Academic Program: UG

Academic Year 2024-25 Syllabus

V & VI 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 V & VI 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 Teamwork:** 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.

Electrical & Electronics Engineering Department												
Scheme for V Semester												
Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMS	22UEEC500	Engineering Economics & Industrial Management	EEE	3	0	0	03	50	100	100	3
2	PCC	22UEEC501	Electrical Machines-II	EEE	4	0	0	03	50	100	100	4
3	PCC	22UEEC502	Power Electronics	EEE	4	0	0	03	50	100	100	4
4	PEC	22UEEE5XX	Program Elective Courses -I	EEE	4	0	0	03	50	100	100	4
5	PCCL	22UEEL503	Machines-I Lab	EEE	0	0	2	03	50	50	100	1
6	PCCL	22UEEL504	Power Electronics Lab	EEE	0	0	2	03	50	50	100	1
7	PROJ	22UEEL505	Minor Project-I	EEE	0	0	4	03	50	50	100	2
8	MC	22URMK506	Research Methodology & IPR	EEE	2	0	0	02	50	50	100	2
9	MC	22UESK507	Environmental Studies	HU	1	0	0	01	50	50	100	1
10	HSMS	22USSK508	Soft Skills-I	CIII	0	0	2	-	50	-	50	Audit
11	MC	22UPYK509	Physical Education and Yoga	PEY	0	0	2	-	50	-	-	Audit
								Total			**1000**	**22**
Program Elective Course –I												
1	PEC-I	22UEEE511	Digital Signal Processing	EEE	4	0	0	03	50	100	100	4
2	PEC-I	22UEEE512	Electro Magnetic Theory	EEE	4	0	0	03	50	100	100	4

HSMS: Humanity and management Science course, PCC: Program Core Course, PCCL: Program Core Course laboratory, AEC: Ability Enhancement course, MC: Mandatory Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. PEC: Program elective course, PROJ: Project. TD: Teaching department, PSB: Paper setting Board.

CIII: Centre of Industry Institute Interaction

Program Elective Courses (PEC): A program elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course.
Minor-Project-I: The students are expected to identify the state-of-the-art technology in his/her 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 problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 2-4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work at higher semesters. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE with suitable rubrics. 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 recommended by the HoD.
Soft Skills-I: Training on communication skills, proficiency in English language and aptitude ability is arranged involving external resource. The external resource person shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 50 marks. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.
Physical Education/Yoga: All students have to register for the course namely National Service Scheme (NSS) with the concerned course coordinator during the first week of respective semester. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS activities. This course shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.
AICTE activity point: Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the program. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

Electrical & Electronics Engineering Department												
Scheme for VI Semester												
Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	22UEEC600	Power System Analysis & Stability	EEE	4	0	0	03	50	100	100	4
2	PCC	22UEEC601	High Voltage Engineering and Power System Protection	EEE	4	0	0	03	50	100	100	4
3	PCC	22UEEC602	Embedded Systems	EEE	3	0	0	03	50	100	100	3
4	PEC	22UEEE6XX	Program Elective Courses-II	EEE	3	0	0	03	50	100	100	3
5	PEC	22UEEE6XX	Program Elective Courses -III	EEE	3	0	0	03	50	100	100	3
6	OEC	22UEEO6XX	Open Elective Course-I	EEE	3	0	0	03	50	100	100	3
7	PCCL	22UEEL603	Machines-II Lab	EEE	0	0	2	03	50	50	100	1
8	PCCL	22UEEL604	Sensors & Control Systems Lab	EEE	0	0	2	03	50	50	100	1
9	PROJ	22UEEL605	Minor Project-II	EEE	0	0	4	03	50	50	100	2
10	HSMS	22USSK606	Soft Skills-II	CIII	0	0	2	-	50	-	50	Audit
11	MC	22UPYK607	Physical Education and Yoga	PEY	0	0	2	-	50	-	-	Audit
								Total			**1000**	**24**
Program Elective Course -II												
1	PEC-II	22UEEE621	Data Structures & Algorithm	EEE	3	0	0	03	50	100	100	3
2	PEC-II	22UEEE622	Linear Integrated Circuits	EEE	3	0	0	03	50	100	100	3
Program Elective Course – III												
1	PEC-III	22UEEE631	Internet of Things	EEE	3	0	0	03	50	100	100	3
2	PEC-III	22UEEE632	Computer Communication and Networking	EEE	3	0	0	03	50	100	100	3
Open Elective Course-I												
1	OEC-I	22UEEO611	PLC & SCADA	EEE	3	0	0	03	50	100	100	3

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Program Elective Course (PEC): A program elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum numbers of students' strength for offering Open Elective Course are as prescribed by the DAP.

Open Elective Courses (OEC): Students belonging to a particular stream of Engineering and Technology are entitled to opt for the open electives offered by their parent Department and other departments provided that they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course are as prescribed by the DAP.

Minor-project-II: It is either a continuation of Mini-Project-I or a new project. The students are expected to identify the state-of-the-art technology in his/her 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 problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 2-4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work at higher semesters. A committee constituted by HOD consisting of minimum 2 faculty members shall evaluate for CIE with suitable rubrics. 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 recommended by the HoD.

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Physical Education/Yoga: All students have to register for the course namely National Service Scheme (NSS) with the concerned course coordinator during the first week of respective semester. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS activities. This course shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

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V Semester

22UEEC500 Engineering Economics & Industrial Management (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn the evolution of Management, the organization structure encompassing planning, organizing, decision making and execution. They will also learn about the concept and scope of entrepreneurship in small, medium, large and Government owned Industries and the issues related to copyright, patents, in all, protection of Intellectual property.

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 to3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe the Engineering and Management history and planning.	11	2	
CO-2	Explain the concepts of organizing, staffing, motivating and controlling.	11	2	
CO-3	Recite the foundations of entrepreneurship, small scale industry, Government and Institutional Support.	11		
CO-4	Exhibit the skills of writing project report and describe issues related to IPRs.	11		12
CO-5	Comprehend the concepts of patents, trademarks and industrial design.	11		

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	1.0			

Prerequisites: 1.A course on Humanities (preferred)

Contents:

Unit-I

Engineering and Management: Historical Development of Engineering, Management, and synthesis.

Planning, Forecasting and Decision Making: Nature of Planning, the foundation of planning, some planning concepts, forecasting, nature of decision making, management science, tools for decision-making, CPM/PERT-Examples. **07 Hrs.**

Unit-II

Organizing and staffing: Nature of organizing, traditional organizational theory, technology, and modern organization structures, staffing technical organization, authority, and power; delegation of power, meeting & committees.

Motivating: Motivation, leadership, motivating and leading technical professionals.

Controlling: Process of control, financial controls, non-financial controls, Examples. **08 Hrs.**

Unit-III

Foundations of Entrepreneurship: Meaning, functions and types of entrepreneurs. Concept of entrepreneurship, role of entrepreneurs in economic development, barriers of entrepreneurship.

Small Scale Industry: Definition, characteristics, objects, role of SSI in economic development, advantages of SSI, steps to start SSI, impact of liberalization, privatization, and globalization on SSI, definition of ancillary and tiny industry.

Government and Institutional Support: Support from government, objectives, and functions of SISI, SIDBI, DIC, single window agency, KIADB, KSSIDC, KSFC. **07 Hrs.**

Unit-IV

Preparations for Project: Meaning of project identification, project report, contents and formulation, identification of business opportunities, feasibility studies, types and purpose, Case study of project report.

Costing: need for costing and types of costing. **08 Hrs.**

Unit-V

Economics: Depreciation and valuation of machinery, Inventory, Economic order quantity, break even analysis. **08 Hrs.**

Reference Books:

1) Thomas W. Zimmerer, “Essentials of Entrepreneurship”,2/e PHI, 2005.

2) Daniel L. Babcock, “Managing Engineering and Technology”, 4/e, PHI,2010.

3) Peter Drucker, “The Practice of Management”1/e, Business & Economics, 26-Jul-2012.
4) N.Narasimhaswamy, Engineering economics andmanagement.2/e, Dynaram Publications, 1990.
5) T.R. Banga & S.C. Sharma, “Industrial organization and engineering economics”1/e, 2003.
6) Raghavendra Rao,“Electrical Estimation Specification & Costing“,1/e,Sapna,2002.

22UEEC501 Electrical Machines-II (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn the basic principle, construction, operation and performance of Induction machines, the basic principle, construction, operation and performance of synchronous machines, the transient behavior and dynamics of machines.

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	Explain the Principle of operation of 3 phase Induction machine and its performance analysis.	1,2		
CO-2	Understand aspects of starting, braking and Speed control of 3-phase induction motor. Explain and analyze working and starting of 1 phase induction motor	1,2		
CO-3	Analyse performance of synchronous generator.	1,2		
CO-4	Determine voltage regulation, and analyze Parallel operation of synchronous generator.	1,2		

CO-5	Understand and analyze the static and dynamic performance of synchronous machines.	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.Basic Electrical Engineering 2. Network analysis

Contents:

Unit-I

Basics and performance of 3 phase induction machine: Review of Basics, Phasor diagram, Torque - slip curves, Equivalent circuit and performance calculations. No load and locked rotor tests. Circle diagram. Starting of 3 phase induction motor. Types of starters. Induction Generators. **12 Hrs.**

Unit-II

Single Phase Induction Motor: Construction, Double revolving field theory. Equivalent circuit, Determination of parameters of equivalent Circuit by tests, Methods of starting.

Control of Induction Motors: Speed control types. Control of rotor slip power of wound rotor induction motors, Power Electronics based control. Deep bar rotor and double cage induction motors. **10 Hrs.**

Unit-III

Basics of Synchronous Generators: Construction, Advantages of rotating field, emf equation, effects of harmonics on generated emf. Poly-phase armature windings, Phasor diagram of a synchronous generator with cylindrical rotor. **08 Hrs.**

Unit-IV

Performance of Synchronous Generators: Voltage regulation by emf, mmf, Potier triangle and ASA methods. Parallel operation. Operation on Infinite bus, operating characteristics and Power flow equations. **12 Hrs.**

Unit –V

Synchronous Motors: Principle of operation, Methods of starting, phasor diagram, effect of changing excitation, two reaction model, Synchronous Condensers**.**

Electrical transients in synchronous machines: Effect of damper windings. Effect of D.C. components. Expressions for reactance and time constants. Dynamics of Synchronous machines pull in phenomenon. Oscillations in synchronous machines. **10 Hrs.**

Reference Books:

1) D. P Kothari & I. J. Nagrath, "Electrical Machines", 3/e, TMH,2010.
2) M. G. Say "Performance and Design of A.C Machines", 3/e, CBS publications 2004.
3) P. S. Bimbra" Electric Machinery", 3/e, Khanna publishers,2003.
4) Ashfaq Hussain "Electric Machines", 2/e, Dhanpathrai & Sons, 2004.
5) Electrical Machinery fundamentals by Stephen J. Champan 4th edition TATA Mcgraw- Hill

22UEEC502	Power Electronics	(4 - 0 - 0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn the concept of Power Electronics and different types of switching devices, their control, performance characteristics & applications. They also learn about the principle of commutation of SCRs, the working principles of AC-AC, AC-DC, DC-DC and DC-AC converters and to analyze the working of various types of converter circuits with different types of loads connected across them.

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 to3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe the basics and significance of Power Electronics with the important devices & circuits.	1		
CO-2	Analyze the performance and protection aspects of power MOSFET and IGBT. Also describe the performance of SCR and its firing circuits.	1,2		
CO-3	Carry out performance analysis of AC Voltage Controllers and DC Choppers.	1,2		

CO-4	Carry out performance analysis of 1-phase & 3-phase Controlled Rectifiers.	1,2		
CO-5	Carry out performance analysis of 1-phase & 3-phase inverters and explain PWM technique and CSI.	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. Basic Electronics

Contents:

Unit-I

Introduction: Types of Power Electronic circuits; Important Power semiconductor devices and their control characteristics; Applications of Power Electronics; Peripheral effects. **04 Hrs.**

Power Transistors: Power MOSFET and Power IGBT: Switching characteristics; Gate drive; Heat Sinks. **06 Hrs.**

Unit-II

Power Transistor Protection & Application: di/dt limitations, Snubbers, Inductor design, MOSFET & IGBT Applications. **06Hrs.**

Thyristors: SCR: Working; Characteristics; Two transistor model; Firing circuits using op-amps and digital IC'S. **04 Hrs.**

Unit-III

AC Voltage Controllers: TRIAC characteristics and applications; Single-phase bi-directional controllers with R, R-L loads; Principle of working Cycloconverter. **04 Hrs.**

DC Choppers: Step-down chopper: Principle of operation; Performance parameters, Chopper classification, Analysis with R, R-L, R-L-E_b loads; Applications. Step-up chopper: Principle of operation; Analysis; **08 Hrs.**

Unit-IV

Controlled Rectifiers: Principle of operation of controlled rectifier; Performance of Single phase semi converters and full converters; Working of dual converters; Performance of Three phase half Controlled and full Controlled converters. **10 Hrs.**

Unit-V

Inverters: Single phase inverters: Bridge configuration; Principle of operation; Performance parameters; Voltage control; PWM techniques; Applications. Current Source Inverter: Working; Applications. Three phase inverters: Performance; Applications. **10 Hrs.**

Reference Books:

1) M. H. Rashid " Power Electronics", 3/e, Prentice Hall of India Pvt. Ltd, Pearson, 2009.
2) G. K. Dubey, S. R. Doradla, A Joshi & Sinha "Thyristorised Power Controllers", 2/e, New Age International (P) Ltd., Publishers, 2003.
3) M. D. Singh and Khanchandani K. B. Power Electronics, 2/e TMH, 2001.
4) Daniel W. Hart "Power Electronics",1/e, McGraw-Hill, 2011.
5) P. C. Sen–"Power Electronics",1/e, Tata McGraw-Hill Education, 1987.

22UEEL503 Machines- I Lab (0–0–2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The students are expected to learn realization of theoretical concepts and verify practically. They will be learning to conduct experiments on DC machines, single phase and three phase transformers to determine the performance characteristics.

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	Conduct experiments to determine the performance parameters of DC machines	9	2	4,8
CO-2	Conduct experiments to determine the performance parameters of single-phase transformers.	9	2	4,8
CO-3	Conduct experiments to determine the performance	9	2	4,8

	parameters of three phase transformers.			
CO-4	Carry out phase conversion	9	2	4,8

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		2.0		1.0				1.0	3.0						

Prerequisites: 1. Electrical machines

Contents: Minimum of 10 experiments to be conducted from the list given below.

Prescribed Experiments:

1. OCC and external characteristics of DC shunt generator.
2. Speed control of DC shunt motor by a) Rheostat control b) Flux control.
3. Load test on DC shunt motor.
4. Field test on DC series machines.
5. Swinburne test.
6. Hopkinson test.
7. Ratio and Polarity test on transformer.
8. OC and SC tests on 1- Φ transformers.
9. Sumpner's test.
10. Scott connection.
11. Parallel operation of 1- Φ transformers.
12. Load test on 3-phase transformers.

Reference Books:

1) D.P. Kothari & I.J. Nagrath- "Electrical Machines", 3/e, TMH,2010.
2) Ashfaq Hussain- "Electric Machines", 2/e, Dhanpatrai & Sons, 2004.

22UEEL504 Power Electronics Lab (0 - 0 - 2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The students are expected to learn conducting experiments on power semiconductor devices plot the characteristics and compare the same with the theoretical characteristics. They will learn to rig up different triggering circuits and commutation circuits. They learn to verify for the waveforms and other performance parameters of the converter circuits with different loads.

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	Relate the theoretical concepts to the experiment	1,2,3	5	4
CO-2	Choose and use appropriate equipment's, tools and procedures for the execution of the experiment	5		4
CO-3	Design and conduct the experiments and infer results	3	5	4
CO-4	Committed to professional ethics, self-learning, punctual and confident	8,9,12	5	4
CO-5	Neat representation of the experiment in oral and written form	10	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	3.0	3.0	3.0	1.0	2.2			3.0	3.0	3.0		3.0			

Prerequisites: Power Electronics.

Contents: Minimum of 10 experiments to be conducted from the list given below.

Prescribed Experiments:

1) Static Characteristics of SCR and MOSFET.
2) SCR turn-off circuits using (i) LC Circuit(ii) Auxiliary Commutation.
3) Synchronized UJT firing circuit for HWR circuits.
4) AC voltage controller using Triac – Diac combination.

5) Single phase FWR with R and RL loads.
6) Simulation of Chopper using MOSFET in MATLAB.
7) Voltage (Impulse) commutated chopper – both constant frequency and variable frequency operations.
8) Speed control of a separately excited DC motor.
9) Speed control of single-phase induction motor using thyristor.
10) Simulation on speed control of single-phase induction motor using VFD.
11) Parallel/Series Inverters.
12) Generation of firing pulses using TL494 IC.
13) Simulation of single phase full bridge inverter using MATLAB.

Reference Books:

1) M. H. Rashid, "Power Electronics", 3/e, Prentice Hall of India Pvt. Ltd, Pearson, 1988.
2) G. K. Dubey, S. R. Doradla, A Joshi & Sinha, "Thyristorised Power Controllers", New Age International (P) Ltd., Publishers, 2003.

22UEEL505	Minor Project - I	(0 - 0 - 4) 2

Contact Hours: 52

Course Learning Objectives (CLOs):

Minor project – 1 is undertaken to focus on the domain related problem definitions, building prototypes which can lead to take up the project in the higher semester(s). The work based on the core courses studied shall be used to formulate the problem. The team consisting of 3-4 students shall be asked to identify the problems related to community and try to propose a solution. The faculty members handling the courses for that semester along with other faculty members shall guide the students.

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	Identify the domain related problem and formulate a problem statement	6, PSO-3		9

CO-2	Propose the technical approach towards the solution.	11, PSO-3	4	9
CO-3	Implement the solution.	4, PSO-3	11	9,10
CO-4	Prepare the report in a specified format.	10		9

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				2.5		3.0			1.0	2.0	2.5				3.0

Contents:

Domain related problems, Technical solutions, and recommendations.

Evaluation and rubrics:

A committee consisting of minimum 3 faculty members shall evaluate for CIE at the end considering the parameters such as problem definition and its relevance, depth of knowledge, work carried out, quality of the report, Presentation & communication and interaction (questions and answers) with preferably equal weightage to all parameters. However, the departments can have little flexibility in the rubrics to be used based on the suitability. The students are required to submit a report on the project carried out. There is no SEE for Minor project-1.

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	10
P8	Paper Publication / Presentation	05

22URMK506	Research Methodology & IPR	(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. Also expected to learn about the importance of IPR and trade mark.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)**		
		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	-	2	5
CO-3	**Describe** measurement and scaling and data collection &report writing			3
CO-4	**Basic** concepts concerning IPR and copy rights	-	4	-
CO-5	**Explain** the need for Trademark and IT act.		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	1.0	1.0	1.5	2.2	-	-	-	-	-	-	-	-	-	-

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. **05 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

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

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

Interpretation and Report Writing: Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing.**06 Hrs.**

Unit-IV

Meaning and conception of IPR, competing, rationale for protection, international conventions, world court.

Copy right: Historical evolution of the law on copy right, meaning, content

Patents: Meaning of Patent, purpose and policy object of patent law, gains to inventor, application of patents, joint application, discovery and invention, patentable and non-patentable inventions. **05 Hrs.**

Unit-V

Trademarks: Definitions and conceptions of Trademark, advantages of registration, marks which are not registrable, known and well-known trade marks, application for registration and procedure for registration, procedure and certification of Trademarks.

The Information Technology Act:

Definitions, certifying authority, meaning of compromise of digital signature, offences and penalties, applicability of IPRs, cybercrimes, adjudicating officer, violation, damages and penalties, Cyber regulation appellate tribunal, World Wide Web and domain names and cyber flying, Self study. **05 Hrs.**

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.
4) N. K. Acharya, Text book on Intellectual Property Rights, 4th Edition, Asia Law House, Hyderabad.

22UESK507 Environmental Studies (1 - 0 - 0) 1

Contact Hours: 13

Course Learning Objective (CLO):

The students are to learn in this course about the need of balanced ecosystem, effects of human activities on environment, optimized use of natural resources including energy extraction and current Environmental issues.

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 the concept of ecosystem and effects of human activities on environment.		7	
CO-2	Describe the adverse effects on health and society due to erratic exploitation of natural resources.			6
CO-3	Understand various types of energy, sources of energy.		6	
CO-4	Explain different types of Pollution and concept of Global warming, Ozone layer depletion.		7	
CO-5	Discuss the current developments towards NGO to protect environment.		6	

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						1.6	2								

Course content:

Unit - I

Environment and Effects of Human activities on Environment: Introduction, Ecosystem – Types & Structure of Ecosystem, Impacts of Agriculture & Housing, Mining & Transportation. Environmental Impact Assessment, Sustainable Development. **03 Hrs**.

Unit - II

Natural Resources: Introduction Water resources – Availability & Quality aspects, Water borne diseases, Fluoride problem in drinking water. Material Cycles - Carbon cycle and Nitrogen cycle. **03 Hrs**.

Unit - III

Energy in Ecological System: Different types of energy, Conventional sources & non-conventional sources of energy. Solar energy, Hydro electric energy, Wind energy, nuclear energy, Biomass & Biogas, Fossil Fuels, Hydrogen as an alternative energy. **03Hrs.**

Unit - IV

Environmental Pollution: Water Pollution, Land Pollution, Air Pollution, Global Warming, Ozone layer depletion. **02 Hrs.**

Unit - V

Current Environmental Issues & Environmental Protection: Environmental Acts & Regulations, Role of Nongovernmental Organizations (NGOs). Introduction to GIS & Remote Sensing, Applications of GIS & Remote Sensing. **02 Hrs.**

Reference Books:

1) P. Meenakshi, “Elements of Environmental Science and Engineering”, Prentice Hall of India Private Limited, New Delhi, 2006.
2) Benny Joseph “Environmental Studies”, Tata McGraw – Hill Publishing Company Limited, 2010.
3) Raj Gopalan “Environmental Studies” Oxford University press, New Delhi, 3rd Edition, 2016.
4) Kaushik and Kaushik “Perspectives in Environmental Studies “, New Age International Private Limited, 2005.
5) D. L. Manjunath “Environmental Studies “, Pearson, Noida, 2016.

22USSK508	Soft skills - I	(0-0-2)Audit

Contact Hours: 26

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs(1-12)/ (PSO 1 to 3)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	**Explain** the significance of communication in the profession.	PSO-1	10	-
CO-2	**Use** the English language with proficiency	PSO-1	10	12
CO-3	**Solve** Aptitude related problems	PSO-1	9	12
CO-4	**Demonstrate** the competency in the placement activities.	PSO-1	9	-

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	2.0	-	1.0	3.0	-	-

Contents:

Number System, Linear Equations + Assessment Test ▪ HCF and LCM, Ratios & Proportions + Assessment Test ▪ Percentage, Profit & Loss + Assessment Test ▪ Time, Work & Distance + Assessment Test ▪ Simple and compound Interest, Averages and Mixtures + Assessment Test ▪ Permutations, Probability + Assessment Test ▪ Data analysis. **14Hrs.**

Cyptarithmetic ▪ Analytical Puzzles ▪ Classification Puzzles ▪ Mathematical Puzzles ▪ Human Relations ▪ Directional tests ▪ Coding and decoding ▪ Series completion – Verbal and Non-verbal ▪ Questions from recent recruitment tests. **10 Hrs.**

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

22UPYK509	Physical Education and Yoga	(0-0-2) Audit

Contact Hours: 24

Course Learning Objectives:

1. The course focuses on overall development and importance of Physical Education & Yoga in day to day life.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO1	Gaining the importance of Physical Education & yoga	12		8, 9
CO2	Understanding the benefits & preventive measures of health	12	6	8, 9
CO3	Gaining the knowledge of yoga	12		8, 9
CO4	Understanding the importance of Human Body conditioning & Sports training	12		8, 9
CO5	Get awareness of Modern technology in sports	12		5, 8, 9

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

Contents

Unit-I

Introduction to Physical Education: Meaning and importance, definition, components, benefits of physical education. **04Hrs**

Unit-II

Health and Wellness, Anatomy and Physiology: Meaning and importance, definition, components, benefits, health habits, basics of diseases and preventive measures, mental health, physical health, social health, spiritual health. Meaning and definition, first aid, injuries and preventions. **05Hrs**

Unit-III

Introduction of Yoga: Origin and history of Yoga, meaning and definition, benefits, Importance prayer Suryanamaskara,

Asana:- Trikonasana, Ardha Chakrasana, Baddha konasana, Utkatasana.

Pranayama:- Bhramari Pranayamai, Kapalbhati Pranayama.

Mudras:- Chinmaya mudra & Nasika mudra. **05Hrs**

Unit-IV

Sports Training: Meaning and definitions, warming up, cooldown, methods of exercises, stretching, speed, endurance, flexibility, agility, Athletics, Netball, Kabaddi, Football Tug of war, Throwball Rules and regulation of all games. **05Hrs**

Unit-V

Modern Technology in Sports and Games: Meaning and definitions, objectives, assisting umpires/ referees, hawk-eye technology, sports specific, computer software, technology in playfields, athletes clothing and equipment, graphics of sports and games, artificial intelligence. **05Hrs**

Reference Books:

1) Petipus, et al., Athlete's Guide to Career Planning, Human Kinetics, 1997
2) The Human Body in Health and Disease with Access 8th Edition 2023.
3) Anatomy and Physiology, Shri K.G. Nadgir College of Physical Education. Dharwad.
4) Health & Wellness Shri K.G. Nadgir College of Physical Education. Dharwad.
5) Nagendra HR., The art and science of Pranayama, 2009
6) Iyengar BKS., The illustrated Light on Yoga(English), 2005

22UEEE511	Digital Signal Processing	(4- 0 - 0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn to analyze sampled data, compare DFT and FFT algorithms in terms of computation burden and memory requirement. Further, they learn to design IIR filters, FIR filters, make use of IIR and FIR filters for different Applications, realize filters in different forms and about the Architecture and capabilities of DSP.

Course Outcomes (COs):

Description of the Course Outcome:	**Mapping to POs(1 to 12)/PSO(1 to3)**		
At the end of the course the student will be able to exhibit:	**Substantial Level (3)**	**Moderate Level (2)**	**Slight Level (1)**

CO-1	Computation of DFT, IDFT by direct method. Application of properties. Computation of circular and linear convolution.	2		
CO-2	Computation of DFT, IDFT using DIT and DIF algorithms. Comparison of algorithms with direct method with direct method.	2		
CO-3	Realization of digital systems.	2		
CO-4	Design IIR filters for given specifications.	3		
CO-5	Design FIR filters for given specifications. Architecture of Fixed point and floating-point Digital signal processors and their applications.	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		3.0	3.0												

Prerequisites: 1.Engineering Mathematics 2. Signal and Systems 3. Network Analysis

Contents:

Unit-I

Discrete Fourier transforms (DFT) and its properties: Circular convolution and linear convolution, use of tabular arrays, circular arrays, stock ham's methods, linear convolution-two finite duration sequences, one finite & one infinite duration **09 Hrs.**

Unit-II

Fast Fourier transforms (FFT) algorithm: Decimation in time algorithm, decomposition, number of computations, continuation of decomposition, number of multiplications, computational efficiency, decimation in frequency algorithm. **09 Hrs.**

Unit-III

Realization of digital systems: Using block diagrams & SFGs, matrix representation, realization of IIR systems-direct form, cascade form, parallel

form, realization of FIR systems-direct form, cascade form, linear phase realizations. **10 Hrs.**

Unit-IV

Design of IIR Digital filters: Impulse Invariant & Bilinear Transformations, all pole analog filters – Butterworth & Chebyshev, design of digital Butterworth & Chebyshev filters. **12 Hrs.**

Unit-V

Design of FIR Digital filters: Using rectangular, modified rectangular, Hamming, Hanning, triangular, Kaiser window, frequency sampling technique. Fixed and floating DSP processors and their applications. **12 Hrs.**

Reference Books:

1) Proakis - Digital Signal Processing: Principle, Algorithms and Applications, 4/e, Pearson Education, PHI, 2007.
2) Oppenheim - Digital Signal Processing, 2/e, Pearson Education, PHI, 2008.
3) Salivahanan, Vallavaraj, Gnanapriya - Digital Signal Processing,2/e TMH,
4) I feachor & Jervis - Digital Signal Processing,3/e Pearson Education, 2004.
5) A Nagoorkani, “Digital Signal Processing”,2/e Tata McGraw Hill Education Pvt. Ltd,2013.

22UEEE512	Electro Magnetic Theory	(4- 0- 0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn about the vectors, scalars and use of the same for field analysis. They are also learning the concepts of energy and potential. They will come to know the behavioral aspects of conductors, dielectrics and capacitance. Further they will know about the time varying field and wave propagation.

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	Describe the concepts of vectors, Coulomb’s law and its applications	1,2		
CO-2	Describe Gauss’s law and its applications, energy density and potential.	1,2		

CO-3	Exhibit the knowledge of properties of conductors, dielectrics, capacitance and applications of Poisson's and Laplace's equations	1,2		
CO-4	Illustrate the knowledge of steady magnetic fields and magnetic forces.	1,2		
CO-5	Comprehend the concepts of time varying fields and analyze uniform plane waves.	1,2		

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													

Prerequisites: 1.Elementary Physics 2. Mathematics 3. Basic Electrical Engg.

Contents:

Unit-I

Vector analysis: Scalars and vectors, vector algebra, Dot & cross products, Cartesian, cylindrical and spherical coordinate system.

Coulomb's law and Electric field Intensity: Field due to a continuous volume charge distribution, Field of a line charge and of a sheet charge.

10 Hrs.

Unit-II

Electric flux density: Gauss's law and Divergence, Electric flux density Divergence, Divergence theorem.

Energy and Potential: Energy expended in a moving point charge in an Electric field. Concept of potential and potential differences. Potential due to point charge and system of charges. Potential gradient, energy density in electric field. **12 Hrs.**

Unit-III

Conductors, dielectrics and capacitance: Continuity of current, conductor property and boundary conditions, Boundary conditions for perfect dielectric materials, capacitance calculations for different configurations.

Poisson's and Laplace's equations: Poisson's and Laplace's equations, Uniqueness theorem, examples of the solution of Laplace & Poisson equations.

12 Hrs.

Unit-IV

The steady magnetic field: Biot-Savart Law, Ampere Circuital Law, Curl, the scalar and vector magnetic potentials.

Magnetic forces: Force on a moving charge, force on a differential current element, Force Between differential current elements, magnetic boundary conditions. **09 Hrs.**

Unit-V

Time Varying Fields & Maxwell's Equations: Faraday's Law, Displacement current, Maxwell's equations in point form and integral form.

The Uniform Plane wave: Wave propagation in free space, wave propagation in dielectrics, Poynting Vector and power considerations, propagation in good conductors and skin effect. **09 Hrs.**

Reference Books:

1) William H. Hayt Jr., John A. Buck, "Engineering Electro Magnetics", 7/e TMH,2006.
2) Ganesh Rao, "Engineering Electromagnetics",1/e, Pearson Education India,2011.
3) John Krauss & Daniel A Fleisch, "Electromagnetics with Applications" 5/e, McGraw Hill,2010.

VI Semester

22UEEC600	Power System Analysis & Stability	(4 - 0- 0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn the importance of per unit computation. How to draw per unit diagram of a given power system. How to analyze symmetrical three phase short circuit on an unloaded synchronous generator. How the circuit breakers are rated? About the symmetrical components of currents and voltages. How to analyze the unsymmetrical faults in a power system. About the steady state & transient stability analysis of power system.

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	Describe the basics of power system and compute per unit representation.	1,2		
CO-2	Analyze symmetrical faults.	1,2		
CO-3	Describe concepts of symmetrical components & sequence network and solve related numerical.	1,2		
CO-4	Analyze unsymmetrical faults.	1,2		
CO-5	Analyze steady state and transient stability.	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.Network Analysis
2.Switchgear and Protection
3.Electrical Power Generation & Transmission
4. Electrical Machines.

Contents:

Unit-I

Representation of Power system Components: Standard symbols of power system components, one line diagram, impedance, and reactance diagram, per unit quantity-definition, per-unit impedance of three phase components, selection of base value, change of base, equivalent load impedance, per unit impedance of two- winding transformer referred to primary and secondary, method to draw p. u. impedance diagram of a power system and advantages of p. u. computations. **10 Hrs.**

Unit-II

Symmetrical 3 - Phase faults:3-phase short circuit at the terminals of unloaded generator, definition of sub- transient, transient and steady state reactance, examples on sub- transient current calculations in unloaded power systems, internal emfs of loaded machines, selection of circuit breaker ratings-momentary current and interrupting capacity. **10 Hrs.**

Unit-III

Symmetrical components: Definition of symmetrical components as applied to 3-phase unbalanced systems, operator ‘a’ and its properties, resolution of unbalanced phasors into their symmetrical components. Expressions for sequence components, examples on calculations of symmetrical components of unbalanced load against balanced 3-phase supply. Phase shift of symmetrical components in star-delta transformer bank, Power in terms of symmetrical components.

Sequence Networks: Sequence impedances and sequence networks. Sequence impedance of power system elements, positive, negative and zero sequence networks of 3-phase generator, transmission lines, 3-phase loads, and transformers**.** **11 Hrs.**

Unit-IV

Unsymmetrical faults: L-G, L-L, L-L-G faults on an unloaded alternator without and with fault impedance, Derivation of connection of sequence networks, Unsymmetrical faults on power system without and with fault impedance, Derivation of connection of sequence networks, examples on calculation of unsymmetrical fault currents. **11 Hrs.**

Unit-V

Power System Stability: Definition, classification; Steady state stability, Transient state stability, Stability limits, Assumptions made in Transient Stability studies, power angle equation, swing equation, synchronizing power co-efficient, equal area criterion (EAC) of stability and EAC applications, numerical problems, factors affecting transient stability and recent trends.

10 Hrs.

Reference Books:

1) W. D. Stevenson, “Elements of Power System Analysis”, 4/e, TMH, 1982.
2) I. J. Nagrath and D. P. Kothari, “Modern Power System Analysis”, 4th Edition, TMH, 2011.
3) Hadi Saadat, “Power System Analysis”, 2nd Edition, TMH, 2005.
4) Stag, G. W., and EI-Abiad A. H., “Computer Methods in Power System Analysis”, International Student Edition, McGraw Hill, 1988.
5) P .M. Chandrashekaraiah, “Power System Analysis and Stability”, First Edition, 2009.
6)V. Neelakantan “Power System Analysis and Stability”, First Edition, 2002.

22UEEC601 High Voltage Engineering and Power System Protection (4–0–0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn the advantages high voltage systems, applications and generation of high voltages. They will learn different methods of measuring high voltages, breakdown mechanism in dielectrics. They are also expected to learn need for protection, different types of relays and circuit breakers,

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	Classify high voltage systems and describe applications.	1		
CO-2	Explain different types of generation of and demonstrate different methods of measuring HVAC and HVDC.	1, 2		
CO-3	Explain the different breakdown phenomenon occurring in dielectrics and	1, 2		

	describe the need for protection of power system.			
CO-4	Explain arcing in CBs, importance of arcing, arc quenching theories and types of circuit breakers	1, 2		
CO-5	Describe and analyze different types of relays.	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 Distribution & Utilization
2. Electrical Measurements

Contents:

Unit-I

HV Systems: Classification, important applications of high voltage. **02 Hrs.**

Generation of HV for testing: HVDC: voltage doubler circuit, Cockcroft-Walton type. Calculation of percentage voltage regulation, percentage ripple and optimum number of stages, examples. HVAC: HV transformer - working of transformer connected in cascade. Series resonant circuit. Tesla coil.

08 Hrs.

Unit-II

Generation of Impulse Voltage and Current: Introduction to standard lightning and switching impulse voltages, Analysis of single stage impulse generator, Multistage impulse generator working of Marx impulse generator and components. Generation of switching impulse voltage and high impulse current.

05 Hrs.

Measurement of high voltages: Measurement of voltage using voltage divider, Rogowski coils. Standard sphere gap measurements. Electrostatic voltmeter-principle & construction. Generating voltmeter- Principle of operation & construction. **05 Hrs.**

Unit–III

Breakdown phenomena: Classification and Properties of HV insulating media. Gaseous, Liquid & Solid dielectrics, Ionizations, primary and secondary ionization processes. Townsend's theory, Streamer's theory. Corona discharges. Expression for disruptive and visual critical voltages and corona power loss. Panchen's law. **06 Hrs.**

Power system protection: Principles, Block diagram of power system protection, Switchgears, Zones of protection, Requirement of good protection system, Types of protection schemes. **06 Hrs.**

Unit-IV.

Circuit breakers: Initiation, maintenance and interruption of arc, arc interruption theories, arc chopping. problems encountered in DC circuit breaking. Rating of CBs. Air break and Air blast CBs, Bulk oil & minimum oil CBs, SF6 CBs, vacuum CB voltage, restriking voltage and recovery voltage, resistance switching, HVDC CBs. **10 Hrs.**

Unit-V

Relays: Relay settings, Torque equations and characteristics of Over current relay, Directional over current relay, Differential relay, Percentage differential relay, Impedance relay, Mho relay. **10 Hrs.**

Reference Books:

1) E. Kuffel and W.S. Zaengl, “High voltage engineering fundamentals”, 2/e, Elsevier, press, 2005.
2) M.S.Naidu and Kamaraju, “High Voltage Engineering”, 3/e, THM, 2007.
3) C.L.Wadhwa, “High voltage engineering”, New Age International Private limited, 1995.
4) Sunil S. Rao–“Switch Gear & Protection”, 1/e, Khanna Publication, 2004.
5) Ravindranath & Chander - Power System Protection & Switch Gear, New Age Publications, 2005.
6) Chakraborthy, Soni, Gupta &Bhatnagar–“A Course in Electrical Power”, 3/e, Dhanapat Rai Publication, 1999

22UEEC602	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, to 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 task synchronization in multi-tasking environment	1	3	
CO-5	Demonstrate the knowledge of integration and testing of embedded systems including advanced microcontrollers.	4		1

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	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, Device Drivers, How to Choose an RTOS. **08Hrs.**

Unit-V

Integration and Testing of Embedded Hardware: Out of Circuit Programming, in system Programming, in application Programming, Use of Factory Programmed Chip. **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 Guidefor Engineers and Programmers”,Newnes,2/e, 2012.

22UEEL603	Machines-II Lab	(0 - 0 - 2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

The students are expected to learn to conduct experiments to measure the line and phase voltages and currents in Star and delta connections. Further, they will be learning to conduct experiments on 3 phase squirrel cage and wound

rotor induction motors, single phase induction motors, alternators and synchronous motors and evaluate the performance.

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	Test and obtain performance characteristics of single-phase induction motors.	9	2	4,8
CO-2	Test and obtain performance characteristics three phase induction motors.	9	2	4,8
CO-3	Determine regulation of large capacity alternator by different methods	9	2	4,8
CO-4	Synchronize the alternator with the busbar	9	2	4,8

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		2.0		1.0				1.0	3.0						

Prerequisites: 1. Electrical Machines

Contents: Minimum of 10 experiments to be conducted from the list given below.

Prescribed Experiments:

1. Load test on 3-phase induction motor.
2. Load test on 1-phase induction motor.
3. Performance predetermination of 3-phase induction motor by equivalent circuit.
4. Performance predetermination of 3-phase induction motor by Circle diagram.
5. Speed control of wound rotor induction motor.
6. Load test on induction generator.

7. Regulation of alternator by emf and mmf methods.
8. Regulation of alternator by Potier triangle method and ASA methods.
9. Synchronization of alternator.
10. Slip test on alternator.
11. V and inverted V curves of synchronous motor.
12. Study of 3-phase winding and speed change by changing number of poles of induction motor.

Reference Books:

1) D.P. Kothari & I.J. Nagrath, “Electrical Machines”, 3/e,TMH,2010.
2) Ashfaq Hussain, ”Electric Machines”, 2/e, Dhanpatrai & Sons, 2004.

22UEEL604 Sensors & Control Systems Lab (0 - 0 - 2) 1

Contact Hours: 26

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. Hence it is necessary to understand the operation of sensors in the measurement applications and also to have hands on experience of using the different types of sensors in control system. The students are expected to learn conducting experiments to be able to use different types of sensors for the measurement of various analog quantities specified. They are also expected to obtain the performance characteristics of the sensors used.

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	Demonstrate the fundamental skill of using the sensors and measure their characteristics.	4		9,PSO3
CO-2	Obtain the characteristics of servomotors.	4		9, PSO3
CO-3	Design and analyze the performance of the second order systems	4		3,9, PSO3

CO-4	Simulate the second order systems and obtain the time domain response.	4	5	9, PSO3

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	3.0	2.0				1.0						1.0

Prerequisites:1. Control Systems 2. Microcontrollers

Contents:

Prescribed Experiments:

Note: Minimum of 10 experiments is to be conducted.

1. Time response of second order system using MATLAB.
2. Frequency response analysis using MATLAB
3. Frequency response analysis of 3rd order system using MATLAB
4. Simulation of temperature sensor using MATLAB Simulink.
5. Transient response of a given electrical network using MATLAB.
6. Experiment to obtain the value of the distance measured, using ultrasonic sensors, embedded computers, IoT and cloud paradigm.
7. Experiment to obtain the value of the temperature and humidity measured, using temperature and humidity sensors to activate an output device using, embedded computers, IoT and cloud paradigm.
8. Experiment to a) detect the contents of gas using gas sensor and b) detect the light using light sensor and activate an output device, IoT and cloud paradigm.
9. Experiment to obtain the value of the distance at periodic intervals using an ultrasonic sensor and Raspberry Pi microcomputer.
10. Simulation of photodiode using MATLAB Simulink

Reference Books:

1) Roy & Choudary, "Operational amplifiers and Linear Integrated circuits", 2/e, New Age International 01-Jan-2003.
2) Cooper D & A D Heifrick, "Modern Electronic Instrumentation and Measuring Techniques", PHI, 1998.
3) I. J. Nagrath and M. Gopal "Control Systems Engineering: 3/e, Wiley Eastern Ltd, 2003.
4) K. Ogata, "Modern Control Engineering", 4/e, PHI, 2004.

22UEEL605	Minor Project-II	(0-0-4) 2

Contact Hours: 52

Course Learning Objectives (CLOs):

Minor project-2: It is to be taken up having had an exposure to the project work in the previous semesters. The students are expected to locate the state of the art technology in his/her 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 problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work at higher semesters.

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	Identify the domain related preferably real time problem and formulate a problem statement	4,PSO-3	6	9
CO-2	Propose the technical approach towards the solution.	4, PSO-3	11	9
CO-3	Implement the solution / demonstrate the working of prototype, execution of codes, etc.	4, PSO-3	11	9,10
CO-4	Prepare the project report in a specified format.	10		9

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				3.0

Evaluation and rubrics: A committee consisting of minimum 3 faculty members shall evaluate at the end for CIE with suitable rubrics. The weightage

of marks shall be 50% for the committee and 50% for the guide. The committee shall consider the parameters such as problem definition and its relevance, depth of knowledge and work carried out, quality of the report, Presentation & communication and interaction (questions and answers) with preferably equal weightage to all parameters during the evaluation. However, the departments can have little flexibility in the rubrics to be used based on the suitability. The students are required to submit a report on the project work carried out. There is a semester end examination SEE (viva voce) which shall be examined by two internal examiners appointed by COE based on the suggestions by the respective HoD.

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

22USSK606 Soft Skills-II (0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Demonstrate** the skill in sentence completion and faster reading of passages	PSO-1	10	-
CO-2	**Use** the English language with proficiency	PSO-1	10	12
CO-3	**Demonstrate** the capability of interview facing ability	PSO-1	9	12
CO-4	**Demonstrate** the competency in the placement activities.	PSO-1	9	-

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	2.0		1.0	3.0		

Contents:

Vocabulary ▪ Formatting and feeding correct structures ▪ Synonyms and Antonyms ▪ Analogies ▪ Sentence Completion ▪ Error Detection and Correction ▪ Faster reading of Passages ▪ Essays ▪ Carryover plan - Dictionary Usage. **10Hrs**.

Understanding Discussions ▪ Parameters measured in GDs ▪ Video Analysis of GDs ▪ Knowledge base and Ideas ▪ Taking the initiative ▪ Introduction and Conclusion **04Hrs.**

Most common personal interview questions ▪ What companies expect ▪ Showing Commitment and Learning Ability ▪ Handling difficult questions ▪ Understanding interviewer psychology ▪ Situation Reaction and Presence of Mind ▪ Dressing right ▪ Interview etiquette **10 Hrs.**

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other

suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

22UPYK607	Physical Education and Yoga	(0-0-2) Audit

Contact Hours: 24

Course Learning Objectives:

2. The course focuses on overall development and importance of Physical Education & Yoga in day to day life.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO1	Gaining the importance of Physical Education & yoga	12		8, 9
CO2	Understanding the benefits & preventive measures of health	12	6	8, 9
CO3	Gaining the knowledge of yoga	12		8, 9
CO4	Understanding the importance of Human Body conditioning & Sports training	12		8, 9
CO5	Get awareness of Modern technology in sports	12		5, 8, 9

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

Contents

Unit-I

Introduction to Physical Education: Meaning and importance, definition, components, benefits of physical education. **04Hrs**

Unit-II

Health and wellness, Anatomy and Physiology: Meaning and importance, definition, components, benefits, health habits, basics of diseases and preventive measures, mental health, physical health, social health, spiritual health, Meaning and definition, first aid, injuries and preventions. **05Hrs**

Unit-III

Introduction of Yoga: Origin and history of Yoga, meaning and definition, benefits, importance prayer Suryanamaskara,

Asana:- Padahastasana, Ardha matsyendrasana, Halasana, Navasana.

Pranayama:- Sitali Pranayama & Nadishodhana Pranayama

Mudras:- Prana mudra & Adhi mudra. **05Hrs**

Unit-IV

Sports Training: Meaning and definitions, warming up, cooldown, methods of exercises, stretching, speed, endurance, flexibility, agility, Athletics, Football, Badmintion, Chess, Teakwondo, Rules and regulation of all games. **05Hrs**

Unit-V

Modern technology in sports and games: Meaning and definitions, objectives, assisting umpires/ referees, hawk-eye technology, sports specific, computer software, technology in playfields, athletes clothing and equipment, graphics of sports and games, artificial intelligence. **05Hrs**

Reference Books:

1) Petipus, et al., Athlete's Guide to Career Planning, Human Kinetics, 1997
2) The Human Body in Health and Disease with Access 8th Edition 2023.
3) Anatomy and Physiology, Shri K.G. Nadgir College of Physical Education. Dharwad.
4) Health & Wellness Shri K.G. Nadgir College of Physical Education. Dharwad.
5) Nagendra HR., The art and science of Pranayama, 2009
6) Iyengar BKS., The illustrated Light on Yoga(English), 2005

22UEEE621	Data Structures & Algorithm	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn basic features of programming language, a abstract data types and its use in solving given any problem. They will be learning how to use of data structures in application development. They are exposed to standard algorithms and analysis.

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	Explain different features of programming language in C & C++.	1	2	
CO-2	Code to implement stack and operations of stack using arrays and pointers.	5	2	
CO-3	Code to implement Queues and tree using arrays and pointers.	5	2	
CO-4	Explain the operations of searching and sorting techniques using code	5	2	
CO-5	Design an algorithm for different optimization techniques and applications.	5	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	2.0			3.0										

Prerequisites: Programming experience in C/C++.

Contents:

Unit-I

Basic Programming Features: Data types, Memory allocation, arrays, structures, unions, pointers, recursion, and file operations**.** **08 Hrs.**

Unit-II

Abstract Data Types: Conceptualization. Implementation of operations on Stack including display and searching using arrays and pointers (Linked List)

08 Hrs.

Unit-III

Implementation of: Queues, Circular queues, Double Ended Queue, Priority Queue and Trees using arrays and pointers (Linked List). **08 Hrs.**

Unit-IV

Searching and Sorting Techniques: Conceptualization, Implementation of: Linear and Binary search, Hashing, sorting techniques: bubble sort, insertion sort, selection sort, quick sort, merge sort, heap sort. **08 Hrs.**

Unit-V

Algorithm Design: Divide and Conquer method and applications (Max-Mm), Greedy strategy method and applications (Job sequencing, Optimal merge patterns), Dynamic Programming method and applications (Multistage graphs, travelling sales problem), Backtracking method and applications (Sum of sets) Branch and Bound method & applications (Travelling Sales problem). **07 Hrs.**

Reference Books:

1) Yedidyah, Augenstein and Tenenbaum, "Data Structures Using C and C++',2/e, PHI- India,2011.
2) E. Balagurusamy, "Programming in ANSI C", 4/e, Tata McGraw-Hill.
3) Sartaj Sahni, "Data Structures, Algorithms and Application in C++", 2/e, University Press, 2005.
4) Thomas H Coreman, Charles E Leiserson& Ronald L Rivest, "Introduction to Algorithms", 1/e, Prentice Hall of India, August 2000.
5) Adam Drozdek, "Data Structures & Algorithms in C++", 2/e, Vikas Publishing House, 2004.

22UEEE622	Linear Integrated Circuits	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn the basic working of Linear IC, design concepts of Linear ICs based circuits and solve relevant problems. They also learn to analyze electronic circuits even with the help of relevant software and fundamental design skills of analog systems using linear ICs which have immediate end application to Engineering 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 to 12)/PSO's(1 to 3)**		
	Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**

CO-1	Recall the basics and understand the stability issues of Opamp circuits.	1		
CO-2	Apply the knowledge of basic Opamps in the linear circuit design.	1		
CO-3	Apply the knowledge of basic Opamps in the non-linear circuit design.	2,3	PSO 3	
CO-4	Apply the knowledge of basic Opamps in the design of oscillators and filters.	2,3		
CO-5	Analyze the performance of different Opamp circuits from the point of view of their applications.	2	5, 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	3.0	3.0	3.0		2.0										2.0

Prerequisites: Basic/Analog Electronics

Contents:

Unit-I

Review of basics: Ideal and practical Opamps, Performance parameters of Opamps. Comparison of BJT and MOS based Opamps. Basic CMOS Opamps. MOS differential amplifier, **Frequency response:** Requirement of circuit stability, Barrack Hussein's criteria, Frequency compensation methods, Effects of slew rate, Circuit stability precautions. **08 Hrs.**

Unit-II

Opamp circuit design: Voltage follower, High input impedance Inverting and non-inverting amplifiers, Differentiator, Integrator, Precision rectifiers (half wave and full wave), Clippers, Clampers, Sample and hold circuits. **07 Hrs.**

Unit-III

Design & Applications of Opamp nonlinear Circuits: Comparators, voltage limiters, differential input and differential output amplifier, Schmitt trigger, Square wave generators, Monostable multivibrators, Voltage to current converter with floating load, Current to voltage converter. **08 Hrs.**

Unit-IV

Oscillators and Filters: Oscillators-Triangular wave generator, RC phase shift oscillator, Wein bridge oscillator, Phase shift oscillator and Active filters-2nd order Butterworth low pass, high pass, band pass and band elimination filters. **07 Hrs.**

Unit-V

Special ICs and applications: Phase locked loops (NE565), Analog to Digital Converters- Successive approximation, Dual slope and Flash type, Digital to Analog Converters- Binary weighted and R-2R type Regulated power supply, Voltage regulator.

Self-learning component: Usage of modern tool for the simulation of Opamp based circuits. **09 Hrs.**

Reference Books:

1) Roy & Choudary, "Operational amplifiers and Linear Integrated circuits", 2/e, New Age International 01-Jan-2003
2) Ramakanth A. Gayakwad, "Operational Amplifiers and Linear IC's"3/e, Prentice Hall,2000.
3) David A. Bell," Operation Amplifiers and Linear IC's",2/e, PHI, 2005.
4) Behzad Razavi, "Design of analog CMOS Integrated circuit ", Tata McGraw-Hill Education, 01-Oct-2002

22UEEE631	Internet of Things	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The students are expected to learn the basic concept of Internet of things, its general architecture, technology, and the design principles behind it. The students are required to get exposure to the handling of data and understand the concept of cloud paradigm being used in IoT environment. Students are also required to understand the role of sensors in IoT and the basics of embedded computing besides understanding certain case studies on IoT application.

Course Outcomes (COs):

Description of the Course Outcome:	**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
At the end of the course the student will be able to:	**Substantial Level (3)**	**Moderate Level (2)**	**Slight Level (1)**

CO-1	Describe the fundamental concept of IoT, design principles and different communication technologies used in IoT paradigm.	1,5		
CO-2	Recite the different data handling protocols and aspects of cloud computing as applicable to IoT.	1,5		2,3
CO-3	Explain the different types of sensors and the data communication protocols for these sensors as applicable to IoT.	1,5		2,3
CO-4	Select a suitable embedded platform for the IoT application.	1,5		2,3
CO-5	Analyze the smart grid technology and different other case studies based on IoT applications.	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	1.5	1.0		3.0	3.0									

Prerequisites:1.Any one basic programming language 2. Digital Electronics
3. Microcontrollers

Contents:

Unit-I

Overview of IoT: Definitions, vision, smart and hyper connected devices. IoT conceptual framework, IoT architectural view. Technology behind IoT, major components of IoT system, sources of IoT. M2M communication

Design principles for connected devices: Introduction, systems, layers, and design standardization modified OSI model for IoT. ITU-T reference model.

Communication technology: Wireless communication technology, RFID, ZigBee IP, Wi-Fi, Wired communication technology, Comparison of communication technologies. **08 Hrs.**

Unit-II

Data handling and Cloud computing paradigm: Introduction to internet-based communication, protocols, version 6, TCP IP suite, IP addressing in IoT.
Data handling: Introduction, data acquiring and storage, organizing data, data analytics.
Cloud computing: Introduction, computing methods, deployment methods, everything as a service, service models. **08 Hrs.**

Unit-III

Sensors and network: Sensor technology, analog and digital sensors, examples, sensing the things-barcodes, QR codes, motion sensors, pressure sensors, environmental monitoring sensors, participatory sensing, industrial IoT, actuators.
Data communication protocols for sensors: RFID technology-Principle, design challenges, wireless sensor networks technology. **08 Hrs.**

Unit-IV

Embedded computing basics: Embedded software and hardware units, embedded platform for prototyping-Arduino, Intel Galileo, Intel Edison, Raspberry Pi. Prototyping embedded device software, Devices, gateways, Internet, and web/cloud services. **08 Hrs.**

Unit-V

IoT applications and Case studies: Introduction to smart grid and a possible IoT based smart grid, Smart home, smart cities, Street light control and monitoring. **07 Hrs.**

Reference books:

1) Internet of Things, Architecture and design principles, Raj Kamal, McGraw Hill Publication, 2017
2) David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome
3) Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
4) Srinivasa K G, "Internet of Things", CENGAGE Leaning India, 2017
5) Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)

22UEEE632 Computer Communication and Networking (3–0–0)3

Contact Hours:39

Course Learning Objectives (CLOs):

The students are expected to learn about the interconnection of autonomous computers making reference to OSI and TCP/IP reference models. The students will understand the need of stack of layers from physical through application layer, their design issues, functions, and significance. They are expected to know different LAN structures, MAN, WAN and Internet. They will also be aware of blue tooth, wireless LAN etc.

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 basics of computer networks, reference models and standardization of networks.	3		
CO-2	Describe the design issues such as timing, electrical, mechanical specifications at physical layer, switching techniques and transmission media.	3	4	
CO-3	Explain Data link layer design issues, medium access, data link protocols including CSMA/ CD and CSMA/CA protocols, LAN protocols & specifications & verification of protocols.	3	4	5
CO-4	Explain Network layer design issues such as Routing, congestion	3	4	5

	control algorithms and Internet working .			
CO-5	Describe design issues and protocols of transport, presentation and Application layers.	3	4	

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-13	PSO-14
Mapping Level			3.0	2.0	1.0									

Prerequisites: 1. Digital Electronics 2. A course on Basic communication

Contents:

Unit-I

Introduction: Uses of computer network, network structure, the OSI reference model. The TCP/IP reference model, services, network standardization. **08 Hrs.**

Unit-II

The Physical layer: Transmission and switching, Frequency and time division multiplexing, circuit switching, packet switching, Hybrid switching. **07 Hrs.**

Unit-III

The medium access sub layer: The local and metropolitan area networks, the protocols, CAN Protocol, LAN protocols, IEEE standard 802 for LAN, fiber optic networks, satellite networks, packet radio networks. The data link layer: Elementary data link protocols- sliding window protocols, protocols specifications and verifications. **09 Hrs.**

Unit-IV

The network layer: Network layer design issues. Routing algorithms, congestion control algorithms. Internet working, network layer in the internet and ATM networks**.** **08 Hrs.**

Unit-V

The transport, presentation, and application layers: Design issues & protocols. **07 Hrs.**

Reference Books:

1) Tanenbaum,"Computer Networks", 3/e edition PHI 1993
2) Farozan, "Data Communication"1/e, Huga Media, 2007
3) W Stalling, "Data and Computer Communications", 1/e, PHI. 2007

4) Micheal A, ”Computer Communications and Network Technologies”, 2/e, Hancock, Thomson Publications, 2003.

22UEEO611	PLC & 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		2,3	PSO-3

	applications in the PLC based system.			
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 Systems3. 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.

CIE and SEE Evaluation (from 2024-25 batch)

Courses with LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

Continuous Internal Evaluation (CIE):

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.
- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course each of 5marks. Total CTA marks-10
- CIE=40 (from tests)+10(from CTA) =50 marks

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub divisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

ASC(IC)/PCC with LTP 2-0-2, 3-0-2 and 2-2-2

Continuous Internal Evaluation (CIE):

Theory CIE component:

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two sub divisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.

Course Teacher Assessment (CTA): Totally based on conduction of experiments as set by the course teacher.

Laboratory component assessment:

- 5 marks: for conduction, regularity, involvement, journal writing, etc. Minimum 75% of attendance is compulsory. If the performance is not satisfactory in laboratory the student shall be detained and required to reregister for the course as a whole whenever offered next.
- 5 marks: Lab Test. A Lab test as per the class time table has to be conducted at the end for50 marks and scale down to 5 marks.
- CIE for integrated course =40 (from IA tests)+10 (from CTA i.e. lab component) =50 marks.
- There will not be any remuneration for Final Lab Test since it is CTA of integrated course.
- Copy of the Marks list to be sent to the concerned course instructor immediately after the completion of test for that batch. Original Marks list to be maintained in the department.
- CIE=40(from tests)+10(from CTA i.e. lab component) =50 marks

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question with maximum of three sub divisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

AEC/HSMS/UHV Courses with LTP 1-0-0:

Continuous Internal Evaluation (CIE)

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: MCQ 20 questions

- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course etc. each of 5marks. Total CTA marks-10
- CIE=40(from tests)+10(from CTA) =50 marks

Semester End Examination (SEE):

- SEE is conducted for 50 marks of 1 hour duration. There will be 50 MCQs.
- Question Paper pattern for SEE: The question paper will contain 12 MCQ questions drawn from each Unit.
- Students have to answer maximum of 10 questions from each unit.
- All five units are to be answered compulsorily.