the Research Problem: Research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, an illustration. **06 Hrs.**

Unit-II

Reviewing the literature: Importance of the literature review in research, How to review the literature, searching the existing literature, reviewing the selected literature and writing about the literature reviewed.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design. **05 Hrs.**

Unit-III

Measurement and Scaling: Measurement in research, measurement scales, sources of error in measurement, scaling, meaning of scaling and important scaling techniques.

Data Collection: Collection of primary data, observation method, interview method, collection of data through questionnaires. **05 Hrs.**

Unit-IV

Testing of Hypotheses: What is a Hypothesis? Basic concepts concerning testing of hypotheses, procedure for hypothesis testing, flow diagram for hypothesis testing, measuring the power of a hypothesis test, tests of hypotheses. **05 Hrs.**

Unit-V

Interpretation and Report Writing: Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing, different steps in writing report, layout of the research report, types of reports, oral presentation and mechanics of writing a research report, precautions for writing research reports, plagiarism and its significance. **05Hrs.**

Reference Books:

1) C.R. Kothari, Gaurav Garg, Research Methodology: Methods and Techniques, New Age International, 4th Edition, 2018.
2) Ranjit Kumar, Research Methodology a step-by-step guide for beginners, SAGE Publications, 3rd Edition, 2011.
3) Fink A, Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications, 2009.

21UEEL701 Relay, High Voltage & Power System Simulation Lab (0 - 0 - 2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The students are expected to learn to independently handle the engineering practices in power systems, High voltage Engineering, Protection by conducting various experiments. They are to learn to formulate the circuit/system/experimental set up/work set up, operate the circuit, record the observations, tabulate the results indicating one specimen calculation, plot the curves if any and finally present the results/inference with

justification and prepare laboratory report. Further they get exposure to the contemporary technological happenings and accordingly make use of software packages, tolls to find the solution for power system related problems.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Form Y bus and calculate solution for swing equation	9, POS-3	5	4
CO-2	Carry out load flow analysis, fault studies	9, POS-2	5	4
CO-3	Determine the characteristics of different relays	9, POS-2	5	4
CO-4	Determine breakdown strength of air and oil	9, POS-2	5	4

PO's	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level				1.0	2.0				3.0					3.0	3.0

Prerequisites: 1. Power system Analysis and Stability
2. High Voltage Engineering
3. Switchgear and Protection

Contents:

Minimum of 10 experiments to be conducted from the list given below.
Expt.1. Y Bus formation by inspection/ singular transformation method.
Expt.2. Swing equation by RK method.
Expt.3. Load flow analysis by GS/NR method.
Expt.4. Fault studies using power system toolbox.
Expt.5 Economic Load Dispatch.
Expt.6. Operating characteristics of electromechanical relay.
Expt.7. Operating characteristics of static relay.
Expt.8. Operating characteristics of Negative sequence relay.
Expt.9. Characteristics of % differential relay.
Expt.10. Operating characteristics of microprocessor based over-current relay.
Expt.11. Induction motor protection using numerical relay.
Expt.12. Break down strength of air by sphere gap method-demonstration.

Expt.13. Break down strength of transformer oil- demonstration.

Reference Books/Material:

1) Laboratory manuals.
2) Relevant books prescribed for the prerequisite subjects.

21UEEL702	Major Project Phase- 1	(0 - 0 - 4) 2

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn carrying out literature survey to locate the state-of-the-art technology while formulating/defining the project problem in engineering domain of their interest. The students are expected Select a topic from an emerging area relevant to electrical sciences and/or other relevant branches and define the problem for the project work. The material collection, survey, visits, data collection, preliminary design, analysis etc. is to be done in this phase. The same work will be continued in the next phase in VIII semester.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Carry out the literature survey to locate the state-of-the-art technology in his Engineering field of interest	2		4, 5, PSO-2, PSO-3
CO-2	Define/formulate the problem for the project work	2, 3	1, 4, 5	PSO-2, PSO-3
CO-3	Design, develop, analyze, test, interpret the results, fabricate, simulate, write code etc. relevant to his project work	3	5	7, 8, 9, 12, PSO-2, PSO-3
CO-4	Summarize the work into a project report and in all can carry out the technical work assigned		10	6, 8, 11, PSO-2, PSO-3

PO's	PO -1	PO-2	PO -3	PO -4	PO-5	PO -6	PO -7	PO -8	PO -9	PO -10	PO-11	PO-12	PSO -1	PSO -2	PSO-3
Mapping Level	2.0	3.0	3.0	1.5	1.6	1.0	1.0	1.0	1.0	2.0	1.0	1.0		1.0	1.0

Prerequisites: Knowledge of both theory and practical courses learnt in all the previous semesters and relevant value-added information.

Contents:

Major project phase-1 in which the students are expected to locate the state of the art technology in his domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The material collection, survey, visits, data collection, preliminary design, analysis etc. is to be done in this phase. The project shall consist of a team of students not more than 4. Each batch shall be assigned with a guide. A committee consisting of minimum 3 faculty members of which guide is a member shall evaluate at the end for CIE. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners appointed by COE based on the suggestions by the respective HoD.

General Instructions to Students:

1. Students are expected to perform extensive literature survey, identify problem statements, and prepare synopsis in consultation with project guide/supervisor. Students are expected to submit synopsis- Initial (Registration Phase-1) approved by project guide, to the project coordinator as per the schedule notified. A copy is to be maintained with students and the guide. This registration/ Initial synopsis contains the description of the project concept created and acts as a base line for design and Implementation of the system.
2. Notification/schedules and evaluation procedures will be sent to all students in the Google groups created in the department.
3. Evaluation of problem statement/synopsis-Initial (registration phase-1), Literature Survey and SRS (Requirement Analysis Phase-1) are done in the 7th semester.

Sl. No.	Parameters for Assessment	% of weightage for CIE and SEE
P1	Project Synopsis/ Proposal Evaluation	15
P2	Literature survey/Technology used / Architectural design	15

P3	Requirement Analysis (SRS)	15
P4	Design methodology/Demonstration of tool used for designing	10
P5	Implementation modules	15
P6	Discussion of test cases /Project demonstration	15
P7	Project Report (phase-1 and Phase-2)	10
P8	Paper Publication / Presentation	05

Reference materials/books:

1. Engineering books.
2. Journals.
3. Manuals and data sheets.
4. Software packages.
5. Previous project reports.
6. Product information brochures.
7. Interaction with academia and industrial experts.
8. Internet.

21UEEE741	Industrial Utilization of Electric Power	(3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn the different electric drives, their selection, and dynamics. Further, they are required to evaluate their performance under transient and study state conditions. They are required to know the performance of specific drives like DC motors, Induction motors and Synchronous motors, their suitability and applications in various industries. It is expected that they are to be aware of new control mechanisms of industrial drives.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Understand the concepts of electrical drives system and dynamics (both transient and steady state) and apply this knowledge to solve numerical.	2		
CO-2	Determine the motor rating selection based on the duty and thermal model for heating and cooling.	2		
CO-3	Analyze the DC Motor Drive characteristics and their control through power electronic systems and apply this knowledge to solve numerical.	2		
CO-4	Analyze the Induction Motor Drive characteristics and their control through power electronic systems and hence be able to solve numerical.	2		
CO-5	Analyze the Synchronous Motor Drive. Also understand the process involved in different mills.	2		

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level		3.0													

Prerequisites: 1. AC and DC Machines. 2. Power Electronics.

Contents:

Unit-I

Introduction to Electrical drives & its dynamics: Parts of electrical drives; Merits & Demerits; choice of electrical drives; status of dc and ac drives. Dynamics of electrical drives; Fundamental torque equation; speed torque conventions; four quadrant operation. Equivalent values of drive parameters. Components of load torques; nature and classification of load torques. Calculation of time and energy loss in transient operations; Steady state stability. **08 Hrs.**

Unit-II

Selection of motor power rating: Design of heating elements, thermal model of motor for heating and cooling, Classes of motor duty, determination of motor rating for Continuous duty, fluctuating duty, short time duty and periodic duty. **08 Hrs.**

Unit-III

D C Motor Drives: Starting; Braking; Transient analysis. Single phase fully controlled rectifier control of dc separately excited motor. Three phase fully controlled rectifier control of dc separately excited motor. Multi quadrant operation of dc separately excited motor fed form fully controlled rectifier. Rectifier control of dc series motor. Chopper control of separately excited dc motor. Chopper control of series motor. **08 Hrs.**

Unit-IV

Induction motor Drives: Operation with unbalanced source voltage and single phasing; Starting; Braking; Transient analysis. Stator voltage control; Variable voltage, frequency control from voltage sources; Voltage source inverter control; Current source inverter control, Rotor resistance control, Slip power recovery, Speed control of single-phase induction motors. **08 Hrs.**

Unit-V

Synchronous motor Drives: Synchronous motor Drive Basics; Operation form fixed frequency supply; Synchronous motor variable speed drives; Variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thyristor inverter.

Industrial Drives: Rolling mill drives; Cement mill drives; Paper mill dries; Textile mill drives. **07 Hrs.**

Reference Books:

1) G.K. Dubey, “Fundamentals of Electrical Drives”, 2 Edition, 5/e reprint Narosa publishing house Chennai, 2002.
2) N.K. De and P.K. Sen, “Electrical Drives”, PHI, 2007.
3) S.K. Pillai, “A first course on electric drives” 1/e Wiley Eastern Ltd 1990.
4) V. R. Moorthi, “Power Electronics, Devices, Circuits and industrial applications”,2/e Oxford University Press, 2005.

21UEEE742 Non-Linear Control Theory (3 – 0 – 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to study and understand concept of state, state variables and state model, state model of linear systems, linearization of state equations and state variable analysis and design. They will learn to derive transfer function from state models and know about controllability and observability. They also learn the concept of pole placement techniques for improvement of stability. Further, they understand the behavior of nonlinear systems and carry out stability analysis using various techniques.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1 to 12)/PSO(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Compute the state model for linear systems and analyses for transfer function from state model. State space representation using different methods.	1,2		
CO-2	Obtain the state transition matrix and solve using different methods.	1,2		
CO-3	Improve stability by state feed- back, obtain the necessary and sufficient conditions for pole placement, design state regulator.	1,2		
CO-4	Compare different non-linear systems and analyze for singular points for stability. Construction of phase trajectories.	1,2		

CO-5	Examine the stability criteria for non-linear systems using Liapunov and Krasovskii's methods.	1,2		

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	3.0	3.0													

Prerequisites:

1. Linear system Analysis 2. Mathematics

Contents:

Unit-I

Variable analysis: Introduction, concept of state, state variables and state model, state model of linear systems, linearization of state equations.

State space representation: using physical variables, state space variables, Jordon canonical model, derivation of transfer function from state model, Digonalization, Eigen values, Eigen vectors, generalized Eigen vectors. **08 Hrs.**

Unit-II

Solution of state equations: state transition matrix and its properties, computation using Laplace transformation, Cayley-Hamilton method, concept of controllability and observability, methods of determining the same. **08 Hrs.**

Unit-III

Pole placement techniques: stability improvements by state feed- back, necessary and sufficient conditions for arbitrary pole placement, state regulator design, Ackraman's formula. **07 Hrs.**

Unit-IV

Non-Linear Systems: Introduction, Characteristics and behavior of non-linear system, common physical non linearities-saturation, friction, backlash, dead zone, relay, multi variable non-linearity

Phase plane method: singular points, stability of nonlinear system, limit cycles, construction of phase trajectories- graphical method. **08 Hrs.**

Unit-V

Non-linear system stability analysis: direct method of Liapunov and Liapunov candidates, Liapunov functions, construction of Liapunov functions for nonlinear system by KRASOVSKII'S method. **08 Hrs.**

Reference Books:

1) M. Gopal, “Digital control & state variable methods”, 2/e, TMH 2003.
2) I.J.Nagrath & M.Gopal, “Control system engineering”, 5/e, New Age International, 2008.
3) Katsuhiko Ogata, “Modern Control Engineering” 4/e, PHI, 2004.
4) K. P. Mohandas, “Modern Control Engineering”, Sanguine Technical Publishers, 2006.

21UEEE751	PLC and SCADA	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives: (CLOs)

The automation in the power systems and also in many of the industrial applications has gained lots of importance in the recent times. The Programmable Logic Controllers (PLC) is one of the important resources of automatic process control systems. The complex control strategies can be effectively realized by means of PLCs. The students shall be able to understand the concept of PLC based systems, the general architecture of PLCs and the operation of PLCs. Apart from this the students shall know the basic ladder programming of PLCs and understand the different logical concepts as applicable to industrial automation. The students shall also understand the basic concept of SCADA system and its components.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO’s(1 to 12)/PSO’s(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Recite the fundamentals aspects programming logic controllers and the I/O devices uses in PLC system.	1		
CO-2	Construct the ladder diagrams for different process control applications using PLC		1,2	3
CO-3	Write the programs based on simple logical applications based on PLC.		2,3	PSO-3

CO-4	Use the timers and counters for the practical applications in the PLC based system.		2,3	PSO-3
CO-5	Understand the basics of SCADA and the SCADA systems.	1		

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	2.67	2.0	1.67												1.0

Prerequisites:1. Digital Electronics2. Control Systems 3. Microcontrollers

Contents:

Unit-I

Programmable Logic Controllers: Introduction, Hardware, Architecture and PLC systems. Input output devices: Sourcing and sinking, Signal conditioning, remote connections, Networks Processing inputs, I/O addresses **07 Hrs.**

Unit-II

Fundamental PLC Wiring Diagrams and Ladder diagram: Ladder programming-ladder diagrams, logic functions, latching, multiple outputs, entering ladder programs, functional blocks, program examples, location of stop and emergency switches.

08 Hrs.

Unit-III

Programming in PLC: Instruction lists, Sequential function charts, structured text **Internal relays:** Ladder programs, battery- backed relays, one - shot operation, set and reset, master control relay, example programs, jump and call subroutines. **08 Hrs.**

Unit-IV

Timers and counters in PLC system: Different types of timers, programming the timers, OFF- delay timers, pulse timers, programming examples, forms of counter, programming, up and down counting, timers with counters, sequencer.

Shift register and data handling: Shift registers, ladder programs, registers, and bits. Case studies in PLCs. **08 Hrs.**

Unit-V

Application of PLC in power system SCADA: SCADA SYSTEM- Introduction, definition and history of Supervisory Control and Data Acquisition, typical power system SCADA Architecture, Communication Requirements, Desirable properties of SCADA system, advantages, disadvantages, and applications of SCADA. SCADA Architecture.

08 Hrs.

Note: The Ladder programs shall be written based on a suitable PLC configuration.

Reference books:

1) Programmable Logic Controllers –W. Bolton-Elsevier publisher
2) Programmable Logic Controllers – Principle and Applications by John W. Webb and Ronald A. Reiss, Fifth Edition, PHI.
3) Introduction to Programmable Logic Controllers- Gary Dunning-Cengage Learning.
4) PLC and SCADA theory and practice, Rajesh Verma, University Science Press, Laxmi Publications Pvt Ltd; First edition (1 January 2016)
5) Programmable Logic Controllers – Programming Method and Applications by J. R. Hackworth and F.D. Hackworth Jr. – Pearson, 2004

21UEEE752 Embedded Systems (3 - 0 - 0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn about Embedded Systems**.** Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems. They also know Sensors and Actuators, Communication Interface, Development Languages, RTOS Based Embedded System Design, Operating System Task Scheduling, memory management. Further they are exposed to Device Drivers, Integration and Testing of Embedded Hardware, Firmware and Advanced Microcontrollers

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1 to12)/ PSO (1, 2 & 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Outline the difference between embedded and desktop system.		1	
CO-2	Recognize the best technology suitable for embedded systems		1,3	
CO-3	Explain real-time operating systems & basic kernel services of an OS and concept of task, processes & threads, basic of multi-tasking and different scheduling algorithms,	1		
CO-4	Comprehend different types of messages passing techniques &analyse inter process communication & the need for	1	3	

	task synchronization in multi-tasking environment			
CO-5	Demonstrate the knowledge of integration and testing of embedded systems including advanced microcontrollers.	4		1

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	2.2		2.0	3.0											

Prerequisites: 1. Basics of Microcontrollers and VLSI.
2. C-programming language

Contents:

Unit-I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded System. **07Hrs.**

Unit-II

Typical Embedded System: Core of the Embedded System, Sensors and Actuators, Communication Interface (on board and off board), Embedded Firmware, Other System components, Embedded Firmware Design Approaches and Development Languages. **09Hrs.**

Unit-III

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. **09Hrs.**

Unit-IV

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, How to Choose an RTOS. **08Hrs.**

Unit-V

Integration and Testing of Embedded Hardware and Firmware: Out of Circuit Programming, in system Programming, in application Programming, Use of Factory Programmed Chip, Device Drivers **06Hrs.**

Reference Books:

1) Shibu K.V, "Introduction to Embedded Systems" 1/e, Tata McGraw Hill, 2013.
2) Jonathan W. Valvano, "Embedded Microcomputer Systems", 3/e, Cengage Learning, 2011.

3) Lyla B. Das, “Embedded Systems an Integrated Approach”, First Impression, Pearson, 2013.
4) Raj Kamal, “Introduction to Embedded Systems”, Tata McGraw Hill, 2/e, 2008.
5) Tammy Noergaard, “Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers”,Newnes,2/e, 2012.

21UEEE761 Power System Operation and Control (3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn SCADA, control canter, digital computer configuration, automatic generation control, area control error, operation without central computers, expression for tie-line flow and frequency deviation, parallel operation of generators, generation control loops, Load frequency control (LFC) modelling, steady state frequency deviation, AGC in single area system and multi area system and tie line bias control. Further, they are required to get exposure to reactive power & voltage control, optimal dispatch of generation and Unit Commitment.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO’s (1 to12)/ PSO’s (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe the concepts of SCADA, AGC, Tie-lines and analyse the process of frequency deviation in power system.	1,2		
CO-2	Develop LFC block diagram and analyse it using MATLAB.	1,2		5
CO-3	Develop AVR block diagram and analyse it using MATLAB and describe the secondary voltage control methods.	1,2		5
CO-4	Exhibit the knowledge of economic dispatch of	1,2		PSO-1

	thermal units using optimization techniques.			
CO-5	Exhibit the knowledge of Unit commitment and explore its methods	1,2		

Prerequisites: 1. Power System Analysis and Stability 2. Control Systems

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	3	3			1								1		

Contents:

Unit-I

Control center operation of power systems: Introduction to SCADA, control center, digital computer configuration, automatic generation control, area control error, operation without central computers, expression for tie-line flow and frequency deviation, parallel operation of generators, area lumped dynamic model. **07 Hrs.**

Unit-II

Power system Control: Basic generation control loops, Load frequency control (LFC) modeling, steady state frequency deviation, AGC in single area system and multi area system, tie line bias control. Examples to be solved with MATLAB & Simulink. **08 Hrs.**

Unit-III

Reactive Power and voltage control: Automatic voltage control (AVR)modeling, steady state voltage response, excitation system stabilizer-rate feedback, and PID controller, power flow through transmission line, relation between voltage, real power and reactive power, supplementary methods of voltage control, sub synchronous resonance, voltage stability, voltage collapse. Examples to be solved using MATLAB and Simulink. **08 Hrs.**

Unit-IV

Optimal dispatch of generation: Introduction, equality and inequality constraints, operating cost of thermal plant, economic dispatch neglecting losses and no generator limits, economic dispatch neglecting losses and including generator limits, economic dispatch including losses. Examples. **08 Hrs.**

Unit-V

Unit Commitment: Statement of the problem, need for and importance of unit commitment, example with shut down rule, constraints, Spinning reserve, thermal unit constraints and other constraints, Unit commitment solution methods-priority lists method, dynamic programming method.

Power system security: Introduction, factors affecting security, contingency analysis, detection of network problems, calculation of network sensitivity factors. **08 Hrs.**

Reference Books:

1) G. L. Kusic, "Computer Aided Power System Analysis", 2/e, Taylor & Francis, 2008.
2) Hadi Saadat, "Power System Engineering",2/e TMH,2002.
3) Kotrhari, Nagrath "Power System Analysis", 2/e, TMH, 2008.
4) A. J. Wood & B. F. Woolemberg, "Power Generation, Operation and Control", 1/e, John Wiley, and Sons,1984.

21UEEE762 AI and its Applications to Power Systems (3 - 0 - 0) 3

Contact Hrs: 39

Course Learning Objectives (CLOs):

The students are expected to learn basic concepts of AI, soft and hard computing. They study about artificial intelligence and relevance of fuzzy logic, fuzzification and defuzzification. Further, they are expected to learn genetic algorithms and apply AI techniques to power system applications.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Discuss soft, hard computing techniques, expert systems, fuzzy systems, and genetic algorithm	1		2
CO-2	Illustrate the concepts of feed forward neural networks, learning and understanding of feedback neural networks.	3	1	2
CO-3	Design and develop fuzzy logic for simple systems.	3	1	2
CO-4	Design and develop genetic algorithms for simple systems.	3	1	2
CO-5	Assess Fuzzy logic, Expert System and Genetic Algorithm application in power systems operation and control.	3,5		

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	2.0	1.33	2.33		3.0										

Prerequisites: 1. A course higher level language 2. Mathematics

Contents:

Unit-I

Introduction: Introduction, definition of AI, difference between soft computing techniques and hard computing systems, Expert Systems, brief history of ANN, Fuzzy Logic and Genetic Algorithm. **07 Hrs.**

Unit-II

Artificial neural networks: Introduction, human brain, model of artificial neuron, neural network architectures, characteristics of neural network, learning methods, architecture of back propagation network, back propagation learning. **08 Hrs.**

Unit-III

Fuzzy logic: Introduction, Fuzzy versus crisp, fuzzy sets - membership function – basic fuzzy set operations – properties of fuzzy sets, crisp relations- fuzzy Cartesian product, operations on fuzzy relations, fuzzy logic - fuzzy quantifiers-fuzzy inference, fuzzy rule-based system, defuzzification methods. **08 Hrs.**

Unit-IV

Genetic algorithms: Working principles, difference between genetic algorithm and traditional methods, different types of coding methods, fitness function, reproduction, different types of cross over methods in genetic algorithm, mutation. **08 Hrs**.

Unit-V

Applications of AI techniques in electrical systems: Applications of ANN, Fuzzy logic, Expert System and Genetic Algorithm in power systems operation and control. **08 Hrs.**

Reference Books:

1) S. Rajasekaran, G. A. V. Pai, "Neural Networks, Fuzzy Logic & Genetic Algorithms" PHI,1/e, New Delhi, 2003.

2) Abe Springer, "Neural Networks and Fuzzy Systems Theory and Applications", Science & Business Media, 2012.

3) D. E. Goldberg," Genetic Algorithms" Pearson Education India,1/e, Dec -2006.

4**)** Weerakorn Ongsakul, "Artificial Intelligence in Power System Optimization" CRC Press, May-2013

21UEEO721	Electric Vehicles	(3 – 0 – 0) 3

Contact Hours:39

Course Learning Objectives (CLOs):

The students are expected to learn the working of Electric Vehicles and recent trends. To analyse different power converter topology used for electric vehicle application. To develop the electric propulsion unit and its control for application of electric vehicles. To design converters for battery charging and explain transformer less topology.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.	1,2		
CO-2	Explain the working of electric vehicles and hybrid electric vehicles in recent trends.	1,2		
CO-3	Energy storage for EV and charging from renewable and grid sources.	1,2		
CO-4	Develop the electric propulsion unit and its control for application of electric vehicles.	1,2		
CO-5	Basic Design of Electric Vehicles	1,2	3	

POs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
Mapping Level	3.0	3.0	2.0												

Prerequisites: Power Electronics

Contents:

Unit-I

Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics,

Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Non-constant FTR, General Acceleration, Propulsion System Design. **07 Hrs**.

Unit-II

Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. **08 Hrs.**

Unit-III

Energy storage for EV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Supercapacitors. Power Electronic Converter for Battery Charging: Charging methods for battery, Termination methods, charging from grid, charging from Renewable Energy Sources. **08 Hrs.**

Unit-IV

Electric Propulsion: EV consideration, DC motor drives, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration, and control of Drives. **08 Hrs.**

Unit-V

Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of Parallel Hybrid Electric Drive Train Design: design of engine power capacity, design of electric motor drive capacity, transmission design. **08 Hrs.**

Reference Books:

1) Iqbal Husain - Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2) M. Ehsani, Y. Gao, S. Gay and Ali Emadi- Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, CRC Press, 2003.
3) Sheldon S. Williamson - Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Springer, 2013.
4) C.C. Chan and K.T. Chau - Modern Electric Vehicle Technology, OXFORD University, 2001.
5) Chris Mi, M. Abul Masrur, David Wenzhong Gao - Hybrid Electric Vehicles Principles and Applications with Practical Perspectives, Wiley Publication, 2011.
6) NPTEL Course: Fundamentals of Electric vehicles: Technology & Economics, IIT Madras Prof. Ashok Jhunjhunwala Prof. Prabhjot Kaur Prof. Kaushal Kumar Jha Prof. L Kannan. https://nptel.ac.in/courses/108106170

VIII Semester

21UEEL801	Technical Seminar / Independent Study	(0 - 0 - 2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The students are expected to learn how to carry out literature survey to locate the state-of-the-art technology in engineering domain of their interest. They are required to carry out selection of an emerging topic beyond the syllabus relevant to Electrical, Electronics and Computer related areas, study the same in detail, understand the concept, analyze, and present effectively before the target audience. Further, they are expected to know how to write a paper in the required format. They are also required to learn the effective communication and modalities of technical interactions.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Select a technical topic in emerging area by referring to renowned journals	12	2	6, PSO-3
CO-2	To study and understand the concept given in the paper /literature		2	6, 8, PSO-2, PSO-3
CO-3	Compile the information and prepare a write up/report/paper			1, 2, 6, 8, 9, 11, PSO-2, PSO-3
CO-4	Make presentation with effective communication and in all will come to know the state-of-the-art technology in E&E Engg. and allied branches	10	5, 9	8, PSO-2, PSO-3

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	1.0	1.6			2.0	1.0		1.0	1.5	3.0	1.0	3.0		1.0	1.0

Prerequisites: Knowledge of both theory and practical courses learnt in all the previous Semesters.

Contents:

1. Select a topic from an emerging area relevant to electrical sciences beyond curriculum and understand, analyze, and present it for 15 minutes followed by 5 minutes for questions and answers. Further, they are to submit the seminar material in the form of a paper in IEEE format. All the students are required to attend all the 52 slots.

2. Present the technical innovative/novel work carried out in the laboratory.

Typical procedure to conduct technical Seminar:

- All the students are informed to select a topic from the field of their interest from their branch or relevant to their branch and register the topic with the faculty(ies.) In charge of Seminar.
- Two faculty members assigned to carry out this activity. The faculty members prepare the schedule of the seminar spread over the entire semester and display the same in the notice board.
- Change of seminar topic is not allowed once registered, however in the case of genuine reasons only once change of topic may be permitted.
- Based on the number of hours mentioned in the scheme, 4-6 students shall present the seminar in one slot of 2/3 hours.
- The faculty members shall conduct the seminar session every week as per the schedule in the slot mentioned on the time table and carry out the evaluation.
- Attendance is compulsory for all the students for all the seminars.
- The students are required to submit two hard copies of report not exceeding 6 pages and one soft copy of seminar report one week prior to their date of presentation.
- Report shall be in IEEE format viz A4 size paper, Title: Bold, Times new Roman Font 14, Sub heading & Body of the text: Times new Roman font 12. Margin for left should be 1 ½.
- Student name, USN, seminar date should be mentioned on the report.
- Presentation is for about 15-20 minutes, followed by 5 minutes for questions and answers.
- Typical evaluation methodology shown in table below: For presentation, the following points not limited to may be considered; Concept, understanding, depth of the knowledge, originality of the topic, Quality of PPT, communication skills etc. For report evaluation, the following points not limited to may be considered Adherence to IEEE format, relevance of topic, subject depth and originality in writing etc.

The seminar is aimed at as an educative program for the students. This is because, the students shall listen to 60- 70 seminars on different topics from emerging areas is as good as undergoing a course on latest happenings in the related branch of Engineering.

Sl. No.	Parameters for Assessment	% of weightage for CIE and SEE
1.	Domain Knowledge and skill	40
2.	Presentation	20
3.	Question and Answer	20
4.	Report	20

21UEEL802	Major Project Phase - 2	(0 – 0 –18) 9

Contact Hours: 234

Course Learning Objectives (CLOs):

The students are expected to learn working in a team and on multidisciplinary projects. They are expected to carry out the intensive literature survey to locate the state-of-the-art technology in his engineering field of interest. They must learn to formulate/define the problem for the project work. They will learn to design, develop, analyze, test, interpret the results, fabricate, simulate, write code etc. relevant to their project work. They are also expected to acquire the skills of summarizing the work into a project report and in all, can carry out the technical work assigned to them independently.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's (1 to12)/ PSO's (1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Carry out the literature survey to locate the state-of-the-art technology in his Engineering field of interest	2		4, 5, PSO-2, PSO-3
CO-2	Define/formulate the problem for the project work	2,3	1,4,5	PSO-2, PSO-3
CO-3	Design, develop, analyze, test, interpret the results, fabricate, simulate, write code etc. relevant to his project work	3	5	7,8,9,12, PSO-2, PSO-3
CO-4	Summarize the work into a project report and in all can		10	6,8,11, PSO-2, PSO-3

	carry out the technical work assigned			

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level		3.0	3.0	1.5	1.66	1.0	1.0	1.0	1.0	2.0	1.0	1.0		1.0	1.0

Prerequisites: Knowledge of both theory and practical courses learnt in all the previous Semesters and relevant value-added information.

Major project phase–2 is the continuation from Major project phase – I in which the students are expected to go for material collection, survey, visits, data collection, preliminary design, analysis, model development, code writing, field work etc. The same project team formed for phase –I will continue the work under the guidance of the same faculty member. For all the projects, problems may be domain specific or interdisciplinary also in nature. A committee consisting of minimum 3 faculty members of which guide is a member shall evaluate at the end for CIE. There is a viva voce examination which shall be examined by two examiners one internal and one external to the college appointed by COE based on the suggestions by the respective HoD.

Reference materials/books:

1. Engineering books.
2. Journals.
3. Manuals and data sheets.
4. Software packages.
5. Previous project reports.
6. Product information brochures.
7. Interaction with academia and industrial experts.
8. Internet etc.

General Instructions to Students:

1. Students are expected to Design the problem modules in consultation with project guide/supervisor. Students are expected to submit Design Phase (Design Aspects in Phase-2) approved by project guide, to the project coordinator as per the schedule notified. A copy is to be maintained with students and the guide. Designs will be the base line for the implementation module.

2. Notification/schedules and evaluation procedures will be sent to all students in the Google groups created in the department.
3. Evaluation of Design Phase, implementation of each module Exploring different test cases with respect to each module is done in 8thsemester.
4. Final Project Report will be prepared includes the content of Phase-1 and Phase-2.

Sl. No.	Parameters for Assessment	% of weightage for CIE and SEE
P1	Project Synopsis/ Proposal Evaluation	15
P2	Literature survey/Technology used / Architectural design	15
P3	Requirement Analysis (SRS)	15
P4	Design methodology/Demonstration of tool used for designing	10
P5	Implementation modules	15
P6	Discussion of test cases /Project demonstration	15
P7	Project Report (phase-1 and Phase-2)	10
P8	Paper Publication / Presentation	05

21UEEL803	Internship - 2	(0 - 0 - 18) 3

Duration:4-6 Weeks.

The students are to undergo internship in Private industries/R&D organizations/Centers of Excellence/Laboratories of Reputed Institutions/Govt. & Semi Govt. organizations, PSUs, construction companies, entrepreneurial organizations, inter departments within the college etc. to get an exposure to the external world for a period of **4 weeks** in the summer vacation after VI sem and before start of VII semester. The students are to prepare a report on the internship work carried out. The internal faculty shall monitor the student and award CIE marks. The student shall present his/her work before a panel of examiners consisting of HoD, Guide and one faculty member during VII semester as final exam. The performance shall be communicated to the CoE office and the same shall reflect in the VII semester grade card.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to PO's (1 to12)/ PSO's (1 to 3)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Know the industrial environment.	1,10	7, 9,11	6,12
CO-2	Acquire knowledge and skill to use in professional career.	1	2, 4, 5	3
CO-3	Acquire the ability of report preparation and presentation skills.	8,10		
CO-4	Follow the code of practice in Electrical & Electronics Engineering related activities.	1		6, 8

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	3.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	3.0	2.0	1.0			

Prerequisites: Knowledge of both theory and practical courses learnt in all the previous Semesters and relevant value-added information.

Evaluation and rubrics: A faculty shall guide and monitor the internship activity of a batch consisting of 4 to 6 students. A committee consisting of two faculty members shall evaluate the internship work considering the parameters such as nature and extent of exposure to the external engineering world, understanding, report preparation, presentation and knowledge gained etc. There is a semester end examination SEE for internship – II. The performance shall be communicated to the CoE office at the end of VIII semester and shall reflect in VIII semester grade card.

Sl. No.	Parameters for Assessment	% of weightage for CIE and SEE
1.	Domain Knowledge and skill	40
2.	Presentation	20
3.	Question and Answer	20
4.	Report	20