Academic Program: UG

Academic Year 2019-20

Syllabus

III & IV Semester B.E.

Electronics & Communication Engineering

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,
DHARWAD – 580 002
(An Autonomous Institution recognized by AICTE & Affiliated to VTU, Belagavi)

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

SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for III & IV semester of UG program in Electronics and Communication Engineering is recommended by Board of Studies of Electronics and Communication 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 2019-20 till further revision.

Chairman BOS & HOD Principal

SDM College of Engineering & Technology, Dharwad-02
Department of Electronics & Communication Engineering

College – Vision and Mission

VISION:

To develop competent professionals with human values

MISSION:

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

SDMCET- Quality Policy

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

SDMCET- Core Values

- Competency
- Commitment
- Equity
- Team work and
- Trust

Department - Vision and Mission

VISION:

Fostering excellence in the field of Electronics & Communication Engineering, showcasing innovation, research and performance with continuous Industry – Institute Interaction with the blend of Human values.

MISSION:

M1: To provide quality education in the domain of Electronics & Communication Engineering through state of the art curriculum, **effective teaching learning** process and the best of laboratory facilities.

M2: To encourage **innovation**, **research** culture and **team work** among students.

M3: **Interact and work** closely with **industries** and **research organizations** to accomplish knowledge at par.

M4: To train the students for attaining **leadership with ethical values** in developing and applying technology for the **betterment of society** and sustaining the global environment.

Programme Educational Objectives (PEOs):

PEOs are broad statements that describe career and professional accomplishments that the program is preparing the graduates to accomplish after few years of graduation. The PEOs are defined based on core competence, breadth of engineering knowledge, professionalism, learning environment.

The graduates, after few years of graduation will be able to:

I. **Apply** the latest in-depth knowledge in the field of Electronics and Communication Engineering with Mathematical applications to address real life challenges.

II. **Exhibit** the confidence for independent working and / or spirit to work cohesively with group.

III. Readily be **accepted** by the Industry **globally**.

IV. **Develop** design skills, fault diagnosis skills, communication skills and create research orientation.

V. **Inculcate** professional, social ethics and to possess awareness regarding societal responsibility, moral and safety related issues.

Programme Outcomes (POs):

Engineering Graduates will be able to:

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

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and

the consequent responsibilities relevant to the professional engineering practice.

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

13. Design economically and technically sound analog and / or digital systems based on the principles of signal processing, VLSI and communication Engineering (PO-13)

14. Integrate hardware – software, and apply programming practices to realize the solutions in electronics domain. (PO-14)

Design and Scheme of Curricula
Credits break up and distribution

III Semester ECE

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	Engg. Mathematics-III	3 - 0 - 0	3	50	100	3	-	-
18UECC300	PC	Electromagnetic Theory	3 - 2 - 0	4	50	100	3	-	-
18UECC301	PC	Digital Circuit Design	3 - 0 - 0	3	50	100	3	-	-
18UECC302	PC	Network Analysis	3 - 2 - 0	4	50	100	3	-	-
18UECC303	PC	Analog Electronic Devices and Circuits	4 - 0 - 0	4	50	100	3	--	--
18UECC304	PC	Signals & Systems	3 - 0 - 0	3	50	100	3	--	--
18UECL305	PC	Analog Electronic Devices and Circuits Laboratory	0 - 0 - 3	1.5	50	--	--	50	3
18UECL306	PC	Digital Circuit Design Laboratory	0-0 -3	1.5	50	--	--	50	3
	Total		**19- 4-6**	**24**	**400**	**600**		**100**	

BS- Basic Science, PC- Program Core
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks

Design and Scheme of Curricula
Credits break up and distribution

IV Semester ECE

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	Engg. Mathematics-IV	3 - 0 - 0	3	50	100	3	-	-
18UECC400	PC	Communication Systems - I	4 - 0 - 0	4	50	100	3	-	-
18UECC401	PC	Control Systems	3 - 2 - 0	4	50	100	3	-	-
18UECC402	PC	Microcontroller	3 - 2 - 0	4	50	100	3	-	-
18UECC403	PC	HDL Programming Using Verilog	3 - 0 - 0	3	50	100	3	--	--
18UECC404	PC	Linear ICs and Applications	3 - 0 - 0	3	50	100	3	--	--
18UECL405	PC	HDL Programming Laboratory	0 - 0 - 3	1.5	50	--	--	50	3
18UECL406	PC	Linear Integrated Circuits Laboratory	0 - 0 -3	1.5	50	--	--	50	3
18UECL407	PC	Introductory Project	0-0-2	1	50	--	--	--	--
	Total		**19 - 4 -8**	**25**	**450**	**600**		**100**	

BS- Basic Science, PC- Program Core

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination
L: Lecture **T**: Tutorials **P**: Practical
*SEE for theory courses is conducted for 100 marks and reduced to 50 marks

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

Contact Hours:39

Course Learning Objectives(CLOs):

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

Course Outcomes(COs):

Description of the Outcome: Upon completion of the course, the student will be able to		**Mapping to POs (1-12) / PSOs(13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	Transform the given function using Laplace /Fourier transforms depending on the nature of engineering applications.		13	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.		13	1,2
CO-3	Solve difference equations using Z-transform.		13	1
CO-4	Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.		1,2,13	
CO-5	Determine the extremals of functional using calculus of variations and solve problems arising in engineering.			1,2

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.2	1.3	-	-	-	-	-	-	-	-	-	-	2	-

Course Contents:

1	**Laplace Transforms:** Definition and Properties. Laplace transform of elementary functions. Laplace transforms of Periodic functions and unit-step function – problems. **Inverse 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.**
2	**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.**
3	**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.**
4	**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.**
5	**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.**

Activity Beyond syllabus:

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)
3. http://academicearth.org/
4. VTU EDUSAT PROGRAMME - 20

Text Books:

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

Reference books:

1. C. Ray Wylie, Louis C. Barrett : “Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
2. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 4th Edition 2010.
3. B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. N. P. Bali and Manish Goyal : A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2014.
4. Veerarajan T., “Engineering Mathematics for First year”, Tata McGraw-Hill, 2008.
5. Thomas G.B. and Finney R.L.”Calculus and Analytical Geometry” 9th Edition, Pearson, 2012.

18UECC300	Electromagnetic Theory	(3-2-0) 4

Contact Hours:52

Course Learning Objectives(CLOs):

The course focuses on the theory and applications of electromagnetic waves. The course concentrates on the study, interpretation and applications of Coulomb's Laws, Maxwell's equations, Gauss's Law, Poisson's and Laplace's equations in the propagation of electromagnetic waves in free space, conductors and dielectrics.

Course Outcomes(COs):

Description of the Outcome: Upon completion of the course, the student will be able to		**Mapping to POs (1-12) / PSOs(13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	**Differentiate** between scalar and vector quantities and solve problems in various co-ordinate systems.	1	-	2,13
CO-2	**Apply** the concepts of vectors to analyze Coulomb's Law, Gauss's Law, Divergence and Curl.	-	1,2	13
CO-3	**Define** energy and potential and analyze the properties of current flow through conductors and dielectrics using Poisson's and Laplace's equations.	2	1	3,13
CO-4	**Discuss** the concepts and laws governing the steady state electro-magnetic fields.	-	1	2,13
CO-5	**Represent** the wave propagation with the help of Maxwell's equations.	1,2	-	4,13
CO-6	**Co-relate** the concepts and laws governing the time-varying electro-magnetic fields with the real time applications of wave theory.	-	1	2,13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.3	1.8	1	1	-	-	-	-	-	-	-	-	1	-

Pre-requisites:

1. Basics of Electronics and Electrical Engineering.
2. Integration, Differentiation and Vector algebra.

Course Contents:

1. **Vector Analysis**: Vector Algebra, Rectangular Coordinate system, Vector Field, Dot Product and Cross-Product of vectors, Cylindrical and Spherical coordinate systems. **4 Hrs.**
2. **a. Coulomb's law and Electric field intensity:** Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge, line charge and sheet charge distribution. **5L+1T Hrs.**

   b. Electric flux density, Gauss' law and Divergence: Electric flux density, Gauss' law, Applications of Gauss' law, Divergence and Divergence theorem. **5L+1T Hrs.**
3. **Energy and potential :** Energy expended in moving a point charge in an electric field, Line integral, Definition of potential difference and Potential, Potential field of a point charge and system of charges, conservative property, Potential gradient, Energy density in an electrostatic field. **5L+1T Hrs.**
4. **Conductors, Dielectrics and Capacitance**: Current and current density, Continuity of current, metallic conductors, Conductor properties and boundary conditions, Boundary conditions for perfect dielectric, capacitance and examples. **6L+2T Hrs.**
5. **Poisson's and Laplace's equations**: Derivation of Poisson's and Laplace's equation, Uniqueness theorem, Examples of solutions of Laplace's and Poisson's equations. **4 Hrs.**

6. **The steady magnetic field:** Biot-Savart law, Ampere's circuital law, Curl and the Stokes Theorem, magnetic flux and flux density, Scalar and vector magnetic potentials, Force on a moving charge and differential current element, Force between differential current elements, Magnetic boundary conditions. **10L+2T Hrs.**

7. **Time varying fields and Maxwell's equations**: Faraday's law, displacement current, Maxwell's equation in point and integral form, retarded potentials. **5L+1T Hrs.**

Activity Beyond Syllabus:
Video sessions on wave propagation concepts.

Reference Books:

1. Hayt & Buck, "Engineering Electromagnetics",Tata McGraw-Hill, 7/e or 6/e, 2001.
2. Hayt, "Engineering Electromagnetics" - TataMcGraw- Hill, 5/e,1989.
3. Kraus & Fleisch, "Electromagnetics with Applications"- McGraw Hill, 5/e, 1999.
4. Edminister, "Electromagnetics", Schaum Outline Series, - McGraw Hill, 2/e, 2006.

18UECC301 Digital Circuit Design (3-0-0) 3

Contact Hours:39

Course Learning Objectives (CLOs):

The course focuses on various optimization techniques applied to combinational and sequential digital design. The course also focuses on building digital circuits using finite state machine and characteristics of logic families.

Course outcomes(COs):

Description of the Outcome – Upon completion of the course, the student will be able to		**Mapping to POs (1-12) / PSOs (13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	**Identify** simplification techniques, **formulate** the methodology to design and implement digital circuits.	-	2,3	1

CO-2	**Formulate** a methodology to design digital computational blocks using MSI components.	3	2,13	-
CO-3	**Design** and **Implement** Sequential logic circuits using Flip Flops.	3	2,13	-
CO-4	**Design** and **Analyze** Synchronous sequential circuits to obtain state diagram.	13	3	2
CO-5	**Analyze** and **compare** different Logic families.	-	-	2,3
CO-6	**Implement** Boolean functions on the PLDs.	-	13	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1	1.6	2.2	-	-	-	-	-	-	-	-	-	2.25	-

Pre-requisites:

Knowledge of Number system, Basics of logic gates, Boolean Algebra.

Course Contents:

1. **Simplification of Boolean Expressions:** Canonical forms, Prime Implicants and Irredundant Disjunctive Expressions, Prime Implicates and Irredundant Conjunctive Expressions, Karnaugh Maps, Quine-McClusky , Map entered Karnaugh Maps techniques. **10 Hrs.**
2. **Logic Design with MSI Components:** Binary adders and subtractors, Decimal adders, Multipliers, Comparators, Encoders, Decoders, Multiplexers, De-multiplexers, Design of combinational circuits using decoders and multiplexers. **10 Hrs.**
3. **Flip–Flops and Applications**: Latches, S-R flip flop, J-K flip flop, D and T Flip flop, Master-Slave Flip-Flops, Edge triggered Flip-Flops, Registers, Counters: Asynchronous counters, Design of Synchronous **10 Hrs.**

Counters: MOD counters, Up/Down counters, Self Correcting Counters.

4. **Synchronous Sequential Networks:** Structure, Operation Analysis and Modeling of Clocked Synchronous Sequential Networks, State table Reduction and State Assignment. **05 Hrs.**
5. **Programmable Logic Devices and Logic Families:** Introduction to PLD's: PAL, PLA, ROM, PROM, EPROM**,** TTL and CMOS logic. **04 Hrs.**

Activity beyond syllabus :

1. Design and simulation of digital circuits using tools such as Labview, Multisim, TINA Software
2. Design of "Digital Clock", A theme based project.

Reference Books:

1. Donald D Givone, "Digital Principles and Design", Tata McGraw Hill Edition, 2003.
2. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2001.
3. Charles H Roth, Jr; "Fundamentals of logic design", Thomson Learning, 2004.
4. Mono and Kim, "Logic and computer design Fundamentals", Pearson, 2/e, 2001.

18UECC302	**Network Analysis**	**(3-2-0) 4**

Contact Hours: 52

Course Learning Objectives (CLOs):

The course focuses on mesh and nodal techniques, network theorems and topology, responses of RLC network, various analysis techniques for AC analysis and two port networks.

Course Outcomes (COs):

Description of the Outcome: Upon completion of the course, the student will be able to	**Mapping to POs (1-12) / PSOs (13,14)**		
	Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**

CO-1	**Determine** currents and voltages using mesh/ nodal analysis	-	2	1
CO-2	**Solve** network problems by applying various network theorems to reduce circuit complexities	2	5	1
CO3	**Solve** for currents and voltages using the concept of network equilibrium equations	-	2	1
CO-4	**Calculate** current and voltages for the given circuit under transient conditions	2	1	-
CO-5	**Apply** various analysis and simplification techniques for AC networks	2	1	13
CO-6	**Determine** various parameters of two port networks	2,3	1,13	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.57	2.7	3	-	2	-	-	-	-	-	-	-	1.5	-

Pre-requisites:
Engineering Mathematics

Course Contents:

1. **Basic Nodal and Mesh Analysis**: Node analysis, Supernode, Mesh Analysis, Supermesh, Nodal Vs Mesh analysis **5L+1T Hrs.**
2. **Network Theorems:** Linearity, Superposition, Source Transformations, Thevenin and Norton equivalent circuits, **6L+2T Hrs.**

Maximum power transfer, Millman's, Reciprocity, Tellegens', Delta-Wye and Wye-Delta conversions

3. **Network Topology:** Graph of a network, Concept of tree and co-tree, Incidence matrix, Tie-set and cut-set schedules. Branch voltage and current equations. Examples on network equilibrium equations **5L+1T Hrs.**
4. **Basic RL, RC and RLC circuits** : Source-free RL circuit, Properties of exponential response, Source-free RC circuit, General perspective, Unit-step function, Driven RL circuits, Natural and forced response, Driven RC circuits, Source-free parallel circuits, Source-free series RLC circuits, Complete response of RLC circuit **10L+2T Hrs.**
5. **Circuit analysis in frequency domain** : Sinusoidal response, Passive circuit elements in frequency domain, Kirchhoff's laws in frequency domain, Series, Parallel and delta-to-Y simplifications, Source transformations & Thevenin-Norton equivalent circuits, Node-voltage method, Mesh-current method**.** Review of Laplace transforms, Nodal and mesh analysis in s-domain **6L+2T Hrs.**
6. **Frequency Response**: Series resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity, Parallel resonance: Resonant frequency and admittance variation with frequency, Bandwidth and selectivity **06 Hrs.**
7. **Two-Port Networks**: Admittance parameters, Impedance parameters, Hybrid parameters, Transmission parameters**,** Interrelationship between parameters **06 Hrs.**

Activity beyond Syllabus:

Register for NPTEL (Electrical circuits) course and solve the assignments.

Reference Books:

1. William H Hayt. Jr., Jack E Kemmerly, Steven M Durbin, “Engineering Circuit Analysis”, Sixth Edition, Tata-McGraw Hill, 2006.
2. Roy Choudhury, “Networks and Systems”, Second Edition, New age International Publications, 2010.
3. James W. Nilsson, Susan A. Riedel, “Electric Circuits”, Eighth Edition, Pearson Edu. 2008.
4. John D Ryder, “Networks, Lines and Fields”, Second Edition, Prentice-Hall of India, 2005.

18UECC303 Analog Electronic Devices and Circuits (4- 0- 0) 4

Contact Hours: 52

Course Learning Objectives (CLOs):

The course focuses on the understanding of electrical characteristics, working and applications of analog electronic devices and the design/analysis of various analog electronic circuits.

Course outcomes (COs):

Description of the Outcome - Upon completion of the course, the student will be able to		**Mapping to POs (1-12) / PSOs (13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level1 Slight**
CO-1	**Design** and **analyze** various wave shaping circuits using Diodes.	1,2	3	-
CO-2	**Explain** the working, electrical characteristics and biasing techniques related to FET.	-	1,2	13
CO-3	**Perform** small signal analysis of FET.	1,2	4	-
CO-4	**Explain** the working of different analog electronic devices and their applications.	-	1,3,4	-

CO-5	**Analyze** the various characteristics of feedback mechanism in amplifiers and oscillators.	1,2,3	-	4,5
CO-6	**Analyze** the different types of power amplifiers.	1,2,3	-	4,5

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Levels	2.66	2.8	2.5	1.5	1	-	-	-	-	-	-	-	1.0	-

Pre-requisites:
Basic Electronics

Course Contents:

1. **Wave Shaping Circuits using Diodes:** Clippers, Clampers **06 Hrs.**
2. **Field-Effect Transistors:** Introduction, construction and characteristics of JFET, transfer characteristics, working of depletion type MOSFET and enhancement type MOSFET, Introduction to CMOS. FET biasing: Fixed bias, self bias, voltage divider bias, biasing in Depletion type MOSFETs and Enhancement type MOSFETs. **10 Hrs.**
3. **Small signal analysis of FET:** Introduction, JFET small signal model, JFET fixed bias configuration, JFET self bias configuration, JFET voltage divider bias configuration, JFET source follower configuration, small signal models of depletion type MOSFETs and enhancement type MOSFETs, Low frequency response of FET Amplifiers. **10 Hrs.**
4. **Feedback amplifiers and oscillator circuits**: Feedback concept, feedback connection types, oscillator operation, FET phase-shift oscillator, Wein Bridge oscillator, Tuned oscillator circuits: FET **10 Hrs.**

Colpitts oscillator, FET Hartley oscillator, Crystal oscillator.

5. **Electronics Devices:** Light emitting diode (LED), Liquid crystal displays (LCD), Photo conductive cell, Photo diode and Solar cell, Phototransistors, Schottky diodes, Varactor diodes, Power diodes, Tunnel diodes, IR Emitters, Thermistors. Thyristors: Introduction, construction, Operation and characteristics of SCR, TRIAC, UJT. **10 Hrs.**
6. **Power amplifiers**: Introduction, classification of power amplifiers, series fed and transformer coupled Class A, Class B, Class C, Class AB amplifier circuits and operations, harmonic distortion. **6 Hrs.**

Activity beyond Syllabus:

Device and Circuit related Projects

Reference Books:

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 10/e, PHI, 2012.
2. Jacob Millman and Christos C. Halkias, - “Integrated Electronics”, 8/e, McGraw Hill, 1999.
3. D. A. Bell, “Electronic Devices & Circuits”, 4th Edition, PHI, 2007.
4. M. H. Rashid, “Power Electronics”, Pearson Education 3rd Edition, 2009.

18UECC304	Signals and Systems	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on learning mathematical model for a signal, properties of a system, system representation in different domains, relation between Fourier representations, sampling and reconstruction of a signal.

Course outcomes (COs):

Description of the Outcome - Upon completion of the course, the student will be able to	**Mapping to POs (1-12) / PSOs (13,14)**

		Level 3 Substantial	Level 2 Moderate	Level 1 Slight
CO-1	**Analyze** different types of signals	1	2	-
CO-2	**Perform** time domain **analysis** of signal.	1	-	-
CO-3	**Solve** for the system response.	1, 2	-	13
CO-4	**Perform** Frequency domain **analysis** of signal.	1	2	-
CO-5	**Apply** the Z- transform to **analyze** discrete-time signals and systems.	1	2	-
CO-6	**Relate** different Fourier representations and apply the same for various applications**.**	1	2	3, 13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	3	2.2	1	-	-	-	-	-	-	-	-	-	1	-

Pre -requisites:

Engineering Mathematics

Course Contents:

1. **Introduction:** Definitions of signals and systems, Classification of signals, Basic operations on signals, Elementary signals, Properties of systems. **6 Hrs.**
2. **Time Domain Representation:** Convolution, Interconnection of LTI systems, Relations between LTI system properties and impulse Response, Solving Differential and Difference Equations, Block diagram representation. **9Hrs.**
3. **Frequency domain Representation:** Complex Sinusoids and Frequency response of LTI Systems, Fourier Representations for four classes of signals - DTFS, FS, DTFT, FT, Properties of Discrete-Time Fourier transform, Frequency response of LTI systems. **11Hrs.**
4. **Applications of Fourier Representations:** Relating FT to FS, DTFT **6Hrs.**

to DTFS, FT to DTFT, FT to DTFS, convolution and multiplication with mixtures of periodic and non periodic signals, sampling and reconstruction of continuous time signals.

5. **Z–Transforms:** Z-Transform, Properties of region of Convergence, Properties of the z-transform, Inversion of z-transform: Partial fraction expansion method and power series method, Unilateral z–transform, Transfer function. **7Hrs.**

Activity beyond Syllabus:

Problem solving using simulation tool.

Reference Books:

1. Simon Haykin, Barry Van Veen, “Signals and Systems”, 2/e, Wiley Publications, reprint 2009.
2. Alan V Oppenheim, Alan S, Willsky and A HamiNawab, “Signals and Systems”, Pearson Education Asia / PHI, 2/e, 1997. Indian Reprint 2002.
3. H. P Hsu and R. Ranjan, “Signals and Systems”, Schaum’s outlines, TMH, 2006.

18UECL305	Analog Electronic Devices and Circuits Laboratory	(0-0-3) 1.5

Contact hours: 36

Course Learning Objectives (CLOs):

The course focuses on conducting experiments to determine characteristics of analog electronic devices and to understand the working and applications of analog electronic devices and circuits.

Course outcomes (COs):

Description of the Outcome: Upon completion of the course, the student will be able to	**Mapping to POs (1-12) / PSOs (13,14)**

		Level 3 Substantial	Level 2 Moderate	Level 1 Slight
CO-1	**Conduct** experiments to determine characteristics of analog electronic devices such as BJTs and FETs.	1	3	5
CO-2	**Design** and **Analyze** the wave shaping circuits using diodes.	1,2	3	-
CO-3	**Design** and **Analyze** RC coupled amplifier using voltage divider bias.	1,2	3	-
CO-4	**Demonstrate** the working of oscillator using FETs.	3	1,2	5
CO-5	**Design** and **Analyze** the various Power amplifiers.	1,3	5	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Levels	2.8	2.66	2.4	-	1.33	-	-	-	-	-	-	-	2.0	-

Pre-requisites:

Basic Electronics

Course Contents:

Sl. No.	**List of Experiments**
1.	Full Wave Rectifier Circuit Operation (with and without filter).
2.	Clipping Circuits using Diodes.
3.	Clamping Circuits using Diodes.
4.	Bipolar Junction Transistor (BJT) Characteristics.
5.	Single stage RC Coupled (CE) Amplifier.
6.	RC Phase Shift Oscillator using FET.

7. Hartley Oscillator using FET.
8. Colpitts Oscillator using FET.
9. Junction Field Effect Transistor (JFET) Characteristics.
10. Complementary Symmetry class B push-pull power amplifier
11. Transistor as a switch/ Relay driver
12. n-channel MOSFET Characteristics.

Activity beyond Syllabus:

Design and simulation of analog circuits using circuit simulation software.

Reference Books:

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 10/e, PHI, 2012.
2. Jacob Millman and Christos C. Halkias, - “Integrated Electronics”, 8/e, a McGraw Hill, 1999.
3. D. A. Bell, “Electronic Devices & Circuits”, 4th Edition, PHI, 2007.
4. M. H. Rashid, “Power Electronics”, Pearson Education 3rd Edition, 2009

15UECL306	Digital Circuit Design Laboratory	(0-0-3) 1.5

Contact hours: 36

Course Learning Objectives (CLOs):

The course focuses on concepts of combinational circuits and their design using MSI components. It also focuses on concepts of flip-flops and design of sequential circuits.

Course Outcomes (COs):

Description of the Outcome - Upon completion of the course, the student will be able to		**Mapping to POs(1-12) / PSOs(13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	**Design** the digital circuits for given Boolean equations.	1	2	-
CO-2	**Design** arithmetic circuits, Encoder, Decoder and other combinational circuits and **Realize** multiplexer as a reconfigurable combinational device.	1,2	3,13	-
CO-3	**Build** various flip flops using basic gates to **Realize** them as memory elements.	1,2	3,13	-
CO-4	**Design** synchronous and asynchronous mod N counters for arithmetic operations	1,2	13	-
CO-5	**Realize** shift registers as a ring counter and twisted ring counter for logical operations.	2	1	13
CO-6	**Observe** the transfer characteristics of TTL and other CMOS logic families	-	-	1,2,13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping levels	2.5	2.5	2	-	-	-	-	-	-	-	-	-	1.6	-

Pre-requisites:

Knowledge of Number system, basics of logic gates, Boolean Algebra.

Course Contents:

List of Experiments

1. Realization of Adder / Subtractor using basic gates and universal gates.

2. i. Code Conversions using Logic gates.
   ii. Realization of parallel adder and parallel subtractor / BCD to Excess-3 converter and vice-versa using IC 7483.
3. i. Design and Implementation of comparator using logic gates
   ii. Implementation of comparator using 7485 IC.
4. i. Realization of MUX using universal gates.
   ii. Realization of DEMUX using universal gates.
5. i. Implementation of the given function using MUX IC 74153.
   ii. Design and implementation of adders and subtractors using Decoder IC 74139.
6. i. Verification of Priority encoder IC74148.
   ii. Use of BCD to seven segment Decoder IC 7447 to drive the LED display.
7. i. Verification of flip-flops using logic gates and IC's
   ii. Conversion of flip-flops.
8. Realization using IC 7476.
   i. Ring counter
   ii. Johnson Counter
9. Design and implementation
   i. Synchronous counters
   ii. Asynchronous counters

10. Transfer characteristics of TTL and CMOS logic families.

Activity beyond Syllabus:

Design and simulation of digital circuits using simulation tools.

Reference Books:

1. Donald D Givone, "Digital Principles and Design", Tata McGraw Hill Edition, 2003.
2. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2001.
3. Charles H Roth, Jr;"Fundamentals of logic design", Thomson Learning, 2004.
4. Mono and Kim, "Logic and computer design Fundamentals", Pearson, 2/e, 2001

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 Outcome - Upon completio of the course, the student will be able to		**Mapping to POs (1-12) / PSOs (13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level1 Slight**
CO-1	Construct and use the concepts of analytic function to solve the problems arising in Engineering field.			1,13
CO-2	Utilize conformal transformation and complex integral to transform irregular domain onto a relatively simple domain.		1,13	
CO-3	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.		1,13	
CO-4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data		1,2	13

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 fit.		1,2	13

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mapping level	1.8	2	-	-	-	-	-	-	-	-	-	-	1.4	-

Pre Requisites:
Elementary Mathematics

Course Contents:

1	**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 and consequences. **Construction of analytic functions:** Milne-Thomson method- Problems.	**7 Hrs.**
2	**Conformal transformations:** Introduction. Discussion of transformations: $\boldsymbol{w = e^z; w = z^2}$, $\boldsymbol{w = z + \frac{1}{z}, z \neq o}$). Bilinear transformations- Problems. **Complex integration:** Line integral of a complex function- Cauchy's theorem and Cauchy's Integral theorem.	**8 Hrs.**
3	**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.	**8 Hrs.**

4	**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 form- $y = ax + b; y = ax^2 + bx + c; y = ax^b$	**8 Hrs.**
5	**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 of fit.	**8Hrs.**

Text Books:

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

Reference books:

1. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
2. S. S. Sastry, Introductory Methods of Numerical Analysis, Prentice Hall of India, 4th Edition 2010.
3. B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. N. P. Bali and Manish Goyal : A Text Book of Engineering Mathematics, Laxmi Publishers,7th Ed., 2014.

Web links and Video Lectures:

1. http://nptel.ac.in/courses.php?disciplineID=111.
2. http://www.class-central.com/subject/math(MOOCs).
3. http://academicearth.org/.

18UECC400	Communication Systems - I	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives(CLOs):

The course focuses on time and frequency domain description of various analog modulation techniques which are widely used in radio / TV communication. Block diagram approach / circuit level description of generation and detection methods is followed by mathematical analysis of various modulation techniques. Comparison in terms of power, bandwidth, circuit complexity, etc. is made. Analysis of noise is covered in the course. The course also focuses on digital communication aspects. It gives an introduction for theoretical bounds on sampling rates, practical aspects of sampling and various encoding methods for converting signal from analog to digital.

Course Outcomes(COs):

Description of the outcome: Upon completion of the course, the student will be able to		**Mapping to POs (1-12)/ PSOs(13,14)**		
		Substantial (3)	**Moderate (2)**	**Slight (1)**
CO-1	**Explain** various technical terminologies used in communication systems, communication channels, channel noise.	-	1	-
CO-2	**Analyze** the various modulation techniques in time and frequency domain.	1, 2	3	-
CO-3	**Describe** generation and detection of various modulation techniques using mathematical approach.	3	1, 2, 13	-
CO-4	**Compute** and **compare** the performance measures of modulation techniques.	-	1, 2	-
CO-5	**Derive** theoretical bounds on sampling rates and **illustrate** practical aspects.	1,2	-	-
CO-6	**Describe** various encoding techniques for data transmission.	-	2,3	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Mapping level	2.4	2.4	2.3	-	-	-	-	-	-	-	-	-	2.0	-

Pre-requisites:

Fourier analysis, circuit analysis.

Course Contents:

1. **Introduction:** Communication process, Sources of Information, Communication Channels, Modulation process, Need for Modulation, Classification of Modulation, Analog and Digital Communication systems, Advantages of digital communication over analog communication. **04 Hrs.**
2. **Amplitude Modulation Techniques:** AM, DSBSC, SSB, VSB: Time domain description, frequency domain description, bandwidth, modulation index, power relations, modulation by several sine waves, Generation, Detection, Quadrature carrier multiplexing, Comparison of various Amplitude modulation techniques. **12 Hrs.**
3. **Angle Modulation Techniques:** Frequency modulation, Phase modulation, Spectrum analysis of FM waves, Narrowband FM, Wideband FM, Transmission Bandwidth, Generation of FM waves: Indirect FM, Direct FM, Demodulation: Balanced frequency discriminator, Zero crossing detector, Phase Locked Loop. **08 Hrs.**
4. **Applications:** Frequency translation, Super heterodyne receivers, Television Fundamentals, FM stereo multiplexing. **05 Hrs.**
5. **Noise in CW Modulation systems:** Introduction, Receiver model, Noise in DSB-SC Receivers, Noise in SSB Receivers, Noise in AM Receivers, Noise in FM Receivers, Pre-emphasis and De-emphasis in FM. **06 Hrs.**
6. **Sampling Process:** Introduction, Sampling Theorem, Aliasing, Practical Aspects of Sampling: Natural sampling, Flat top sampling, **08 Hrs.**

Sample and Hold circuit, PAM, TDM.

7. **Waveform Coding Techniques**: Quantization, Quantization noise, Signal to Quantization Noise Ratio, Robust Quantization, Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation. **06 Hrs.**

8. **Pulse Modulation Techniques:** Introduction, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation, Generation and Detection. **03 Hrs.**

Activity beyond Syllabus:

Simulation of modulation techniques using MATLAB.

Reference Books:

1. Simon Haykin, “An introduction to analog and digital communications”, 3/e John Wiley, 2005.
2. Simon Haykin, “Communication systems”, 3/e, John Wiley, 2009.
3. Simon Haykin, “Digital Communications”, John Wiley, 2009

18UECC401	Control Systems	(3-2-0) 4

Contact Hours:52

Course Learning Objectives(CLOs):

The course focuses on mathematical modeling, arriving at system transfer function from block diagram / signal flow graph, finding out time and frequency response of the control system, various methods of finding out stability of a system, state model representation and its solution for electrical systems. Numerical examples are taken up for discussing these topics.

Course Outcomes(COs):

Description of the Outcome: Upon completion of the course, the student will be able to		**Mapping to POs (1-12) / PSOs(13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	**Classify** different Control Systems with examples and **Analyze** electromechanical	1	2	-

	systems by mathematical modeling.			
CO-2	**Develop** transfer function of a control system using Block diagram reduction technique and signal flow graph method.	1,2	-	-
CO-3	**Determine** Transient and Steady State behavior of systems using standard test signals and it's time response specifications	1,2	-	13
CO-4	**Analyze and investigate** the stability of different control systems using graphical and mathematical techniques in time domain.	2	-	3
CO-5	**Examine** the stability of different control systems using graphical and mathematical techniques in frequency domain.	2	13	3
CO-6	**Understand** the modeling of linear-time-invariant systems using state-space representation.		1,2	13

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	2.75	2.66	1	-	-	-	-	-	-	-	-	-	1.33	-

Pre-requisites:
Laplace Transform, Partial Fractions, Differentiation & Integration

Course Contents:

1.	**Modeling of Systems:** The control system, Mathematical models of Physical systems: Differential equations of physical systems - Mechanical systems, Translational systems, Rotational systems, Electrical systems, Analogous systems.	**5L+2T Hrs.**
2.	**Block diagrams and signal flow graphs:** Transfer functions, Block diagram algebra and Signal Flow graphs.	**5L+1T Hrs.**
3.	**Time Response of feedback control systems:** Standard test signals, Unit step response of First and second order systems, Time response specifications, Steady-State Errors and Error Constants, Types of Control Systems, Dominant Poles of Transfer Functions.	**5L+2T Hrs.**
4.	**Stability analysis:** Concepts of stability, Necessary conditions for Stability, Routh-stability criterion, Relative stability analysis.	**5L+1T Hrs.**
5.	**Root-Locus Techniques:** Introduction, the root locus concepts, Construction of root loci, numerical examples.	**6 Hrs.**
6.	**Stability in the frequency domain:** Mathematical preliminaries, Nyquist Stability criterion, Assessment of relative stability using Nyquist criterion, numerical examples.	**6L+1T Hrs.**
7.	**Frequency response analysis:** Introduction, Correlation between time and frequency response, Bode plots, All pass and minimum phase systems, Experimental determination of transfer functions, Compensation: Introduction, Types of compensators, Realization of basic compensators.	**6L+1T Hrs.**
8.	**Introduction to State variable analysis:** Concepts of state, state variable and state models for electrical systems, Solution of state equations, Transfer Function from the State Model.	**6 Hrs.**

Activity Beyond Syllabus:

Modeling and simulation of simple control systems using modeling software

Reference Books:

1. I.J.Nagarath and M.Gopal, "Control Systems Engineering", 5/e, New Age International (P) Limited, Publishers, 2007.
2. A. Anand Kumar, "Control Systems", PHI, 1/e, 2011.
3. K. Ogata, "Modern Control Engineering", 4/e, Pearson Education Asia/PHI, 2002.
4. B. C. Kuo, "Automatic Control Systems", 7/e, EEE, PHI, 2005.
5. A.K. Jairath, "Solutions and Problems of Control Systems", 2/e, CBS Publishers & Distributors, 1997.

18UECC402 Microcontroller (3-2-0) 4

Contact Hours:52

Course Learning Objectives (CLOs):

This course focuses on architectural features and instruction set of 8051 micrcontroller. It also focuses on programming using assembly language of 8051 and C language, programming the timers in different modes, programming for serial communication, interrupts and interfacing devices.

Course outcomes (COs):

Description of the Outcome: Upon completion of the course, the student will be able to		**Mapping to POs (1-12) / PSOs (13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	**Explain** the architectural features of microcontrollers, 8051 in particular.	-	14	1
CO-2	**Explain** the operation of data movement, logical, arithmetic and branching instructions.	-	1,14	-
CO-3	**Write** programs for 8051 microcontroller using assembly and	2,3,4	13,14	-

	Embedded C Language.			
CO-4	**Program** the timers in different modes using assembly and C programming.	-	2,3,14	-
CO-5	**Write a program** for serial communication between 8051 and peripherals.	3	1,14	
CO-6	**Program** 8051 interrupts and interface ADC, DAC, stepper motor and other peripherals.	3,4,14		

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1.66	2.5	2.75	3	-	-	-	-	-	-	-	-	2	2.16

Pre-requisites:
Boolean Algebra, Analog and Digital Circuits, Logic and reasoning skills.

Course Contents:

1. **Microprocessors and microcontroller:** Introduction, Overview of 8085 Microprocessor, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture. The 8051 Architecture-Block diagram, Pin Configuration, 8051 port structure. **6L+2T Hrs.**
2. **Addressing Modes and Operations:** Introduction, Addressing modes, External data transfer, Code Memory, Read Only Data transfer / Indexed Addressing modes, PUSH and POP opcodes, Data exchanges, Example Programs; Byte level logical Operations, Bit level Logical Operations, Rotate and Swap Operations, Example Programs. Arithmetic Operations: Flags, Incrementing and Decrementing, Addition, Subtraction, Multiplication and Division, Example-programs. **6L+2T Hrs.**

3. **Jump and Call Instructions:** The JUMP and CALL Program range, Jumps, calls and Subroutines, Interrupts and Returns, Examples. **6 Hrs.**
4. **8051 programming in C:** Data types and time delays in C for 8051, I/O programming, logic operations, data conversion programs. **4 Hrs.**
5. **Timer / Counter Programming in 8051:** Programming 8051 Timers, Counter Programming, programming timers 0 and 1 in C and ALP. **6L+2T Hrs.**
6. **8051 Serial Communication:** Basics of Serial Communication, 8051 connections to RS-232, 8051 Serial communication Programming, Serial port programming in C and ALP. **6L+2T Hrs.**
7. **Interrupts Programming:** 8051 Interrupts, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051, interrupt programming in C and ALP. **5 Hrs.**
8. **Embedded Sub Systems Using 8051:** Interfacing 8051 to LCD, Keyboard, DAC, Stepper Motor. **5 Hrs.**

Activity beyond syllabus

Microcontroller based projects, simulation of programs using Keil, Proteus.

Reference Books:

1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", 3rd Edition, Cengage Learning, 2011.
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay, "The 8051 Microcontroller and Embedded Systems – using assembly and C", 2nd Edition, Pearson, 2008.
3. Predko, "Programming and Customizing the 8051 Microcontroller", TMH, 2005
4. Dr. Ramani Kalpathi and Ganesh Raja, "Microcontroller and its applications", Sanguine Technical Publishers, 2005

18UECC403 HDL Programming Using Verilog (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on HDL programming concepts, verilog constructs, and application to the implementation of various digital circuits. Also, course focuses on hardware description of a digital system using Verilog.

Course Outcomes (COs):

Description of the Outcome: Upon completion of the course, the student will be able to		**Mapping to POs (1-12) / PSOs (13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	**Recognize** the need for HDL and **describe** typical design flow and design methodologies of VLSI.	-	3	1
CO-2	**Identify** and **illustrate** various terminologies, data types and system tasks of verilog language.	14	2	-
CO-3	**Apply** the knowledge of various design models and techniques in Verilog programming to **describe** the digital system.	2,3	1,4,14	13
CO-4	**Analyze** the given task and **develop** the program using subroutines with useful modeling techniques.	2,3,4,14	-	-
CO-5	**Identify** the useful modeling techniques for file output, display hierarchy, memory initialization.	3	2,14	4
CO-6	**Illustrate** the concept of synthesis, mapping and optimization	3,4,14	2	1

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14

Mapping Level	1.3	2.4	2.8	2.3	-	-	-	-	-	-	-	-	1	2.6

Pre-requisites:
Digital circuit design, programming fundamentals.

Course Contents:

1. **Overview of Digital Design with Verilog HDL**: Typical VLSI Design Flow, Design Methodologies, 4 bit Ripple Carry Counter, Modules, Instances, Components of a Simulation, Examples. **5 Hrs.**
2. **Basic Concepts & Modules and Port**s: Basic Concepts: Lexical Conventions, Data types, System Tasks and Compiler Directives, Modules, Ports, Examples. **5 Hrs.**
3. **Gate Level Modeling:** Gate types And/ Or gates, Buffer / Not gates, Examples, Gate Delays, Rise, Fall and turn –off delays, Minimum / Typical /Maximum values. **5 Hrs.**
4. **Dataflow Modeling:** Continuous Assignments, Delays, Expressions, Operations, and Operands, Operator types, Examples. **5 Hrs.**
5. **Behavioral Modeling:** Structured Procedures, Procedural Assignments, Timing Controls, Conditional Statements, Multi-way Branching, Loops, Examples. **8 Hrs.**
6. **Tasks, Functions and Useful modeling techniques:** Difference between Tasks and Function, Tasks declaration and invocation, Task examples, Function declaration and invocation , Function examples, Time Scales, Useful System tasks. **6 Hrs.**
7. **Logic Synthesis with Verilog HDL**: Logic Synthesis, Synthesis information from module inputs / Outputs, Synthesis Design Flow, RTL Description, translation, Logic Optimization, Technology Mapping and Optimization, examples. **5 Hrs.**

Activity beyond Syllabus:
Verilog model of complex digital system design using simulator, hobby project.

Reference Books:

1. Samir Palnitkar, “Verilog HDL”, 2/e, Pearson Education, IEEE 1364-2001 Compliant, 2015.
2. T.R. Padmanabhan, B. Bala Tripura Sundari, “Design Through Verilog HDL”, ISBN: 978-0-471-44148-9, Wiley-IEEE Press, 2004.
3. Nazeih M Botros, “HDL Programming, VHDL and Verilog”, Deamtech Press, 2007.
4. Peter J. Ashenden, “Digital Design: An Embedded Systems Approach Using verilog”, Elsevier, 2010.

18UECC404 Linear ICs and Applications (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

The course focuses on working and characteristics of OPAMP, various feedback techniques, frequency response and compensation techniques. It also focuses on various applications of OPAMP.

Course outcomes (COs):

Description of the Outcome - Upon completio of the course, the student will be able to		**Mapping to POs (1-12) / PSOs (13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level1 Slight**
CO-1	**Derive** the expression for gain and input resistance for dual input balanced output differential amplifier.	-	1	2
CO-2	**Design** feedback amplifiers using op-amp for the known gain.	-	1	2
CO-3	**Analyze** the stability and **propose** compensatory measures for the feedback amplifiers.	-	3	1

CO-4	**Construct** various circuits using op-amp for different applications.	-	13	1,2.3
CO-5	**Design** filters and oscillators for given specifications and **study** various waveform generators using op-amp.	3	13	1
CO-6	**Illustrate** the working of 555 timer and 565 PLL as multivibrator and frequency multiplier.	-	-	1,2

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping level	1.4	1	2	-	-	-	-	-	-	-	-	-	2.0	-

Pre-requisites:
Analog Electronic circuits.

Course Contents:

1. **Operational Amplifier Fundamentals**: DC and AC analysis for Dual input-Balanced output differential Amplifier, Differential amplifier with swamping resistors, Constant current bias and current mirror circuits, Block diagram representation of Op-amp, Basic and Ideal Op-amp, Equivalent circuit of an Op-amp, Ideal voltage transfer curve, Open Loop Op-Amp configurations, Op-amp parameters, Input and Output Voltage CMRR, PSRR, offset voltage and Currents. **7 Hrs.**

2. **Op-Amp with Negative Feedback:** Block diagram representation of feedback configuration, Voltage series **6 Hrs.**

feedback amplifier, Voltage shunt feedback amplifier, Differential Amplifier

3.	**Op-Amps frequency response and compensation:** Circuit stability, Frequency and phase response, Frequency compensating methods, Band width, Slew rate and its effects	**4 Hrs.**
4.	**OP-AMP Applications:** Introduction, Summing, scaling and averaging amplifiers, Instrumentation amplifier, Peaking amplifier, Voltage to current converter with floating and grounded load, Current to voltage converter, Integrator, Differentiator.	**6 Hrs.**
5	**Active filters and Oscillators:** Introduction, Active filters, first and second order low pass and high pass Butterworth filter, Phase shift oscillator, Wein bridge oscillator, Square wave generator, triangular wave generator, saw tooth wave generator, Comparators and converters: Schmitt trigger, Clippers and clampers, rectifiers, peak detectors, sample and hold circuit.	**10 Hrs.**
6	**Linear IC applications:** 555 timer-Basic timer circuit, 555 timer used as astable and monostable multivibrator, PLL-operating principles, Phase detector/comparator, VCO; D to A and A to D converters.	**6 Hrs.**

Activity beyond Syllabus:

Study of sensors and simulation of circuits using modern tools.

Reference Books:

1. David A. Bell, “Operational Amplifiers and Linear IC’s”, 2/e, PHI, 2004.
2. Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, 3/e, PHI.
3. D. Roy Choudhury and Shail B. Jain, “Linear Integrated Circuits”, 2/e, New Age International, Reprint 2006.
4. Robert. F. Coughlin & Fred. F. Driscoll, “Operational Amplifiers and Linear

Integrated Circuits", PHI, 2006.

18UECL405	HDL Programming Laboratory	(0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives (CLOs):

The course focuses on experiments based on HDL programming for digital circuit design using Verilog. Also, the course contemplates the interfacing programs to interface different hardware components using programmable device (FPGA).

Course Outcomes (COs):

Description of the Outcomes- Upon completion of the course, the student will be able to **:**		**Mapping to POs(1-12)/ PSOs(13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level1 Slight**
CO-1	**Relate** the need for HDL in Typical design flow of VLSI Technology.	-	14	1
CO-2	**Apply** appropriate techniques, resources, and EDA tools for modeling, simulation and synthesis of various digital systems.	5,14	3,4,13	1,2
CO-3	**Design** combinational circuits using various programming techniques.	5,14	3,4,13	1,2
CO-4	**Model** Sequential circuits using Verilog programming techniques.	5,14	3,4,13	1,2
CO-5	**Build** the HDL model to interface FPGA kits with various peripherals	14	5	1,2,3,4
CO-6	**Generate** the test vectors for the HDL model using stimulus block.	5,14	3,4,13	1,2

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping Level	1	1	1.8	1.8	2.8	-	-	-	-	-	-	-	2	2.8

Pre-requisites:

Digital Logic Circuits, Programming fundamentals

Sl. No.	List of Experiments
1.	Write a Verilog code to implement the following Basic Gates: (Using Dataflow, Behavioral and Structural style of modelling).
2.	Write a Verilog code to implement Adders, Subtractors, Encoders and Decoders. (Using Dataflow, Behavioral and Structural style of modelling).
3.	Write a Verilog code to implement Multiplexers, De-multiplexers, Code converters, Comparators. (Using Dataflow, Behavioral and Structural style of modelling).
4.	Write a Verilog Code to implement 4-bit ALU. Verify the same generating test vectors for the various operations. Write the test bench (stimulus block) and verify that it behaves as ALU.
5.	Design a 4-bit ripple carry adder using concept of hierarchical structured modeling by using module instantiation, tasks and functions.
6.	Write the verilog code to implement all flip flops.
7.	Write a Verilog code to implement the following: a) 4-bit Shift register (Right shift and left shift) b) 4-bit Ring counter and Johnson counter c) 4-bit up counter and 4-bit down counter d) 4-bit updown counter e) Any given sequence counter (4-bit) f) BCD updown Counter g) Mealy and Moore's synchronous circuit design.
8.	Write a verilog code to run the stepper motor in clockwise and anti-clockwise direction.
9.	Write a verilog code to generate any given waveforms using DAC kit.

10. Write a verilog code to Interface hex keypad and display it on 7-segment LED.

Note: Simulation should be done using Xilinx ISE tool and Implementation on Spartan –6 FPGA Kits.

Reference Books:

1. Samir Palnitkar, “Verilog HDL”, 2/e, Pearson Education.
2. T.R. Padmanabhan, B. Bala Tripura Sundari, “Design Through Verilog HDL”, ISBN: 978-0-471-44148-9, Wiley-IEEE Press
3. Nazeih M Botros, “HDL Programming, VHDL and Verilog”, Deamtech Press.
4. Peter J. Ashenden, “Digital Design: An Embedded Systems Approach Using verilog”, Elsevier, 2010.

18UECL406 Linear Integrated Circuits Laboratory (0-0-3) 1.5

Contact Hours: 36

Course Learning Objectives (CLOs):

The course focuses on experiments highlighting various applications of linear ICs: Op-amp and 555 timer

Course Outcomes (COs):

Description of the Outcome - Upon completion of the course, the student will be able to:		**Mapping to POs (1-12) / PSOs (13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	**Demonstrate** Op-amp as DC and AC amplifier in inverting and non-inverting configuration	-	-	1
CO-2	**Design** of Op-amp based circuits for various arithmetic operations, filters and comparators.	2	3	1
CO-3	**Demonstrate** the use of Op-amp for DAC application.	-	13	1,2
CO-4	**Design** of 555 timer as multivibrator.	2	4	1
CO-5	**Demonstrate** the use of Op amp as waveshaping and rectifier circuits	13	-	1,2
CO-6	**Design** various waveform generators using	13	1,2	

	Op-amp			

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping levels	1.2	2.0	2.0	2.0	-	-	-	-	-	-	-	-	2.7	-

List of Experiments

1. Operational amplifier as voltage follower, inverting and non-inverting amplifier.
2. OP-AMP circuit for implementing given arithmetic expressions.
3. Instrumentation amplifier using Op-Amps.
4. Design low-pass and high-pass first and second order Butterworth filters.
5. Design a Schmitt Trigger for a given UTP and LTP.
6. Design R-2R DAC using OP-AMP.
7. Design of multivibrators for given specifications using IC-555.
8. Wave shaping Circuits using Op-Amp.
9. Waveform Generators using Op-Amp.
10. Rectifiers using Op-amp.

Activity beyond syllabus:

Simulation of circuits using software tools.

Reference Books:

1. Ramakant A. Gayakwad,“Op-Amps and Linear Integrated Circuits”, 3/e,PHI.
2. David A. Bell, “Operational Amplifiers and Linear IC’s”, 2/e,PHI, 2004.

18UECL407	Introductory Project	(0-0-2) 1

Contact Hours: 24

Course Learning Objectives (CLOs):

The course provides an exposure to the students to identify simple societal problems and propose a technical solution. It also helps them 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 POs (1-12) / PSOs (13,14)**		
		Level 3 Substantial	**Level 2 Moderate**	**Level 1 Slight**
CO-1	**Identify** a socially/ technically relevant problem and **formulate** a problem statement	-	2	6, 7
CO-2	**Propose** the technical approach towards the solution.	2	6, 7	11
CO-3	**Implement** the solution in hardware & / or software	1, 3, 12	9, 10, 13	-
CO-4	**Organize** the topics and **Prepare** the report in a specified format.	9	12	-
CO-5	**Present** the work carried out in a systematic manner.	5, 9	12, 13	-

POs/PSOs	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Mapping levels	3	2.5	3	-	3	1.5	1.5	-	2.67	2	1	2.3	2	-