Academic Program: UG

Academic Year 2021-22 Syllabus

III & IV 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 2018-June 2022)**)**

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SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for III & IV 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 2021-22 till further revision.

Principal Chairman BoS & HoD

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 modeling 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 the 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 and responsibilities and norms of the engineering practice.

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

PO 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11.**Project Management and Finance:**Demonstrate knowledge and understanding of the engineering and knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

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

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

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

III Semester (E & E)

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration in Hrs.
18UMAC300	BS	Engineering Mathematics-III	3-0-0	3	50	100	3	-	-
18UEEC300	PC	Network Analysis	4-0-0	4	50	100	3	-	-
18UEEC301	PC	Analog Electronics	3-0-0	3	50	100	3	-	-
18UEEC302	PC	Electrical and Electronics Measurements	3-0-0	3	50	100	3	--	-
18UEEC303	PC	Digital Electronics and Verilog	4-0-0	4	50	100	3	--	-
18UEEC304	PC	Electrical Power Generation, Transmission and Distribution	4-0-0	4	50	100	3	--	-
18UEEL305	PC	Digital Electronics and Verilog Lab	0-0-3	1.5	50	--	--	50	3
18UEEL306	PC	Analog Electronics Lab	0-0-3	1.5	50	--	--	50	3
		Total	**21 - 0- 6**	**24**	**400**	**600**		**100**	

BS- Basic Science, PC- Program Core

*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

IV Semester (E & E)

Course Code	Course Category	Course Title	Teaching		Examination				
			L-T-P (Hrs/Week)	Credits	CIE	Theory (SEE)		Practical (SEE)	
					Max. Marks	*Max. Marks	Duration in Hrs.	Max. Marks	Duration In Hrs.
18UMAC400	BS	Engineering Mathematics -IV	3-0-0	3	50	100	3	-	
18UEEC400	PC	Signals and Systems	3-0-0	3	50	100	3	-	
18UEEC401	PC	Microcontrollers	4-0-0	4	50	100	3	-	
18UEEC402	PC	Electrical Machines- I (DC Machines & Transformers)	4-0-0	4	50	100	3		
18UEEC403	PC	Control Systems	4-0-0	4	50	100	3		
18UEEC404	PC	Linear ICs and Applications	3-0-0	3	50	100	3		
18UEEL405	PC	Measurement and Circuit Simulation lab	0-0-3	1.5	50	--	--	50	3
18UEEL406	PC	Microcontroller Lab	0-0-3	1.5	50	--	--	50	3
18UEEL407	PC	Introductory Project	0-0-2	1	50				
		Total	**21-0-8**	**25**	**450**	**600**		**100**	

BS- Basic Science, PC- Program Core
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks.

Total number of credits offered for the Second year: 49

III Semester

18UMAC300	Engineering Mathematics-III	(3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

To have an insight into Laplace transforms, Fourier series, Fourier transforms, Difference equations and Z-transforms. To develop the proficiency in variational calculus and solving ODE's arising in engineering applications, using numerical methods.

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)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Transform the given function using Laplace/Fourier transforms depending on the nature of engineering applications.			1
CO-2	Express periodic function as a Fourier series and obtain the various harmonics of the Fourier series expansion for the given numerical data.			1,2
CO-3	Solve difference equations using Z-transform.			1
CO-4	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.		1,2	
CO-5	Determine the extremals of functional using calculus of variations and solve problems arising in engineering.			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	POS-1	POS-2	POS-3
Mapping Level	1.2	1.3													

Pre-requisites: A basic course on differentiation and integration.

Contents:

Unit-I

Laplace Transforms: Definition and Properties. Laplace transform of elementary functions. Laplace transforms of Periodic functions and unit-step function problems. **Laplace Transforms**: Inverse Laplace transform - problems, Convolution theorem(without proof) to find the inverse Laplace transform and problems, solution of linear differential equations using Laplace transform. **08 Hrs.**

Unit-II

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions of period 2π and arbitrary period. Half- range Fourier series. Practical harmonic analysis, examples from engineering field. **08 Hrs.**

Unit-III

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Simple problems.

Z-Transforms and Difference Equations: Z-transform- definition, Standard Z-transforms, Damping and shifting rules, Initial value and Final value theorems (without proof) with problems. Inverse Z-transform. Simple problems. Difference equations-basic definition. Application of Z-transform to solve Difference equation. **08 Hrs.**

Unit-IV

Numerical Solutions of Ordinary Differential Equations (ODE's): Numerical solution of ODE's of first order and first degree-Taylor's series method, Modified Euler's method. Runge–Kutta method of fourth order, Milne's predictor and corrector method (No derivations of formulae).Problems. **07 Hrs.**

Unit-V

Numerical Solution of Second Order ODE's: Runge-Kutta method and Milne's predictor and Corrector method. (No derivations of formulae).

Calculus of Variations: Variation of function and functional, variational problems, Euler's equation (without proof), Geodesics (plane), hanging chain problems. **08 Hrs.**

Reference Books:

1) B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition (Reprint),2016.
3) Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd edition, 2016.

18UEEC300 Network Analysis (4-0-0)4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn fundamentals of energy sources and different methods like network reduction, loop current and node voltage methods to solve AC and DC Circuits. They will learn different network theorems and their application to AC and DC circuits, concepts of resonance and transient response of RL, RC and RLC series circuits. Further, they will be able to calculate rms and average values of non-sinusoidal signals and calculate power consumed by the network. They will apply Laplace Transforms to find out response of the network to different inputs. They will be introduced to coupled circuits and to two port network parameters.

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	Apply network reduction techniques, KVL, KCL and superposition, Thevenin's and Norton's theorems for the solution of electrical networks.	1	2	
CO-2	Use Maximum Power Transform& Reciprocity theorem for ac & dc circuits, and analyses resonance phenomena in electric circuits.	1	2	
CO-3	Determine initial and final values of currents/ voltages and their derivatives, carry out transient analysis of circuits excited by dc voltages.	1	2	
CO-4	Obtain the solutions for electrical network using Laplace transform technique, and also to calculate the different specifications of non-sinusoidal signals.	1	2	
CO-5	Analyze the series and parallel magnetically coupled circuits and two port networks.	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**	**POS-1**	**POS-2**	**POS-3**
Mapping Level	3.0	2.0													

Prerequisites: 1. Basic Electrical Engineering, 2. Engineering Mathematics

Contents:

Unit-I

Basic Concepts: Source transformation techniques. Mesh and Nodal analysis of DC and AC networks. Star-Delta and Delta-Star conversions**.**

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem for dc and ac networks. **11 Hrs.**

Unit-II

Maximum power transfer theorem and Reciprocity. Theorems for dc and ac networks**.**

Resonance in Electric circuits: Variation of impedance with frequency in series circuits and of admittance with frequency in parallel circuits. Calculation of resonant frequency, half power frequencies, band width and quality factor in series and parallel resonant circuits. **10 Hrs.**

Unit-III

Initial conditions: Initial conditions in R, L, C and RLC networks. Procedure for evaluating initial conditions. Calculation of initial values of current/ voltage and theirderivatives.

Transients in DC circuits: Growth and decay of current in RL circuit, charging and discharging of capacitor in RC circuits, transient response of RLC circuits. **10 Hrs.**

Unit-IV

Application of Laplace Transformation Techniques: Laplace transforms of standard signals, Laplace Transform of periodic signals, solution of differential and integro-differential equations, solution of electrical networks excited by step, pulse and other standard signals using Laplace Transformation techniques.

Non sinusoidal signals: calculation of average and rms values of non-sinusoidal signals, power calculation in networks excited by non-sinusoidal inputs**.** **11 Hrs.**

Unit-V

Coupled Circuits: Magnetic coupling, coefficient of coupling, Dot convention, Analysis of series and parallel coupled circuits.

Two Port Networks: Impedance, admittance, hybrid and ABCD parameters. Relation between parameter sets, interconnection of two port networks. Symmetrical and reciprocal networks, input and output impedances, image impedance. **10 Hrs**.

Reference Books:

1) Hayt, Kemmerley, Durbin, "Engineering Circuit Analysis", 6thEdition, TMH, 2002.
2) M. V. Vanvalkenburg, "Network Analysis", 3rd Edition, PHI/ Pearson Education, 1997.
3) A. Chakrabarti, "Circuit Theory (Analysis and Synthesis)", 5thEdition, DhanpatRai&Co.2007.
4) RoyChoudhary, "Networks and Systems", 2ndEdition, New Age International

18UEEC301	Analog Electronics	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

To develop strong basics in design concepts of wave shaping, rectifiers, amplifiers circuits. Orient the students to develop ability in problem solving, mathematical reasoning, and analyzing Electronic circuits. To train the students in designing Analog systems using transistor /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 to3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Demonstrate basic knowledge in analysis and design of rectifiers, clipping, clamping circuits using diode.	1, 2	3	
CO-2	Comprehend FET and MOSFET construction, operation and demonstrate basic knowledge in FET biasing.	1, 2		
CO-3	Analyze and design common source and common drain FET amplifiers.	1, 2,3		
CO-4	Demonstrate basic knowledge & analysis of feed-back amplifiers, Oscillators and 555 timer.	1, 2		3
CO-5	Analyze Power amplifiers.	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	2.0												

Prerequisites: Diode and Transistor fundamentals viz.forward & reverse bias, CE,CB, CC configuration of Transistor.

Contents:

Unit-I

Diode circuits: Diode as circuit element, piece-wise linear model, full wave rectifier circuit andcapacitor filters working analysis and numerical problems.

Diode wave shaping circuits: Clipping and clamping circuits (brief analysis), Introduction of Schottkey diode. **07Hrs.**

Unit-II

FET fundamentals: JFET, MOSFET constructions & their characteristics; operating point, Fixed bias, Self-bias circuits and numerical problems.

FETbiasing: Voltage divider biasing of FET and MOSFETs and numerical problems. **08 Hrs.**

Unit-III

Field Effect Transistor Circuits: FET small signal model, FET CS and CD Amplifier analysis. i.e. voltage gain and input-output impedance derivation. Lowfrequency and High frequency response FET amplifier. **10Hrs.**

Unit-IV

Feed Back Amplifiers: Feed-back Concepts, Characteristics of Feed Back amplifiers, advantages of negative feed-back, feedback amplifier, derivation of sensitivity factor, input-output impedance, Band-width of feedback amplifier.

Oscillator and timers: Principle, Phase shift Oscillators, derivation of frequency of Oscillations of Colpit's oscillator, FET oscillator; 555 timer block diagram, astableOperation and derivation of frequency of oscillations, mono-stable multi vibratoroperation, pulse width derivation. **08 Hrs.**

Unit-V

Large signal amplifiers: Classifications of amplifiers, Power amplifiers**:** Class Apower amplifier analysis viz. efficiency, Second harmonic distortion, power dissipation, numerical problems.

Power amplifiers: Class B Push-Pull operation and analysis, power dissipationderivation,numerical problems, transformer-less class B operation, Class A operation. **07Hrs.**

Reference Books:

1) Electronic Devices and Circuit theory by Boylstead and Neshlsky. 11th edition, Pearson publication.
2) Millman&Halkias, Satybritjha – Electronic Devices and Circuits, Tata McGraw Hill, 2005.
3) Electronic Circuit Analysis and Design Sudhakar Samuel - Electronics circuits,Sanguine Technical Publishers, 2005.
4) Integrated Electronics by Millman and Halkias McGraw Hill.

18UEEC302	Electrical and Electronics Measurements	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives(CLOs):

The students are expected to learn the basic measuring units of various physical parameters, bridges to measure R, L & C, and the extension of range of the instruments. They are exposed to power and energy measurements, electronic

instruments, display devices, signal generators and their applications. Further, they learn about different electrical transducers, the concept of data acquisition, construction & working of signal generators and display devices.

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	Understand the basics of units and dimensions and analyze the different measurement methods of resistance, inductance, and capacitance.	1	2	
CO-2	Understand the importance of extension of meter ranges and Illustrate the measurements of power, energy.	1	2	
CO-3	Explain the electronic instruments and measurement of non-electrical quantities.	1		2
CO-4	Describe the signal conditioning and data acquisition systems, filters and modulation techniques.	1		
CO-5	Describe the working of signal generators, recorders and display devices.	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	3.0	1.6													

Prerequisites: 1.Basic Electrical Engineering.

Contents:

Unit-I

Introduction: Units, dimensions, sensitivity, errors, accuracy in measuring instruments, Calibration and its importance.

Measurement of resistance, inductance and capacitance : Wheatstone bridge, sensitivity analysis, limitations; Kelvin's double bridge; earth resistance measurement

using Megger; Anderson bridge, Schering bridge; sources of errors, Examples.

08 Hrs.

Unit-II

Extension of instrument range: Necessity**,** Shunts and multipliers, construction and application of instrument transformers, Definitions of ratio and phase angle errors of CT and PT.

Measurement of power and energy: Dynamometer type wattmeter, construction and operation of induction type energy meter, principle of electronic energy meter and Trivector meter. **08 Hrs.**

Unit-III

Electronic Instruments: Introduction, true RMS voltmeter, electronic multi-meters, digital voltmeters, Qmeter, phase Measuring Unit.

Transducers: Classification and selection of Transducers, strain gauges, LVDT, selsyn,photovoltaic cells, and thermo-couple. **09 Hrs.**

Unit-IV

Signal conditioning and Data Acquisition: Introduction, block diagram of electronic aided measurement, dc signal conditioning system, ac signal conditioning system, generalized data acquisition system. Filters-Passive filters and active filters, Amplitude and Frequency modulation. **07 Hrs.**

Unit-V

Signal generators and display devices:AF oscillators, basic standard signal generator-sine wave, strip chart recorder, X-Y recorders, LCD and LED display, CRO– block diagram, working, dual beam and dual trace. **07 Hrs.**

Reference Books:

1) A K Sawhney, ”Electrical & Electronic Measurements & Instrumentation”,10/e, Dhanpat Rai & Sons, 2002
2) Cooper D & A D Heifrick, “Modern Electronic Instrumentation and Measuring Techniques”, PHI, 1998.David A Bell ”Electronic Instrumentation and Measurements” Oxford University press Second Edition 2014
3) H. S. Kalsi, “Electronic Instrumentation”, 2/e, TMH, 2004.
4) Golding and Widdies, “Electrical Measurements and Measuring Instruments”, 4/e, Wheelers Edition, 1999.

18UEEC303	Digital Electronics and Verilog	(4-0-0) 4

Contact Hours: 52

Course Learning Objective (CLOs):

The students are expected to learn about Boolean algebra, logic problem formulation, K-map, tabular and VEM methods for logic simplification. They learn to explain the concept and design of combinational logic circuits and analyze & synthesize the

clocked synchronous sequential circuits. Further, they are required to know programmable logic devices and features of different logic families. They are required to learn modeling of digital circuits using Verilog.

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	Recite the concepts of Boolean algebra, logic expressions, gates and use various tools to minimize logic functions.	1		
CO-2	Describe and design MSI logic circuits, (analysis & synthesis) both at gate and IC levels and recite HDL basics &Write Verilog code for simple combinational circuits.	1	3	5
CO-3	Explain the working of latches, flip flop circuits, characteristic equations along with applications and Write Verilog code for simple sequential elements.	1		5
CO-4	Describe the types of register, design asynchronous & synchronous mod-n counters, non-binary counters and write Verilog code for simple sequential circuits.	1, 3		5,12
CO-5	Demonstrate the knowledge about PLDs, Logic families and Analyze& Synthesize finite state Moore and Mealy machines.	1,3	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	2.0	2.7		1.0							1.0			

Prerequisites: Basic Electronics

Contents:

Unit-I

Boolean algebra and logic gates: Postulates, theorems and properties of Boolean Algebra, Boolean functions, normal and standard forms. Basic, Universal (derived) and special gates.

Simplification of expressions:POS and SOP simplification, Minimal sums and minimal products, Use of Boolean algebra, Karnaugh map (up to five variables), Quine McCluskey method, Prime implicant chart, Petrick's method and table reduction to determine irredundant expressions and Variable entered Karnaugh map.**12 Hrs.**

Unit-II

Combinational logic design with MSI components: Combinational circuits, analysis & synthesis procedure, binary adder, carry look ahead adder, subtractor, decimal adder, comparator, code converters, decoder, logic design using decoder and demultiplexer, encoder, priority encoder, multiplexers, logic design using MUX.Self-study: Study of ICs: 7483, 74153 & 74139. 7446/7447.

Circuit model using Verilog: Need, evolution of Verilog HDL, data types, operators, code structure, styles of modeling and code for simple combinational circuits.

12 Hrs.

Unit-III

Sequential circuits: Basic bi-stable element, latches, SR latch, switch debouncer, Gated SR and D latch, Timing considerations, JK flip-flop, Master slave JK flip-flop, Race around condition, Direct inputs, characteristic equations, Flip-Flop conversions.Verilog code for simple sequential basic elements. **08 Hrs.**

Unit-IV

Registers and counters: Bidirectional shift registers & universal registersCounters: Binary ripple counters.Synchronous counters: Design of modulo-Ncounters using JK, T, D & SR flip-flops.Register based counters: Ring counter, switch tail counter with decoding logic. Self-study: Study of IC 7493 & IC 7490.

Verilog code for simple sequential circuits. **09 Hrs.**

Unit-V

Programmable Logic Devices: Introduction, PROM, PLA, PAL and function realization using PLDs.

Logic families: Definition of Logic level, scale of Integration, propagation delay, fan-in and fan-out. TTL with totem pole output and wired logic. MOS families, CMOS inverters, NOR and NAND gates.

Introduction to synchronous sequential networks: Structure, analysis and synthesis of clocked synchronous sequential circuits, Mealy Model and Moore Model.

11 Hrs.

Reference books:

1) Donald D. Givone, "Digital Principles and Design" 1/e, TMH, 2004.
2) Morris Mano, "Digital Circuits & Logic Design", 4/e, Pearson Education 2007.
3) Malvino Leech, "Digital Circuits & Applications", 2/e, TMH, 2008.
4) Yarbrough, "Digital Logic Applications and Design", 2/e, Thomas publishing company, 1997.
5) Nazeih M.Botros, " HDL Programming VHDL and Verilog" Dreamtech Press New Delhi, Reprint 2009.

18UEEC304 Electrical Power Generation, Transmission & Distribution (4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn different energy sources for generation of electric power, the concept of load curve & plant capacity factor etc. Further, they learn about the different supports of over-head transmission line, corona effect, insulators of O.H. lines and line parameters & performance of O.H. lines. And also the students are expected to learn the importance of underground cables in distribution systems, the distribution system types and calculation of electrical quantities for concentrated 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	Explain Energy sources, Electric Energy generation and Economics of generation.	1, PSO-2		
CO-2	Explain Standard voltages for transmission; describe AC & DC transmission, Corona, string efficiency of insulators and testing of insulators.	2	1, PSO-2	
CO-3	Explain Estimation of the inductance & capacitance O.H. lines and assess performance of O.H. lines.	2		PSO-2
CO-4	Explain Cable types, materials used, grading, testing and evaluation of inter sheath	1,2		PSO-2

	potentials.			
CO-5	Explain Types of distribution systems, volume of copper used, designing of the feeder by applying Kelvin's law, Substations & Neutral Grounding.	1,2		PSO-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	2.75	3.0												1.25	

Prerequisites: 1.Basic Electrical Engineering.

Contents:

Unit-I

Generation : Sources of conventional energy sources, selection of site, classification – Hydroelectric, Thermal, Nuclear power plants - components & working, comparative study.

Factors influencing cost of energy - Demand factor, diversity factor, load factor, plant capacity factor, plant use factor, loss factor, energy load curve, load duration curve; Introduction to Load forecasting. **10 Hrs.**

Unit-II

Transmission lines: Typical transmission scheme, Standard voltages for transmission, Sag calculation in conductors, (a) Suspended on level supports (b) supports at different levels. Effect of wind, ice, tension and sag at erection. Stringing chart.

Corona: Phenomena, expression for disruptive and visual critical voltages and corona power loss.

Insulators: Types, potential distribution over a string of suspension insulators. String efficiency and methods of increasing string efficiency and testing of insulators.

12 Hrs.

Unit-III

Line parameters and Performance : Calculation of inductance of single phase and three phase lines with equilateral and unsymmetrical spacing. Inductance of composite conductor lines. Capacitance – Calculation for single phase systems and for 3 phase lines with equilateral and unsymmetrical spacing. Bundled conductors.Transposition of conductors. Performance calculation of Short, medium and long transmission lines: equivalent T and π network representation of long

transmission lines. Line regulation and efficiency, ABCD constants. Line regulation. **12 Hrs.**

Unit-IV

Underground Cables: Types, material used. Insulation resistance, thermal rating of cables, charging current. Grading of cables, capacitance grading and inter sheath grading, testing of cable, problems**.** **09 Hrs.**

Unit-V

Distribution: Introduction: Radial and ring main systems, AC & DC distribution:calculation for concentrated loads, problems. Design of feeders-Kelvin's law.

Substations and neutral grounding: Classification of substations, substation equipments, earthing in substations, power system earthing, neutral groundingtypes. **09 Hrs.**

Reference Books:

1) Soni Gupta & Bhatnagar, "A Course of Electrical Power", 4/e,Dhanpatrai and Sons, 1981.
2) C. L. Wadhwa, "Electrical Power Systems", 2/e,Wiley Eastern, 1991.
3) S. M. Singh, "Electric Power Generation Transmission and Distribution",1/e, Prentice Hall of India Ltd.
4) J. B. Gupta, "A Course in Electrical Power", 12/e, S. K. Kataria, 2002.
5) H. Partab. "Utilization of Electrical Power".

18UEEL305	Digital Electronics and Verilog Lab	(0-0-3)1.5

Contact Hours: 36

Course Learning Objectives(CLOs):

The students are expected to learn tosimplify, realize and verify logic circuits using basic, universal and special gates by conducting experiments. They learn to demonstrate the skills of implementation and verification of combinational MSI circuits both at gate level and IC level, sequential circuits for data storage, movement and conversion.To learn implementation and verification of synchronous and asynchronous sequential circuits for pattern generation/counting etc. and clock generation using timer ICs. They are required to use software tools to validate the design of circuits (Verilog).

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 knowledge of Simplifying the given expression	4		1

	and implement minimal circuits.			
CO-2	Comprehend and Realize MSI circuits like arithmetic circuits, encoders, decoders with driver/display, multiplexers, DE multiplexers, priority encoders etc.	4	2	
CO-3	Apply the techniques for data manipulation and realize latches, flip flops, shift registers both at gate and IC level and validate by using Verilog	4, 5		2
CO-4	Design and test counter circuits,generate clock of desired frequency, pulse stretcher circuits, frequency division employing timer IC 555.	4, 5		

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

Prerequisites:1.Basic electronics(preferred). 2. Digital fundamentals.

Contents:Prescribed Experiments:

Note: Minimum of 10 experiments to be conducted.

1. Simplification & realization of Boolean expressions using different gates. Simulation using Verilog.
2. Implementation of arithmetic circuits using basic/universal gates. Use 4-bit binary parallel adder IC 7483. Simulation using Verilog.
3. Implementation of Code converters: Binary to excess-3 using IC 7483, Excess-3 to Binary, Binary to Gray and Gray to Binary.
4. Realization of 2 to 4 line decoder and 4 to 2 encoder, priority encoder.
5. Realize BCD to 7-segment decoder/driver using IC 7446/7447.
6. Logic design using multiplexers and de-multiplexers using IC 74153 and IC 74139 respectively. Simulation using Verilog.
7. Implementation of flip flops using gates and study of IC 7446 and IC 7474. Simulation using Verilog.
8. Realization of 3-bit asynchronous up/down counter using IC 7476.
9. Design and implementation of mod-n (mod-6) counter using IC 7476 or IC 7474.

10. Realization of shift registers using IC 7474: SISO, SIPO, PISO and PIPO.Bidirectional shift register and universal register. Shift register based counters i.e. ring counter and twisted ring counter with decoding logic.

11. Design and Implementation of astable and monostable multi-vibrators using timer IC 555.

12. Design of two bit magnitude comparator and study of IC 7485 4-bit magnitude comparator.

Reference Books/materials:

1) Laboratory Manual
2) Donald D. Givone,"Digital Principles and design" 1/e, TMH, 2004.
3) Morris Mano,"Digital Circuits & Logic Design", 4/e, Pearson Education 2007.
4) Malvino Leech, "Digital Circuits & Applications", 2/e, TMH, 2008.
5) Yarbrough, "Digital Logic Applications and Design", 2/e, Thomas publishing company, 1997.

18UEEL306	Analog Electronics Lab	(0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives (CLOs):

The students are expected to realize Diode circuits and do analysis viz. rectifiers, wave shaping circuits**;** Design & implement CE amplifier using BJT/MOSFET, also learn to conduct experiments by designing Oscillator circuit using BJT and analyze Power amplifier.

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	Design and demonstrate the working of Diode rectifiers, clipping and clamping circuits, FET biasing circuits.	9,2	5, 6, PSO-3	
CO-2	Demonstrate the design fundamentals of Transistor and analyze MOSFET amplifiers.	9, 2	5, 3, 6	PSO-3

CO-3	Perform and analyze fundamentals of oscillator circuits and feed-back amplifier.	9	5, 1, 2	PSO-3
CO-4	Preform and analyze class-B power amplifier		9	1, 2, PSO-3

POs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	1.5	2.25	2.0		2.0	2.0			2.75						1.25

Prerequisites: 1. Basic Electronics
2. Course on Analog Electronics (Preferred)

Contents:

Prescribed Experiments: (**Note: Minimum of 10 experiments to be conducted.)**

1. Design of Rectifier (full wave) with filter
2. Stability analysis of BJT/FET
3. Clipping circuits using diodes
4. Clamping circuits using diodes.
5. Amplifier design using BJT/FET
6. R C Coupled Amp. Freq. response input & output impedance
7. Colpitt's Oscillator
8. Class B Power Amplifier.
9. RC phase-shift Oscillator
10. Summing amplifier using Op-amp.
11. Simulation of Voltage series feed-back
12. Simulation of Sub-tractor.

Reference Books/Materials:

1) Analog Electronics Laboratory manual.
2) Millman&Halkias, "Integrated Electronics", 5/e, McGraw Hill, 2005.
3) Sudhakar Samuel, "Electronics circuits", Sanguine Technical Publishers, 2005.
4) RamakantGayakwad, "Op-amp & LICs", 4th Edition, Eastern economy edition, 2004.

IV Semester

18UMAC400	Engineering Mathematics-IV	(3 - 0 - 0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

To provide an insight into applications of conformal mapping, integration of complex functions and application of probability distributions in Engineering.

Course Outcomes (COs):

Description of the Course Outcomes: 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	Construct and use the concepts of analytic function to solve the problems arising in Engineering field.			1
CO-2	Utilize conformal transformation and complex integral to transform irregular domain onto a relatively simple domain.		1	
CO-3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.		1	
CO-4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.		1,2	
CO-5	Estimate the correlation, covariance using joint probability distributions. Also use student's t-distribution,Chi-square distribution as a test of goodness of it.		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	1.8	2.0													

Pre-requisites: 1. A basic course on Differentiation and integration.
2. A basic course on probability and statistical averages.

Contents:

Unit-I

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms. Construction of analytic functions: Milne-Thomson method-Problems. **07 Hrs**.

Unit-II

Conformal transformations: Introduction. Discussion of transformations $w = e^z; w = z^2, w = z + \frac{1}{z}, z \neq 0$).Bilinear transformations- Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's Integral theorem. **08 Hrs.**

Unit-III

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression–problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form $= ax + b; y = ax^2 + bx + c; y = ax^b$. **08 Hrs**.

Unit-IV

Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions-problems (No derivation for mean and standard deviation)-Illustrative examples. **08 Hrs**.

Unit-V

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation and covariance.

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness off it. **08 Hrs**.

Reference Books:

1) E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons 10th edition (Reprint) 2016.
2) 2.B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
3) 3.Srimanta Pal et al: Engineering Mathematics, Oxford University Press, 3rd edition, 2016.

18UEEC400	Signals and Systems	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

Thestudents are expected to Learn and understand various types of signals and systems and their properties. They are also be aware of carrying out analysis and synthesis of signals using various transforms and to find system output using system impulse response and system equations.

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	Define signals and systems with its properties. Classify signals and check the periodicity, even and odd nature of the signal.	1, 2,		
CO-2	Represent LTI systems in time-domain using impulse response, differential/difference and block diagram approach.	1, 2		
CO-3	Represent periodic signal using Fourier series representation in both continuous and discrete time domain.	1, 2		5
CO-4	Represent non periodic signal using Fourier transform representation and illustrate applications	1, 2		5
CO-5	Solve Z-transform and IZT using different methods.	1, 2		

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

Prerequisites: 1. Engg. Mathematics.
2. Network Analysis.

Contents:

Unit-I

Introduction: Definition of a signal and a system, classification of signals, basic operations on signals, elementary signals and systems viewed as interconnections of operations, properties of systems. **08 Hrs.**

Unit-II

Time-domain representation for LTI systems: Convolution, impulse response representation, properties of impulse response representation, differential and difference equation representations. Block diagram representations. **08Hrs.**

Unit-III

Fourier Series Representation of signal: Introduction, Fourier representations of periodic signal, Properties of Fourier series, Applications of Fourier series representation. **07 Hrs**.

Unit-IV

Fourier Transform Representation of signal: Introduction,Fourierpresentations of non-periodic signal, Properties of Fourier transform, Applications of Fourier transform representation. **07 Hrs.**

Unit-V

Z-Transforms: Introduction, Z-transforms, properties of ROC, properties of Z-transforms, inversion of Z-transforms, transforms analysis of LTI systems, transfer function, stability and causality, unilateral Z-transform and its application to solve difference equations. **09 Hrs.**

Reference Books:

1) Simon Haykin and Barry Van Veen, “Signals and Systems”, 2nd edition, John Wiley & sons, 2005.
2) Michel J Roberts, “Signals and systems: Analysis of signals through linear systems”, 2/e, Tata McGraw Hill, 2003.
3) Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”, 2nd edition, Pearson Education Asia, 1997.
4) Ganeshrao&Tunga, ”Signals & Systems”, 2004.
5) Uday Kumar S. “Signals & Systems” 6th Edition, Prism Publication, 2017.

18UEEC401	Microcontrollers	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

To understand the basic differences between microcontrollers and microprocessors and microcontroller architecture. To understand the different addressing modes and instruction set Assembly. Programs associated with 8051 Microcontroller. To write and test assembly and C language programs with a tradeoff between size and

complexity using development tools. To understand the concepts of timers, interrupts, serial communication and memory interfacing to design an embedded system and to implement real time applications.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to PO's(1 to 12)/PSO's(1 to 3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the basics of microprocessor & microcontrollers and write assembly programs for 8051.	1, 2		
CO-2	Write Assembly and C programs for 8051.	1, 2	5	
CO-3	Apply programming techniques for timers and serial communication.	1,2	3,5	
CO-4	Apply concepts of interfacing to implement controllers for applications using interrupts, memoryand data converters.	1,2,3	5	PSO 3
CO-5	Apply concepts of interfacing to implement controllers for applications using keyboard, display device, motors; Learn basic architecture of Advance microcontroller MSP 830.	3	2, 5	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	2.6	2.8	2.5		2.0										1.0

Prerequisites: 1. Logic design.2. C programming language

Contents:

Unit-I

Microprocessors and Microcontrollers: Microcontrollers and Embedded Processors. RISC & CISC Architectures, Harvard & Von-Neumann CPU architecture.
The 8051 Architecture and Instruction set of 8051: Instruction set, Addressing modes, I/Oport programming, **10Hrs.**

Unit-II

Assembly Language Programming: Assembly programming examples:addition subtraction, smallest and biggest no finding, palindrome, data serialization, code conversion, checksum byte program.

8051 programming in C: Data types and time delays in 8051, I/O programming, logic operation, data conversion programs, accessing code ROM space, data serialization. **12Hrs.**

Unit-III

Timer and Counter Programming of 8051 in Assembly and C: Programming 8051 Timers and counters in mode 1 and mode 2

Serial Communication and Programming of 8051 in Assembly and C: Basics of Serial Communication, 8051 connections to RS 232, DB 9 Pin Connector, 8051 Serial Communication Programming. **11Hrs.**

Unit-IV

8051 Interrupts, Programing in Assembly and C: Response of 8051 to interrupts, Interrupt types, Programing Timers, serial, external Hardware interruptsand Interrupt priority.

8051 Interfacing and Applications: Memory interfacing, 8255 interfacing, ADC and LM34/35 interfacing, DAC. **11Hrs.**

Unit-V

Display, Keyboard and Motor Interfacing to 8051: Interfacing 8051 to LCD,Keyboard, Stepper motor and DC motor Interfacing.

Introduction to Advanced Micro-controller: Architecture of MSP 430 Micro-controller, outline of its features. **08Hrs.**

Reference Books:

1) Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rolling D. Mekinlay - The 8051 Microcontroller and Embedded Systems-using assembly and C, Pearson, 2006.
2) Kenneth J. Ayala - The 8051 Microcontroller Architecture, Programming &Applications, 2nd edition, Thomson Learning, 2005.
3) Microcontroller and Applications by Dr. RamaniKalpathi and Ganesh Raja SanguinePublication
4) Raj Kamal - Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson, 2005.

18UEEC402 Electrical Machines-I (DC Machines & Transformers) (4-0-0)4

Contact Hours: 52

Course Learning Objectives (CLOs):

The students are expected to learn the basic principle, construction, characteristics and operating modes of dc machines, the performance analysis and applications of

dc machines. They also learn the basic principle, construction, characteristics and operating modes, the performance analysis and applications of single and three phase transformers. They are also exposed to the basic concepts, construction and characteristics of special electrical machines.

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	ExplainElectromechanical Energy Conversion, the construction and working, e.m.f equation, armature reaction, draw the characteristics, numerical related to DC Generator	1, 2		
CO-2	Explain Principle, types, characteristics, necessity of Starter, speed control, testing &applications of DC motors.	1, 2		
CO-3	Explain Construction, operation, e.m.f equation, phasor diagram, determination of voltage regulation, all day efficiency & equivalent circuit of single phase transformer, Parallel operation,	1, 2		
CO-4	Comprehend the Single phase auto transformers:Principle,construction, determination of saving in copper, Construction, Types of connections, Magnetization characteristics and harmonics in three phase transformers and applications in transmission section.	1, 2		
CO-5	Explain the Construction, working, Drawing the characteristics ofdc servomotor, PMDC motor and universal motor	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	3.0	3.0													

Prerequisites: Basic Electrical Engineering

Contents:

Unit-I

Principle of Electromechanical Energy Conversion: Energy in magnetic system, field energy and mechanical force, mechanical energy. Doubly excited magnetic field systems. Forces/ Torques in systems with permanent magnets. Dynamical equations of electro mechanical systems.

DC Generators: Construction, emf equation, armature reaction, calculation of demagnetizing and cross magnetizing AT/pole. Compensating winding, commutation and inter poles, Characteristics and applications of different types of dc generators. **12Hrs.**

Unit-II

DC Motors:Principle, types, characteristics and applications of dc motors. Starters for dc shunt motors, speed control and braking of dc motors. Losses, efficiency and testing of dc machines (Swinburne's test, Hopkinson's test and retardation tests). Field test on dc series machines. **11Hrs.**

Unit-III

Single Phase Transformers: Construction of core and shell type transformers. Operation on no load and on load. Phasor diagrams. O.C., S.C and Sumpner's tests. Losses, efficiency and voltage regulation. Equivalent circuit and predetermination of performance. All day efficiency. Parallel operation and load sharing. **11Hrs.**

Unit-IV

Three Phase Transformer: Construction, star-star, star-delta, delta-star and delta-delta transformers, Scott connection and open delta connections. Magnetization characteristics and harmonics. Parallel operation, three winding transformers.

Auto Transformer: Single phase auto transformers: Principle, construction, saving in copper. Threephase auto transformers and applications. **09Hrs.**

Unit-V

Miscellaneous topics: Pulse transformer, Welding Transformer, Servo motors, PMDC motor, BLDC Motor, Stepper Motor, Universal motor. **09Hrs.**

Reference Books:

1) D.P.Kothari and I.J.Nagrath,"Electric Machines", TMH 4th Edition 2011
2) M.G.Say, "Performance and design of AC machines", 3/e, CBS Publications, 2002.
3) AshfaqHussain, "Electric Machines", 2/e, DhanpatRai& Co, 2005.
4) Mulukutla S. Sarma&Mukesh K. Pathak, "Electric Machines", 4th Indian Reprint 2011, Cengage Learning India Pvt. Ltd.

18UEEC403 Control Systems (4-0-0) 4

Contact Hours: 52

Course Learning Objectives(CLOs):

The students are expected to learn the definition of control system, open loop and closed loop system, electromechanical systems, differential equations of physical systems and mathematical modeling. They will learn to formulate, solve and analyze control engineering problems. Further, they learn to check the stability of control systems using different techniques and also write simple MATLAB programs for the same.

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	Distingush between open loop and closed loop systems, write the mathematical representation of electromechanical systems and reduction of block diagrams, demonstrate the transfer function of ac and dc servomotors	1,2	PSO 2	
CO-2	Develop the knowledge of signal flow graphs,Mason's gain formula and illustrate the time domain specifications.	1,2		4, PSO 2
CO-3	Examine the stability using Routh Hurwitz's criterion and introduction to types of controllers.	1,2		4
CO-4	Illustrate the stability analysis using root locus and get introduced to MATLABprogramming	1,2		4, 5 PSO 2
CO-5	Predict the stability analysis of frequency domain using Bode and Nyquist plots	1,2		PSO 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		1.0	1.0									1.25	

Prerequisites: 1. Basic Electrical engineering.
2. Engineering Mathematics.

Contents:

Unit-I

Introduction: Definition of control systems, open loop and closed loop system comparison with examples. Electromechanical systems.Differential equations of physical systems.

Block diagram and reduction of block diagrams: Transfer function, Block diagram representation and reduction, Transfer functions of control components dc servomotor, two- phase AC servomotor. **11 Hrs**.

Unit-II

Signal flow graphs and reduction of signal flow graphs: signal flow graph representation and reduction using Mason's Gain formula.

Time response: feedback control system, standard test signals, unit step response of first and second order systems, examples, static error analysis, examples. **11 Hrs.**

Unit-III

Stability: Concept of stability, Relative stability analysis, stability for a second order system, Routh-Hurwitz stability criterion, examples, Introduction to P, PI and PID controllers. **09 Hrs.**

Unit-IV

Root locus: Concept, steps to solve the problems with root locus, advantages of root locus, examples on determination of gain constant and damping ratio.

Introduction to MATLAB: Obtaining transient response, Root locus, Bode plot using MATLAB, Exercises. Introduction to SIMULINK, P, PI & PID controllers using SIMULINK **11 Hrs.**

Unit-V

Frequency domain Analysis: Stability analysis, Bode plot and to obtain phase margin and gain margin of third order system, examples. **10 Hrs.**

Reference Books:

1) I. J. Nagrath and M. Gopal, "Control Systems Engineering", 3/e, Wiley Eastern Ltd, 2003.
2) K. Ogata, "Modern Control Engineering", 4/e, PHI, 2004.
3) B. C. Kuo, "Automatic control systems", 7/e, PHI.2000.
4) Gopal M., "Control System - Principles & Design", 4/e,TMH, 1984.
5) http://www.nptelvideos.in/2012/11/control-engineeringprof-gopal.html

18UEEC404 Linear ICs and Applications (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	Comprehend the fundamentals of MOS based Opamp circuits.	1		
CO-3	Apply the knowledge of basic Opamps in the linear circuit design.	2,3	PSO 3	
CO-4	Apply the knowledge of basic Opamps in the non-linear circuit design.	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. **Frequency response:** Requirement of circuit stability, Barrack Hussein's

criteria,Frequency compensation methods, Circuit bandwidth, Effects of slew rate andstray capacitance, Circuit stability precautions. **08 Hrs.**

Unit-II

CMOS Opamps: Comparison of BJT and MOS based Opamps. Basic CMOS Opamps. MOS differential amplifier, Single ended and differential amplifier, Quantitative and qualitative analysis (Only elementary treatment), Basic current mirrorcircuits,Cascode current mirror circuits. **07 Hrs.**

Unit-III

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. **08 Hrs.**

Unit-IV

Design & Applications of Opamp Nonlinear Circuits: Comparators, Schmitt trigger, Square wave generators, Monostable multivibrators, Oscillators-Triangular wave generator, RC phase shift oscillator, Wein bridge 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, IC 723 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) BehzadRazavi, “Design of analog CMOS Integrated circuit “, Tata McGraw-Hill Education, 01-Oct-2002

18UEEL405	Measurement and Circuit Simulation lab	(0-0-3) 1.5

Contact Hours: 36

Course learning Objectives (CLOs):

The students are expected to learn conducting experiments to determine the resistance, inductance and capacitance of given specimen by using suitable bridges. The students learn to measure power in three phase circuit and to draw calibration

curve of energy meter. They will also study to obtain transfer functions of ac, dc motors and learn to write simple MATLAB programs to solve control system 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	Demonstrate the fundamental skills of determining the values of circuit elements using bridges.		2, PSO 2	
CO-2	To measure power in three phase circuit and to draw the calibration curve of energy meter.		2, PSO 2	
CO-3	Demonstrate the knowledge of obtaining the transfer function of servomotors and write MATLAB program to steady state response		2,PSO 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		2.0												2.0	

Prerequisites: 1. Basic Electrical Engineering.
2. Electrical and Electronics Measurements.

Contents:

Prescribed Experiments:

(**Note:** Minimum of 10 experiments is to be conducted.)

1. Measurement of resistance using Wheatstone Bridge
2. Measurement of resistance using Kelvin's Double Bridge.
3. Measurement of inductance using Anderson Bridge.
4. Measurement of capacitance by Schering Bridge.
5. Measurement of three phase power using two-wattmeter method.
6. To draw the calibration curve of single phase energy meter.
7. Transient response of second order system and determination of transient response specifications analytically and obtaining from experiment.
8. Verification of network theorems i) Maximum power transfer theorem ii) Superposition theorem
9. Verification of network theorems i) Thevinin's theorem ii) Reciprocity theorem

10. Transient response of RL,RC and RLC circuits.
11. Study of series resonance
12. Study of digital energy meter.

Reference Books:

1) Measurements and control systems Laboratory Manual.
2) A. K.Sawhney, "Electrical & Electronic Measurements & Instrumentation", 10th edition, DhanpatRai& Sons, 2002.
3) Cooper D & A D Heifrick, "Modern Electronic Instrumentation and Measuring Techniques", PHI, 1998.
4) I. J. Nagrath and M. Gopal, "Control Systems Engineering" 3/e, Wiley Eastern Ltd, 2003.7.K. Ogata, "Modern Control Engineering", 4/e, PHI, 2004.

18UEEL406	Microcontroller Lab	(0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives(CLOs):

The students are expected to learn fundamentals of Assembly Language Programming, acquire logical skills for developing / implementing given problem, acquire Programming skills in embedded 'C' andunderstand and get the knowledge, about interfacing I / O s, mixed signal circuits and actuators.

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 fundamentals of assembly language and C programming skills.	9, 5	1, PSO 3	2
CO-2	Demonstrate on chip timer counters for counting, serial communication and generating waveforms.	9, 5	1, 2	3
CO-3	Demonstrate the interfacing of DAC and external ADC.	9, 5, PSO 3	1	3, 6
CO-4	Demonstrate the interfacing stepper motor and. LCD	9, 5, PSO 3	1	3, 6

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	1.5	1.0		3.0	1.0			3.0						2.67

Prerequisites: Course on microcontrollers.

Contents:

Prescribed Experiments:**(Note: Minimum of 10 experiments to be conducted)**

I. PROGRAMMING:

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations)
5. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX
6. Programs using serial port and on-chip timer /counter.
   i. Program on serial communication.
   ii. Program on timer (on chip). Waveform generation using on chip timer of 8051on the ports of 8051.

II. INTERFACING:

C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.

1. Alphanumeric LCD panel and Hex keypad input interface.
2. External ADC and Temperature control interface.
3. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface; change the frequency and amplitude.
4. Stepper and DC motor control interface.Generate waveform of a particular frequency using on-chip timer.

Reference Books / Materials:

1) 1.Microcontroller Laboratory Manual**.**

2) 2. Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rolling D. Mekinlay, "The 8051 Microcontroller and Embedded Systems-using assembly and C:1/e, Pearson,2006.

3) 3.Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming & Applications", 2/e, Thomson Learning, 2005.

4) Predko, "Programming and Customizing the 8051 Microcontroller", 1/e, TMH,2004.

18UEEL407	Introductory Project	(0-0-2) 1

Contact Hours: 24

Course Learning Objectives (CLOs):

The course is to provide an exposure to the students to identify simple societal problems and propose a technical solution. They are also required to learn to find related material, use appropriate tool to obtain the solution and prepare a report based on the work carried out.

Course Outcomes (COs):

Description of the Outcome: Upon completion 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 a socially/ technically relevant problem and formulate a problem statement		6	1
CO-2	Propose thetechnical approach towards the solution.		6	
CO-3	Implementthe solution.		6	3
CO-4	Prepare the report in a specified format.		10	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	1.0		1.0		3.0	2.0				2.0	1.0				

Contents:

Introductory project is introduced with an objective of understanding and identifying the community expectation in terms of possible Engineering solutions by applying the fundamental knowledge of basic sciences and basic engineering courses. The project shall be engineering oriented in terms of problem definition, related literature survey and existing solutions.

Evaluation:

The team consisting of 10-12 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 shall guide the students. A committee consisting of minimum 3 faculty members shall evaluate at the end for CIE. There is no SEE for introductory project.