ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು

(ಸ್ವಾಯತ್ತ ವಿದ್ಯಾ ಸಂಸ್ಥೆ)

ಬುಲ್ ಟೆಂಪಲ್ ರಸ್ತೆ, ಬೆಂಗಳೂರು – ೫೬೦ ೦೧೯

BMS COLLEGE OF ENGINEERING

(Autonomous college under VTU)

BENGALURU-560019

ELECTRICAL & ELECTRONICS ENGINEERING

Scheme & syllabus for

III & IV Semester

Academic year: 2015-2016

BMS COLLEGE OF ENGINEERING, BENGALURU

Autonomous College under VTU

VISION	MISSION
Promoting Prosperity of mankind by augmenting human resource capital through Quality Technical Education & Training	Accomplish excellence in the field of Technical Education through Education, Research and Service needs of society

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING

SECOND YEAR SYLLABUS BOOK

With effect from A. Y. 2015 – 16

Table of Contents

AY	Academic Year
AAT	Alternative Assessment Tools
BOE	Board of Examiners
BOS	Board of Studies
CBCS	Choice Based Credit System
CGPA	Cumulative Grade Point Averages
CIE	Continuous Internal Evaluation
CO	Course Outcomes
DC	Departmental Core
GC	Group Core
HSS	Humanity and Social Science Courses
IC	Institutional Core
IE	Institutional Elective
IL	Institutional Lab
LTPS	Lecture-Tutorial-Practical-Self Study
NFTE	Not Fit for Technical Education
PCC	Professional Core Courses
PEC	Professional Elective Courses
PEO	Program Educational Objectives
PO	Program Outcomes
SEE	Semester End Examination
SGPA	Semester Grade Point Average
ST	Studio

DEPARTMENT VISION	DEPARTMENT MISSION
Facilitating the development of competent professionals capable of adapting to the constantly changing global scenario in the field of Electrical Sciences	• Impart quality technical education and encourage research in the field of Electrical Sciences • Empower every individual to develop as a professional with an ability to apply his/her knowledge and skills to adapt to the evolving technological requirements of society

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The PEOs have been evolved in alignment with the vision and mission of the Department. The broad objective of the program is to facilitate the development of competent and successful professionals in tune with modern day technological and societal requirements.
Therefore, after concerted interactions (both formal and informal) with all major constituents including Alumni, Employers, experts from industry and institutions, faculty and students, parents etc., the following Program Educational Objectives of the UG course offered by Electrical and Electronics Engineering department have been arrived at:

The PEOs of the program is as under:

1. **PEO-1:** Possess successful careers in Electrical Sciences, and allied areas and pursue higher education with a broad knowledge base in Mathematics and Engineering principles.

2. **PEO-2:** Utilize their technical, analytical, communicative and managerial skills and knowledge for societal progress and enrich them to keep in pace with relevant advancements by engaging themselves in lifelong learning.

3. **PEO-3:** Exhibit professionalism by displaying competence, leadership, dedication and commitment.

Program Outcomes

Program outcomes (POs), are attributes acquired by the students at the time of graduation. The POs given in the table below, ensure that the POs are aligned to the Graduate Attributes (GAs) specified by National Board of Accreditation (NBA). These attributes are measured at the time of graduation and hence computed every year for outgoing batch. The POs are addressed and attained through the Course Outcomes (COs) of various courses of the curriculum.

PO-1	Apply the knowledge of mathematics, science, and engineering principles to the solution of electrical and allied engineering problems.
PO-2	Formulate and analyze complex engineering problems using first principles of mathematics, physical and engineering sciences.
PO-3	Design solutions for complex engineering problems, and design system components that meet specific societal needs.
PO-4	Design and conduct experiments and analyze and interpret data for complex systems.
PO-5	Select and apply appropriate modern engineering tools to complex engineering activities with an understanding of the limitations.
PO-6	Apply reasoning informed by contextual knowledge to assess societal health, safety, legal and consequent responsibilities relevant to the professional engineering practice.
PO-7	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	Understand ethical principles and social issues.
PO-9	Function effectively as an individual, and as a member or leader in diverse teams to accomplish a common goal.
PO-10	Communicate effectively with diverse audiences and able to write effective reports and design documentation.
PO-11	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 in multi-disciplinary environments.
PO-12	Recognize the need to engage in independent and lifelong learning in the context of technological change.

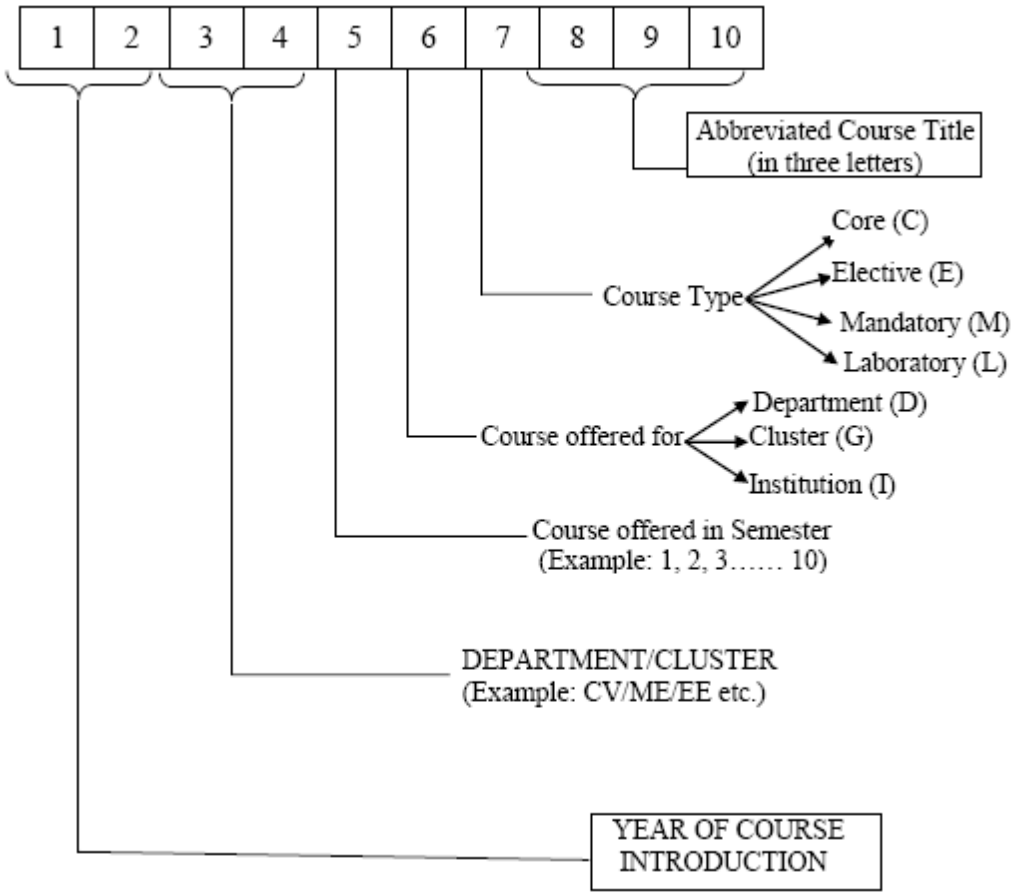
III Semester Scheme

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	15MA3GCAEM	Advanced Engineering Mathematics	3	1	0	0	4
2	15ES3GCLCA	Linear Circuit Analysis	3	1	0	0	4
3	15ES3GCAMC	Analog Microelectronics	3	0	1	2	6
4	15ES3GCDEC	Digital Electronics	3	0	1	2	6
5	15EE3DCFTH	Field Theory	3	1	0	0	4
6	15EE3DCSL1	Simulation Lab –I	0	0	1	0	1
Total			15	3	3	4	25

IV Semester Scheme

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	15MA4GCDMP	Discrete Mathematics and Probability	3	1	0	0	4
2	15ES4GCAIC	Analog Integrated Circuits	3	0	1	2	6
3	15ES4GCMCS	Microcontrollers	3	0	1	2	6
4	15ES4GCCST	Control Systems	3	1	0	0	4
5	15ES4GCSAS	Signals and Systems	3	1	0	0	4
6	15EE4DCSL2	Simulation Lab -II	0	0	1	0	1
Total			15	3	3	4	25

NOMENCLATURE FOR THE COURSE CODE



III Semester Syllabus

Course Title	ADVANCED ENGINEERING MATHEMATICS (Common to EC, TE, EE, IT, ML)				
Course Code	15MA3GCAEM	Credits	4	L-T-P-S	3:1:0:0
CIE	50 Marks(100% weightage)	SEE	100 Marks(50% weightage)		

Prerequisites:
Trigonometric formulas, methods of differentiation, methods of integration, partial derivatives, matrices, Fourier Series, Fourier Transforms

UNIT-I		9 hours

MATRICES: Introduction: Elementary row transformations, Echelon form of a matrix, rank of a matrix by elementary row transformations. Consistency of system of linear equations and solution.

Solution of a system of non-homogenous linear algebraic equations: Gauss elimination method, LU decomposition method, Gauss-Seidel method. Eigen values and eigenvectors of matrices. Reduction of a matrix to diagonal form. **(7L+2T)**

Suggested Reading: Inverse of a matrix using Gauss-Jordan method. Largest Eigen value and corresponding eigenvector using Rayleigh power method.

UNIT-II		10hours

NUMERICAL METHODS:

Solution of algebraic and transcendental equations: Newton-Raphson method.

Finite Differences and interpolation: Forward differences, backward differences. Newton-Gregory forward interpolation formula, Newton-Gregory backward interpolation formula, Lagrange's interpolation formula, Lagrange's inverse interpolation. Numerical integration: Simpson's $1/3^{rd}$, $3/8^{th}$ rule, Weddle's rule. Numerical solution of ordinary differential equations: Euler's modified method, Runge-Kutta method of fourth order**.** **(8L+2T)**

Suggested Reading: Milne's method to solve ordinary differential equations. Solution of simultaneous differential equations by Runge-Kutta fourth order method.

UNIT-III		10hours

PARTIAL DIFFERENTIAL EQUATIONS:

Formation of Partial differential equations-elimination of arbitrary constants, elimination of arbitrary functions. Equations of first order- Solution of the linear equation $P\,p + Q\,q = R$ **(**Lagrange's partial differential equation).

Applications: One-dimensional heat equation and wave equation (without proof), Transmission

line-telegraph equations, various possible solutions of these by the method of separation of variables.

(7L+3T)

Suggested Reading: Direct integration method, method of separation of variables, D'Alembert's solution of wave equation.

UNIT-IV		**9 hours**

COMPLEX ANALYSIS 1:

Function of a complex variable, limits, continuity and differentiability of a complex valued function. Analytic functions, properties of analytic functions, Cauchy-Riemann equations in Cartesian and polar form, construction of analytic functions by Milne-Thomson method.

Conformal mapping-Transformations: $w = z^2$ and $w = z + \frac{a^2}{z}$ $(z \neq 0)$.Bilinear transformations.

(7L+2T)

Suggested Reading: Standard transformations $w = c + z$, $w = cz$, $w = 1/z$, properties of bilinear transformations.

UNIT-V		**9 hours**

COMPLEX ANALYSIS 2:

Complex integration: Line integral, Problems on line integral, Cauchy's theorem, Cauchy's integral formula.

Complex series: Taylor's series, Maclaurin's series and Laurent's series (without proof).

Zeros, Poles and Residues: Residue theorem (without proof). Evaluation of real definite integrals using residues.

(7L+3T)

Suggested Reading: Power series, radius of convergence. Removable and essential singularities, improper real integrals with singular points on real axis.

Applications: Use of harmonic function to a heat transfer problem. Analyzing AC circuits, Current in a field- effect transistor.

Mathematics Lab

- Solution of system of algebraic equations using Gauss Seidel method.
- LU decomposition of matrices.
- Eigen values and eigenvectors of matrices.
- Largest Eigen value, smallest Eigen value and corresponding eigenvectors of a matrix.

• Solution of algebraic and transcendental equations using Newton- Raphson method. • Numerical integration. • Numerical solution of ordinary differential equations	
Text books:	
1.	Higher Engineering Mathematics, B.S. Grewal, 43rd edition, 2014, Khann a Publishers.
2.	Advanced Engineering Mathematics, 5th edition, 2011, by Dennis G.Zill and Cullen, Jones and Bartlett India Pvt. Ltd.
Reference books:	
1.	Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.
2.	Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition Vol.1 and Vol.2, 2014, Wiley-India.
3.	Numerical Methods for Scientific and Engineering Computation. M.K. Jain, S.R.K Iyengar, R.K. Jain, 6th edition, 2010, New Age International (P) Limited Publishers
E Books:	
1.	Engineering Mathematics, K. A. Stroud, Dexter J. Booth, Industrial Press, 2001 http://books.google.co.in/books/about/Engineering_Mathematics.html?id=FZncL-xB8dEC&redir_esc=y.
2.	Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.
3.	http://ocw.mit.edu/courses/mathematics/ (online course material)
Moocs:	
1.	http://nptel .ac.in/courses.php?disciplineId=111
2.	https://www.khanacademy.org/
3.	https://www.class-central.com/subject/math (MOOCS**)** (4)E-learning: www.vtu.ac.in
4.	E-learning: www.vtu.ac.in

Course outcomes At the end of the course ,the student will have the ability to
CO-1: Obtain numerical solution a system of algebraic equations, algebraic and transcendental equations and ordinary differential equations.
CO-2: Formulate boundary value problems involving one dimensional heat and wave equation
CO-3: Solve partial differential equations with appropriate boundary conditions using the method of separation of variables
CO-4: Construct analytic functions and simple conformal mappings.
CO-5: Evaluate real and complex integrals using the calculus of residues.

Course Title	LINEAR CIRCUIT ANALYSIS				
Course Code	15ES3GCLCA	Credits	4	L-T-P-S	3-1-0-0
CIE	50 Marks(100% weightage)	SEE	100 Marks(50% weightage)		

Prerequisites:
Basic Electrical Engineering, Engineering Mathematics- I & II

UNIT-1		5+2 hours

Basic Concepts:

Practical sources, Source transformations, Network reduction using Star Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of supernode and supermesh.

UNIT-2		8+3hours

Network Topology:

Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set & cut- set schedules, Formulation of equilibrium equations, Principle of duality.

Resonant Circuits: Series and parallel resonance, frequency response of series and Parallel circuits, Q factor, Bandwidth

UNIT-3		7+3 hours

Network Theorems:

Superposition, Reciprocity, Milliman's, Thevenin's and Norton's theorems; Maximum Power transfer theorem

UNIT-4		10+3 hours

Transient behavior and initial conditions:

Behavior of circuit elements under switching condition and their representation, evaluation of initial and final conditions in RL,RC and RLC circuits

Laplace Transformation & Applications:

Review of Laplace transforms, Waveform Synthesis, initial and final value theorems, step, ramp and impulse responses, convolution theorem, solution of simple R-L,R-C,R-L-C networks for AC and DC excitations using Laplace transforms.

UNIT-5		6+1 hours

Two port network parameters and State Variable analysis:

Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets. Writing state equations and solution using Laplace transforms.

Text books:	
1.	"Network Analysis", M.E.Van Valkenburg, PHI/PearsonEducation,3rd Edition. Reprint2002.
2.	"Network and systems",Roy Choudhury,2nd edition,2006 re-print, New Age International Publications
3.	Theory and Problems of Electric Circuits, Schaum`s Series, 2nd Edition Mc Graw Hill
Reference books:	
1.	"Engineering Circuit Analysis",Hayt, Kemmerly and Durbin, TMH 6th 2002
2.	"Network analysis and Synthesis", Franklin F. Kuo, Wiley Edition
3.	"Analysis of Linear Systems",David K.Cheng,Narosa Publishing House,11th reprint,2002
4.	"Circuits",Bruce Carlson, Thomson Learning,2000.Reprint2002
E Books:	
1.	Nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur
2.	Nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi
3.	www.electrodiction.com/circuit-theory
Moocs:	
1.	http://elearning.vtu.ac.in/06ES34.html
2.	https://www.coursera.org/course/circuits

Course outcomes At the end of the course ,the student will have the ability to
CO-1: Formulate equations based on physical laws and analyze the steady state behavior of complex electric networks
CO-2: Apply the knowledge of mathematics and graph theory to the solution of complex electrical networks
CO-3: Apply mathematical and analytical techniques to analyze transient behavior of networks
CO-4: Analyze networks based on two port networks and state variables

Course Title	ANALOG MICROELECTRONICS				
Course Code	15ES3GCAMC	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks(100% weightage)	SEE	100 Marks(50% weightage)		

Prerequisites:
Elements of Electronics Engineering

UNIT-1		7 hours

Diodes: Introduction
Limiting and clamping circuits -Limiter circuits, The Clamped capacitor or DC restorer.
Bipolar Junction Transistor (BJTs):Introduction,
Single stage BJT amplifiers -The basic structure , characterizing BJT Amplifiers, The common emitter amplifier
Frequency Response of the CE amplifier-The 3 frequency bands, The high frequency response The low frequency response.

UNIT-2		8 hours

MOSFETS:
Introduction ,**Device structure and physical operation** -Device structure, operation with no gate voltage, creating a channel for current flow, Applying a small VDs, Operation as VDs is increased, Derivation of the id-V_{DS} relationship, The P- Channel MOSFET, Complementary MOS or CMOS, operating the MOS transistor in the subthreshold region .
Current voltage Characteristics – Circuit symbol, id-V_{DS} characteristics, characteristics of the P-Channel MOSFET
MOSFET Circuits at DC
The MOSFET as an amplifier and as a switch - Large - signal operation , Graphical derivation of the transfer characteristic, operation as a switch, operation as a linear amplifier.
Biasing in MOS amplifier circuits-Biasing by fixing V_{GS}, Biasing by fixing V_G and connecting a resistor in the source , Biasing using a drain to gate feedback resistor, biasing using a current source.

UNIT-3		7 hours

Small - signal operation and models of MOSFETs-The DC bias point, the signal current in the drain terminal ,the voltage gain, separating dc analysis and the signal analysis, small signal equivalent circuit models, the transconductance g_m, the T equivalent circuit model.

Single stage MOS amplifiers - The basic structure, characterizing amplifiers, The CS amplifier,

The CS amplifier with a source resistance.
IC Biasing - Current sources, current mirror and current steering circuits-
The basic MOSFET current source, MOS current steering circuits
Current mirror circuit with improved performance - The Wilson current mirror

UNIT-4		**7 hours**

Feedback:-
Introduction ,the general feedback structure, S**ome properties of negative feedback**-Gain density, bandwidth extension, noise reduction, reduction in nonlinear distortion, **The four basic feedback topologies-** Voltage amplifiers, current amplifiers, transconductance amplifiers , practical feedback circuits for current series and voltage series feedback

UNIT-5		**7 hours**

Power Amplifiers:
Introduction, The classification of output stages.
C**lass A output stage** - transfer characteristic, signal waveforms, power dissipation, power conversion efficiency, transformer coupled power amplifiers, class B transformer coupled amplifier
Class B output stage - Circuit operation , transfer characteristic, power conversion efficiency, power dissipation, reducing crossover distortion, single supply operation
Class AB output stage - Circuit operation, output resistance
Power BJTs – Junction temperature, thermal resistance, power dissipation versus temperature, transistor case and heat sink

Laboratory Experiment List:

Diode and Transistor as a switch, Zener diode characteristics and Zener as regulator, Diode clipping circuits- Single/Double ended, Diode clamping Circuits - positive clamping/negative clamping, BJT as RC coupled amplifier, BJT as RC phase shift oscillator, Crystal Oscillator, Power Amplifier, Open ended experiments.

This course shall include an assessment based on the **QEEE Phase IV** on 'Fundamentals of Small Signal Analysis' taught by Prof. Shanthi Pavan, IIT Madras.

Text books:

1.	Microelectronic Circuits-Theory and applications by Adel S. Sedra and Kenneth C.Smith, Fifth Edition , (Oxford International Student Edition)
2.	Electronic Devices and Circuit Theory-Robert L.Boylestad and Louis Nashelsky (Pearson Education)

Reference books:	
1.	Electronic Devices and Circuits- Millman and Halkias, TMH
E Books:	
1.	www.pyroelectro.com/edu/analog
2.	http://freevideolectures.com/Course/3020/Circuits-for-Analog-System-Design
Moocs:	
1.	https://www.mooc-list.com/course/electronic-systems-and-digital-electronics-uninettuno?static=true
2.	http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-spring-2009/
3.	Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware | Reviews and Ratings

Course outcomes

At the end of the course ,the student will have the ability to

CO-1: Define, understand and explain the structure, V-I characteristics, working and applications of analog electronic devices like diodes, Bipolar Junction Transistors(BJTs) and MOSFETs

CO-2: Apply the knowledge of KVL and KCL to obtain voltage /current/waveform at different points in analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, current sources, current mirrors, power amplifiers, feedback amplifiers

CO-3: Analyze analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, current sources, current mirrors, power amplifiers, feedback amplifiers etc. to obtain voltage /current/waveform at different points for given specifications

CO-4: Design analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, current sources, current mirrors, power amplifiers, feedback amplifiers for given specifications.

CO-5: Conduct experiments using analog electronic components and electronic instruments to function as switch, regulator, clippers, clampers, small signal amplifiers, oscillators, power amplifiers

CO-6: Engage in self-study/independent study to formulate, design, implement, analyze and demonstrate an application using analog electronic components through an open ended

experiment
CO-7: Engage in self-study/independent study to submit a seminar report and make an effective presentation on topics related to the course (e-waste management, www.deity.gov.in, Comparative study of components, preparing the specifications of components, verifying the data sheets, applications of analog electronics)

Course Title	DIGITAL ELECTRONICS				
Course Code	15ES3GCDEC	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks(100% weightage)	SEE	100 Marks(50% weightage)		

Prerequisites:
Elements of Electronics Engineering

UNIT-1		8 hours

Introduction: Review of Boolean algebra, logic gates.

Simplification of Boolean functions : Three Variable K – Maps, Four Variable K – Maps, The Tabulation Method, Determination of Prime Implicants, Selection of prime implicants.

Combinational Logic Circuits: Introduction, Carry Look Ahead Adder, Parallel Adder, Decimal Adder Code conversion, , Magnitude Comparator, Decoders, Multiplexers, Read Only memories (ROM), Programmable Logic Arrays(PLAs).

UNIT-2		7 hours

Flip-Flops:
The Basic Flip-flop circuit, Clocked Flip-flops, Triggering of Flip-flops: Master Slave Flip-Flops, Edge Triggered Flip Flops, Characteristic Equations.

UNIT-3		8 hours

Sequential Logic Circuits:
Shift Registers, Ripple Counters, Design of Synchronous Counters

UNIT-4		8 hours

Sequential systems:
Analysis of Clocked Sequential circuits, State Reduction and Assignment, Design Procedure, Design with State Equations

UNIT-5		8 hours

Logic Families: Characteristic of Digital ICs, Transistor – Transistor Logic, Complementary MOS (CMOS) Logic, Comparison of TTL and CMOS families

Laboratory Experiment List:

Applications of IC 7483 (Adders, Subtractors and Comparators), Multiplexers (using Gates and IC) and their applications, Decoders/DeMultiplexers (using Gates and IC) and their applications, BCD to Decimal decoder using 7-segment display, Verification of MSJK Flip-flop (using Gates and IC 7476), Asynchronous counters (using ICs 7476,7490,7493), Synchronous Counters (using ICs 7476, 74190/74192), Shift registers and their applications (using ICs 7476, 7495)

This course shall include assessments based on the QEEE Phase IV lecture on 'Nitty Gritty of Logi Gates to Processor Design' by Prof. Ashok Jhunjhunwala, IIT Madras (based on the topics Logic Gates to Execution Unit Design, ALU design)

Text books:	
1	Digital Logic and Computer Design- M. Morris Mano, Prentice Hall – Pearson Education
2	Fundamental of Logic Design- Charles Roth Jr., Thomas Learning
Reference books:	
1	Digital Principles and Design- Donald Givone, Tata McGraw Hill
2	Digital Logic Applications and principles- John Yarbrough, Pearson Education
E Books:	
1.	http://www.free-engineering-books.com/2014/11/digital-fundamentals-by-thomas-l-floyd.html
2.	https://books.google.co.in/books/about/Fundamentals_of_Digital_Circuits.html?id=BOVkrtiLUcEC
Moocs:	
1.	http://freevideolectures.com/blog/2010/11/130-nptel-iit-online-courses/
2.	http://freevideolectures.com/Course/2319/Digital-Systems-Design#
3.	www. Pyroelectrom.com/edu
4.	Nptel.ac.in/courses/117106086
5.	http://nptel.ac.in/courses/117105080
6.	Digital Circuits and SystemsYouTube - S. Srinivasan, IIT Madras
7.	Digital Integrated Circuits YouTube –Amitava Dasgupta, IIT Madras

Course outcomes At the end of the course ,the student will have the ability to
CO-1: Understand, define and explain the fundamental concepts of Digital circuits
CO-2: Applythe knowledge of digital circuit concepts (Boolean Algebra, K-Maps and Quine-Mc Clusky method) to optimize a digital circuit for the given parameter (number of gates, time delay, power consumption, cost)
CO-3: Analyze digital circuits and arrive at suitable conclusions
CO-4: Design a digital circuit for given specifications
CO-5: Conduct experiments using digital ICs for a given application/problem statement
CO-6: Engage in self-study to formulate, design, implement, analyze and demonstrate an application of digital electronic circuits through an open ended experiment
CO-7: Engage in self-study to deliver a seminar on topics related to the course accompanied by a seminar report (www.deity.gov.in, Comparative study of components, preparing the specifications of components, verifying the data sheets, applications of digital ICs, the characteristics/specifications of different digital ICs, etc.)

Course Title	FIELD THEORY				
Course Code	15EE3DCFTH	Credits	4	L-T-P-S	3-1-0-0
CIE	50 Marks(100% weightage)	SEE	100 Marks(50% weightage)		

Prerequisites:
Engineering Mathematics- I & II, Engineering Physics

UNIT-1		10 hours

Introduction to electrostatics: Introduction to line integral, surface integral, volume integral of vectors, Coulomb's Law (vector form), Electric Field Intensity (vector form),EFI due to different types of charge distributions.

Electric Flux Density (EFD), Gauss' Law, Divergence: Electric Flux Density (EFD), Gauss' Law Application, Divergence and Divergence Theorem

UNIT-2		10 hours

Energy and Potential: Energy spent in moving charge, Definition of Potential Difference (PD), PD due to Point Charge and System of Charge, Energy Density

Current and current density: Current and Current Density, Continuity of Current, Conductor, Properties, and Boundary Conditions

UNIT-3		8 hours

Dielectric: Dielectric materials, boundary conditions,
Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, solution Poisson's and Laplace for Single Variables, Capacitance of different configurations using Laplac equation.

UNIT-4		10 hours

Steady Magnetic Field:
Biot-Savart Law, Ampere's circuital law, curl, Magnetic Flux, Flux Density, Scalar and Vector Magnetic Potentials, Force on a moving charge, Force on different current element, Inductance and Mutual Inductance Magnetic Boundary Condition.

UNIT-5		10 hours

Time varying fields and Maxwell's equations: Faraday's Law, Displacement Current, Maxwell's Equations in Point and Integral Form, Uniform plane waves, Wave equations , solution of wave equation, wave propagation through good dielectric, good conductor, skin depth, Poynting Theorem

This course will include lecture from QEEE followed by a suitable QUIZ

Text books:

1	Engineering Electromagnetics, W H Hayt, J A Buck, M Jaleel Akhtar Tata McGraw-Hill, 8th Edition, 2014.
2	Electromagnetics**,** Schaum's Outline series Joseph A Ediminister Tata McGraw-Hill, revised second Edition, 2014.

Reference books:

1	Electromagnetics with Applications, John Krauss and Daniel A Fleisch, McGraw-Hill, 5th Edition, 1999.
2	"Field and wave electromagnetic", David K Chary, Pearson Education Asia, Second Edition – 1989, Indian Reprint – 2001

Video links:

1.	NPTEL Video Lecture On Electromagnetic Theory By Dr. Harishankar Ramachandran, IIT Madras. http://www.nptel.ac.in/courses/108106073/
2.	Phillips P., Engineering Dielectrics Volume IIA Electrical Properties of Solid Insulating Materials: Molecular Structure and Electrical Behaviour.http://www.astm.org/DIGITAL_LIBRARY/STP/SOURCE_PAGES/STP783.htm

Course outcomes

At the end of the course ,the student will have the ability to

CO-1: Apply the fundamental Knowledge of electrostatics

CO-2: Apply the fundamental Knowledge of magneto-statics

CO-3: Formulate and analyze problems involving different media with boundaries using uniform plane wave

Course Title	Simulation Lab -I				
Course Code	15EE3DCSL1	Credits	01	L-T-P-S	0-0-1-0
CIE	50 Marks(100% weightage)	SEE	100 Marks(50% weightage)		

	Part A Experiments (MATLAB)
1.	Introduction: The MATLAB Environment, MATLAB as a calculator, Syntax and Semantics, Help, Plotting, Publishing. Introduction to matrices and operators, the colon operator, accessing parts of a matrix, combining matrices, Arithmetic operations, operator precedence.
2.	Introduction to functions, function I/O, definitions of functions, scope, advantages, scripts, File I/O, MAT files, excel files, text files, binary files.
3.	Signal generation, determination of the signal parameters. Three dimensional visualization of functions.
4.	Analysis of electrical networks in steady state.
5.	Transient analysis of electrical systems.
	Part B Experiments (SIMULINK)
1.	Introduction: Simulink as a tool box, steps involved in creating system models using the simulink library, solver selection, creating model hierarchy.
2.	Mathematical modeling of physical systems
3.	Realization of Boolean expression.
4.	Analysis of electrical systems under transient conditions. Transfer of variables between Simulink and MATLAB workspace.
5.	Realization of Uncontrolled and controlled rectifiers, determination of parameters associated with the output.

Course outcomes At the end of the course ,the student will have the ability to
CO-1: Navigate the MATLAB user interface, enter commands, Create access, modify, perform calculations, and visualize matrix data and customize plots.
CO-2: Import data from files, write and debug scripts and create functions.
CO-3: Visualize and interpret three dimensional plots of functions and responses of electrical systems.
CO-4: Create and simulate a model of a physical system
CO-5: Create mathematical models of systems such as controlled and uncontrolled rectifiers and determine the parameters associated with the output signal.
CO-6: Interact with MATLAB workspace.

IV SEMESTER

Course Title	Discrete Mathematics and Probability (Common to ECE/EEE/IT/ML/TCE)				
Course Code	15MA4GCDMP	Credits	4	L-T-P-S	3-1-0-0
CIE	50 Marks(100% weightage)	SEE	100 Marks (50% weightage)		

Prerequisites:

Basic concepts of set theory, relations and functions, Matrices, Basic concepts of probability, addition theorem, conditional probability, Bayes' theorem, discrete random variable, Binomial distribution

UNIT-1		12 hours

SET THEORY AND RELATIONS :

Introduction to sets and subsets, operations on sets, laws of set theory. Duality, Principle of duality for the equality of sets. Countable and uncountable sets. Addition Principle. Introduction to Relations. Definition, Types of functions, operations on relations, matrix representation of relations, composition of relations, properties of relations, equivalence relations, partial orders, Hasse diagram. Posets- extremal elements on posets.

(9L+3T)

Suggested Reading: Some particular functions- Floor and ceiling functions, Projection, Unary and Binary operations.

UNIT-2		10 hours

ALGEBRAIC STRUCTURES: Groups, properties of groups. Some particular groups- The Klein 4-group, additive group of integers modulo *n*, multiplicative group of integers mod *p*, permutation groups. Subgroups, Cyclic groups, Coset decomposition of a group, homomorphism, isomorphism. **(7L+3T)**

Suggested Reading: Lagrange's theorem and its consequences.

UNIT-3		9 hours

GRAPH THEORY :

Basic concepts: Types of graphs, order and size of a graph, in-degree and out-degree, connected and disconnected graphs, Eulerian graph, Hamiltonain graphs, subgraphs, dual graphs,

isomorphic graphs. Matrix representation of graphs: adjacency matrix, incidence matrix. Trees: spanning tree, breadth first search. Minimal spanning tree: Kruskal's algorithm, Prim's algorithm, shortest path-Dijkstra's algorithm.

(7L+2T)

Suggested Reading: Konigsberg bridge problem, Utility problem.

UNIT-4		**8 hours**

PROBABILITY: Theoretical distributions: Poisson distribution, Normal distribution: Error function, Central limit theorem.
Two dimensional random variables: Discrete random variable, Mathematical expectation, Covariance and Correlation. **(6L+2T)**

Suggested Reading: Exponential distribution, Uniform distribution. Continuous two dimensional random variables.

UNIT-5		**9 hours**

MARKOV CHAIN AND QUEUING THEORY :
Markov Chain, Probability vectors, stochastic matrices, fixed point vector, regular stochastic matrices. Higher transition probabilities, stationary distribution of regular Markov chains. Queuing models: Concept of Queue, M/M/1 queuing systems.

(7L+2T)

Suggested Reading: Power supply model, Economic cost profit model.

Mathematics Lab

- Probability distributions
- Minimal spanning tree- Kruskal's algorithm, Prim's algorithm.
- Shortest Path- Dijkstra's algorithm

Text books:

1.	Discrete Mathematical Structures, Dr. DSC, 4th edition, 2011-12, Prism Engineering Education Series.
2.	Higher Engineering Mathematics, B.S. Grewal, 43rd edition, 2013, Khanna Publishers.
3.	Discrete Mathematics, Seymour Lipschutz. M. Lipson, 2005, Tata McGraw Hill.

Reference books:

1.	Higher Engineering Mathematics, B.V. Ramana, 2007, Tata Mc. Graw Hill.
2.	Discrete Mathematics, J K Sharma, 3rd edition, 2013, Macmillan India Ltd.
3.	Queuing Theory and Telecommunications, Networks and applications, Giovanni Giambene, 2005, Springer
4.	Data Networks, Dimitri Bertsekas, Robert Gallager, 2nd edition, 1992, Prentice India
5.	Schaum's Outline of Probability and Statistics, John J Schiller, Murray R Speigel, 4th edition, 2013, Schaum's Outlines
E Books:	
1.	Discrete Mathematics for Computer Science, Gary Haggard, John Schlipf, Sue Whitesides, Thomson Brooks/Cole, 2006
2.	(1) http://www.khanacademy.org/math/probability/random-variablestopic/ random_variables_prob_dist/v/random-variables
3.	http://ocw.mit.edu/courses/mathematics/ (online course material)
Moocs:	
1.	www.nptelvideos.in/2012/11/discrete-mathematical-structures.html
2.	www.cs.berkeley.edu/~daw/teaching/cs70-s05
3.	https://www.khanacademy.org/

Course outcomes
At the end of the course ,the student will have the ability to
CO-1: Understand the notation of set theory, relations and functions.
CO-2: Construct a Hasse diagram for partial orderings, Use many terms associated with graphs and prove whether two graphs are isomorphic.
CO-3: Obtain the probability of an event using discrete and continuous distributions, including the n-step transition probability.
CO-4: Analyse and classify simple states (recurrent/transient)
CO-5: Understand, derive and apply the properties of the M/M/m queuing model (properties like stationary probability, average waiting and system time, expected number of customers in

the queue)

Alternate Assessment Tool: 20% of CIE marks for the lab.

Question Paper Pattern

1. Each unit consists of one full question.
2. Each full question consists of three or four subdivisions.
3. Five full questions to be answered.
4. Internal choice in unit 2 and unit 3.

Course Title	Analog Integrated Circuits				
Course Code	15ES4GCAIC	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks(100% weightage)	SEE	100 Marks (50% weightage)		

Prerequisites:

Elements of Electronics Engineering, Analog Microelectronics

UNIT-1		8 hours

Operational Amplifier Characteristics:
Introduction, DC Characteristics, AC Characteristics, Analysis of data sheets of an OP-AMP
Operational Amplifier Applications:
Review of basic Opamp applications, Instrumental Amplifier, V to I and I to V converter, Op-amp circuits using Diodes - Half wave rectifier, Full wave rectifier, Sample and hold circuit, Multiplier and Divider.

UNIT-2		7 hours

Comparators and Waveform Generators:
Introduction, comparator, Regenerative comparator (Schmitt Trigger), Square wave generator (Astable Multivibrator), Monostable Multivibrator, Triangular wave generator. (RC and Wein bridge oscillators only).

UNIT-3		7 hours

Voltage Regulators:
Introduction, Series op-amp regulator, IC Voltage regulators, 723 General purpose Regulator, Switching Regulator.
Active Filters:
Introduction, RC Active Filters, First order low pass filter, second order active filter, Higher order low pass filter, High pass active filter, All pass filter-phase shift lead and lag circuit

UNIT-4		7 hours

Timers :
Introduction to 555 timer, Description of Functional diagram, monostable operation, astable operation.

Phase locked loops : Introduction, Basic principles, phase detector/comparator, voltage controlled oscillator (VCO)

UNIT-5		**7 hours**

D-A and A-D Converters:
Introduction, Basic DAC Techniques- Weighted Resistor DAC, R-2R Ladder DAC.
A-D Converters: Direct type ADCs- The parallel Comparator (Flash) A/D converter, Successive Approximation Converter, DAC/ADC Specification, Sigma – delta ADC

Laboratory Experiment List:

Inverting and non- inverting amplifier, voltage follower, Inverting and non- inverting summing Amplifier, Differentiator and integrator, Precision half wave and full wave rectifier, Zero crossing detector and Schmitt trigger, Weinbridge Oscillator, First order active low pass filter, First order active high pass filter, 555 as astable multivibrator, 555 as monostable multivibrator, IC 723 as low voltage and high voltage regulators, D to A convertor, A to D convertor, Clipping Circuits, Clamping Circuits

Text books:

1.	Linear Integrated Circuits-D. Roy Choudhury & Shail B.Jain(New age Publication)
2.	Op-Amps and Linear Integrated Circuits-Ramakanth A.Gayakwad,4th edition ,PHI

Reference books:

1.	Linear Integrated Circuits-S.Salivahanan & V.S.Kanchana Bhaaskaran (Tata McGraw-Hill Publication)
2.	Opamps and Linear ICs-David A.Bell (Prentice-Hall Publications)

E Books:

1.	http://freevideolectures.com/Course/2321/Electronics-for-Analog-Signal-Processing-I
2.	http://freevideolectures.com/Course/2322/Electronics-for-Analog-Signal-Processing-I

Moocs:

1.	http://ocw.tudelft.nl/courses/microelectronics/analog-integrated-circuit-design/course-home/
2.	Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware | Reviews and Ratings

3.	http://www.pannam.com/blog/free-resources-to-learn-electrical-engineering/

Course outcomes

At the end of the course ,the student will have the ability to

CO-1: Define, understand and explain the DC and AC performance characteristics of Opamp, applications of Opamp, working of 555 timer and voltage regulators.

CO-2: Apply the knowledge of KVL and KCL to obtain voltage /current/waveform at different points in analog electronic circuits such as Opamp amplifiers, rectifiers, filters, waveform generators, PLL, data converters, regulators, comparators ,555 timers.

CO-3: Analyze analog electronic circuits such as Opamp amplifiers, rectifiers, filters, waveform generators, PLL, data converters, regulators, comparators, and 555 timers etc to obtain voltage/current/waveform at different points that meet desired specifications.

CO-4: Design analog electronic circuits such as Opamp amplifiers, rectifiers, filters, waveform generators, PLL, data converters, regulators, comparators ,555 timers etc. that meet desired specifications.

CO-5: Conduct experiments using analog electronic components, electronic instruments to function as amplifiers, comparators, rectifiers, filters, astable and monostable circuits using 555, data converters.

CO-6: Engage in self-study/independent study to formulate, design, implement, analyze and demonstrate an application using analog electronic components/ASLK/Multisim through a mini-project and submit the mini-project and make an oral presentation of the work.

Course Title	MICROCONTROLLERS				
Course Code	15ES4GCMCS	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks(100% weightage)	SEE	100 Marks (50% weightage)		

Prerequisites:

Elements of Electronics Engineering, Digital Electronics

UNIT-1		7 hours

INTRODUCTION TO MICROCOMPUTER AND MICROCONTROLLER:

Introduction to Microprocessors, Internal organization of computer- Bus Structures, Harvard & Von-Neumann CPU architecture, **The 8051 Architecture:** Introduction, 8051 Microcontroller Hardware, Input / Output Pins, External Memory Interface.

UNIT-2		8 hours

MICROCONTROLLER PROGRAMMING:

Instruction set architecture-RISC & CISC CPU Architectures, Pipelining, Execution of an instruction, Addressing Modes and Instruction set. Example Demonstration using 8051 instruction set, Data transfer instructions, Arithmetic instructions, Logical instructions, Branching and Subroutines, Example programs.

UNIT-3		8 hours

CONCEPTS OF EMBEDDED 'C' PROGRAMMING:

Data types, examples in 8051 C, program structures, logical operations, Memory and I/O access, Programming peripherals (Examples: Timer / Counter), Programming serial communication (serial data input/output) - example programs using 8051

UNIT-4		7 hours

INTERRUPTS AND INTERRUPT PROGRAMMING:

Concept of Interrupts, Interrupts in 8051. Programming Timer Interrupts, Programming External Hardware Interrupts, Programming Serial Communication Interrupts

UNIT-5		6 hours

INTERFACING AND APPLICATIONS:

Interfacing 8051 to LCD, DAC, ADC Stepper motor interfacing. Applications of

microcontrollers.

LABORATORY EXPERIMENTS:

Part A: Data Transfer, Logical-Byte/Bit manipulations, Jump and Subroutine Calls using Assembly language, counters and delay generation using timers, Embedded C programs

Part B: Interfacing: LCD Display, Stepper motor control, logical interface, 7 segment interface, DAC and keyboard.

Text books:

1.	"The 8051 Microcontroller Architecture, Programming & Applications", Kenneth J. Ayala 2e, Thomson Learning 2005
2.	"The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006

Reference books:

1.	'Computer Organization and Architecture', Carl Hamacher, Mc Graw Hill, 5th Edition
2.	http://cnx.org/contents/dadb4fd5-8390-4323-a056-f6381587e89a@1/Microcontroller%288051%29-Lab

E Books:

1.	nptel.ac.in/courses/Webcourse-contents/IIT.../microcontrollers
2.	http://freevideolectures.com/Course/3018/Microprocessors-and-Microcontrollers

Moocs:

1.	**Embedded Systems - Shape The World**-https://www.edx.org/course/embedded-systems-shape-world-utaustinx-ut-6-02x
2.	**Electronic Interfaces: Bridging the Physical and Digital Worlds-** https://www.edx.org/course/electronic-interfaces-bridging-physical-uc-berkeleyx-ee40lx-0

Course outcomes

At the end of the course ,the student will have the ability to

CO-1: Understand and explain computer based and memory based architecture, microcontroller, pipelining, addressing modes, data types in Embedded C, basics of serial communication, timer configuration and interrupt handling

CO-2: Calculate instruction execution time, delay, baud rate, and write assembly and C Code,

identify the timer mode, serial communication mode and interrupt priorities
CO-3: Debug/ analyze the code in assembly as well as Embedded C
CO-4: Identify the IDE to conduct experiments by simulating, debugging and executing the assembly and Embedded C code
CO-5: Engage in independent study/ self-study by preparing a 5 min video on 'Applications of Microcontrollers for health, safety, environment and society'
CO-6: Work as an individual and as a team-member to design, formulate and implement experiments using microcontroller through conduction of an Open-Ended experiments

Course Title	CONTROLSYSTEMS				
Course Code	15ES4GCCST	Credits	4	L-T-P-S	3-1-0-0
CIE	50 Marks(100% weightage)	SEE	100 Marks (50% weightage)		

Prerequisites:

Linear Circuit Analysis, Engineering Mathematics I & II, Advanced Mathematics

UNIT-1		9+3 hours

Introduction:
Examples of Control Systems, open loop vs Closed loop Systems, Mathematical Modeling of Linear Systems: Transfer functions, Mechanical Systems, Analogous Systems, Block diagram, Signal Flow graph, Compensators: Lag, Lead(obtaining transfer functions only).

UNIT-2		6+3 hours

Controllers & Time response analysis:
Step response of first order, second order systems, response specification ,steady state error and error constants. Example of effect of P-I controllers on the time response

UNIT-3		9+2 hours

Stability Analysis:
Concept of stability, RH criterion, applications of RH criterion with limitations, Nyquist plot, Polar plots, Stability Analysis using Nyquist criterion

UNIT-4		6+2 hours

Root locus technique:
Introduction to root locus concepts, Construction rules, Analysis of stability by root locus plot

UNIT-5		6+2 hours

Frequency response Analysis:
Bode plots, Relative stability, Frequency domain specification.

Text books:

1.	Control Engineering by Nagrath & Gopal, New Age International Publishers

2.	Engineering control systems - Norman S. Nise, John WILEY & sons , fifth Edition
Reference books:	
1.	Modern control Engineering-Ogata , Prentice Hall
2.	Automatic Control Systems- B.C Kuo, John Wiley and Sons
E Books:	
1.	http://en.wikibooks.org/wiki/Control_Systems
2.	http://www.electrical4u.com/control-system-closed-loop-open-loop-control-system/#practical-examples-of-open-loop-control-system
3.	http://www.facstaff.bucknell.edu/mastascu/eControlHTML/CourseIndex.html
Moocs:	
1.	www.nptel.com/IITK
2.	https://www.edx.org/course/
3.	http://nptel.ac.in/courses/108103007/1
Course outcomes At the end of the course ,the student will have the ability to	
CO-1: Obtain mathematical models of open loop and closed loop physical systems	
CO-2: Apply mathematical techniques to perform time response analysis of a control system	
CO-3: Carry out stability analysis using different mathematical techniques	

Course Title	SIGNALS AND SYSTEMS				
Course Code	15ES4GCSAS	Credits	4	L-T-P-S	3-1-0-0
CIE	50 Marks(100% weightage)	SEE	100 Marks (50% weightage)		

Prerequisites:

Linear Circuit Analysis, Engineering Mathematics I & II, Advanced Mathematics

UNIT-1		10 hours

INTRODUCTION: Definitions of a signal and a system, classification of signals, basic operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems.

UNIT-2		10 hours

TIME-DOMAIN REPRESENTATIONS FOR LTI SYSTEMS: Convolution, impulse response representation, Convolution Sum and Convolution Integral, Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.

UNIT-3		8 hours

FOURIER SERIES: Introduction, Discrete time and continuous time Fourier series (derivation of trigonometric Fourier series representation are excluded), Properties of Fourier series (No proof), Applications of Fourier series. Sampling Theorem and Reconstruction

UNIT-4		10 hours

FOURIER TRANSFORM: Discrete and continuous Fourier transforms & their properties (With proof). Fourier transform representation of periodic signals, Applications of Fourier transform, Frequency response of LTI systems. Laplace Transform and its Applications.

UNIT-5		10 hours

Z-TRANSFORMS: Introduction, Z – transform, properties of ROC & Z – transforms Inverse Z– transforms, unilateral Z- Transform, analysis of LTI Systems and application to solve Difference equations.

Text books:

1.	Simon Haykin and Barry Van Veen "Signals and Systems", John Wiley & Sons, 2001.Reprint 2002

2.	Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002
Reference books:	
1.	H. P Hsu, R. Ranjan, "Signals and Systems", Scham's outlines, TMH, 2006
2.	B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2005
3.	Ganesh Rao and SatishTunga, "Signals and Systems", Sanguine Technical Publishers, 2004
E Books:	
1.	NPTEL lecture Video on Signals and Systems by Prof. S.C.Dutta Roy, http://www.satishkashyap.com/2012/04/iit-video-lectures-on-signals-and.html
2.	NPTEL lecture Video on Signals and Systems by Prof. T.K. Basu,IIT Kharagpur. http://www.nptel.ac.in/courses/108105065/
3.	NPTEL on line Course Modules–IIT Bombay –Signals and Systems http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Signals%20and%20System/TOC-M1.html
Moocs:	
1.	https://www.edx.org/course/signals-systems-part-1-iitbombayx-ee210-1x-0
2.	https://www.edx.org/course/signals-systems-part-2-iitbombayx-ee210-2x-0
Course outcomes At the end of the course ,the student will have the ability to	
CO-1: Apply the knowledge of mathematics and engineering to analyze and obtain the response of continuous and discrete time systems.	
CO-2: Analyze Continuous Time and Discrete Time signals and systems in Frequency domain using Fourier analysis tools like CTFS, CTFT, DTFS and DTFT	
CO-3: Analyze Discrete Time systems using Z-transforms.	

Course Title	Simulation Lab -II				
Course Code	15EE4DCSL2	Credits	01	L-T-P-S	0-0-1-0
CIE	50 Marks(100% weightage)	SEE	100 Marks(50% weightage)		

Simulation Experiments	
1.	To find the resonance frequency, band width and Q factor of the given RLC series and parallel circuit.
2.	Application of circuit theorems for a given electrical network and visualize the results.
3.	Design and analysis of an amplifier circuit.
4.	Design and analysis of an oscillator circuit.
5.	Verification of voltage and current relationships in a three phase AC system.
6.	Simulation and analysis of Inverting and Non inverting amplifier.
7.	Simulation of a Schmitt trigger circuit.
8.	Stability studies of a system using Bode plot.
9.	Simulation of diode clipping and clamping circuits.

Course outcomes

At the end of the course ,the student will have the ability to

CO-1: Develop simulation circuit for a given electric network and verify KVL and KCL.

CO-2: Design and analysis of power amplifier, Inverting and Non inverting amplifiers and oscillator circuit through simulation.

CO-3: Develop circuit model to analyze a second order system and perform stability studies

CO-4: Develop circuit model and apply circuit theorems.

MANDATORY MATHEMATICS COURSES FOR LATERAL ENTRY STUDENTS

Course Title	**Mathematics-I** (All Branches)				
Course Code	**15MA3IMMAT**	**Credits**	**0**	**L-T-P-S**	**0:0:0:0**
CIE	100 marks (100% weightage)				

Pre-requisites:

Basic concepts of Trigonometry, Trigonometric formulas, concept of differentiation, concept of integration

UNIT I		**[9 hours]**

DIFFERENTIAL AND INTEGRAL CALCULUS:

List of standard derivatives including hyperbolic functions, rules of differentiation. Differentiation of product of two functions using Leibnitz rule (direct problems). Taylor's and Maclaurin's series expansion for functions of single variable. List of standard integrals, integration by parts. Definite integrals – problems.

(7L+2T)

UNIT II		**[10 hours]**

POLAR COORDINATES AND PARTIAL DERIVATIVES :

Polar curves: Polar coordinates, angle between radius vector and tangent, angle between two polar curves. Partial differentiation. Total differentiation-Composite and Implicit functions. Taylor's and Maclaurin's series expansion for functions of two variables. Jacobians and their properties (without proof) – Problems. **(7L+3T)**

UNIT III		**[08 hours]**

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS :

Introduction to first order differential equations. Linear equation and its solution. Bernoulli's equation and its solution. Exact differential equation and its solution. Orthogonal Trajectories. **(6L+2T)**

UNIT IV		[9 hours]

SECOND AND HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS:
Ordinary differential equations with constant coefficients: Homogeneous differential equations, non-homogeneous differential equations – Particular integral for functions of the type f (x) = e^{ax}, sin(ax), cos(ax), x^n, e^{ax}sin(bx), e^{ax}cos(bx). Method of variation of parameters. Cauchy's and Legendre differential equations.

(7L+2T)

UNIT V		[8 hours]

VECTOR CALCULUS AND ORTHOGONAL CURVILINEAR COORDINATES (OCC):
Recapitulation of scalars, vectors and operation on scalars and vectors. Scalar and vector point functions. Del operator, gradient-directional derivative, divergence, curl and Laplacian operator. Vector identities (without proof). Cylindrical and Spherical polar coordinate systems. Expressing a vector point function in cylindrical and spherical systems. Expressions for gradient, divergence, curl and Laplacian in OCC.

(6L+2T)

Text Books:

1.	Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Precise Textbook series, Vol. 1 and Vol. 2, 10th edition, 2014, Wiley- India.
2.	Higher Engineering Mathematics, B.V. Ramana, 7th reprint, 2009, Tata Mc. Graw Hill.

Reference Books:

1.	Higher Engineering Mathematics, B.S. Grewal, 43rd edition, 2014, Khanna Publishers
2.	Advanced Engineering Mathematics, 4th edition, 2011, by Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd.

E Books:

1.	Engineering Mathematics, K. A. Stroud, Dexter J. Booth, Industrial Press, 2001 http://books.google.co.in/books/about/Engineering_Mathematics.html?id=FZncL-xB8dEC&redir_esc=y.
2.	Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.

3.	http://ocw.mit.edu/courses/mathematics/ (online course material)
Moocs:	
1.	https:// www.khanacademy.org/Math
2.	https:// www.class-central.com/subject/math (MOOCS)
3.	E-learning: www.vtu.ac.in
Course Outcomes At the end of the course, the student will have the ability to	
CO-1: Understand the basic concepts of differentiation and integration.	
CO-2: Apply the concepts of polar curves and multivariate calculus.	
CO-3: Apply analytical techniques to compute solutions of first and higher order ordinary differential equations.	
CO-4: Apply techniques of vector calculus to engineering problems.	
CO-5: Comprehend the generalization of vector calculus in curvilinear coordinate system.	

Course Title	Mathematics-II (All Branches)				
Course Code	15MA4IMMAT	Credits	0	L-T-P-S	0:0:0:0
CIE	100 marks (100% weightage)				

Pre-requisites:

Basic concepts of Trigonometry, Trigonometric formulas, concept of differentiation, concept of integration.

UNIT I		[8 hours]

LAPLACE TRANSFORMS:

Laplace transforms of standard functions. Properties and problems. Laplace Transform of Periodic functions with plotting. Unit step function.

(6L+2T)

UNIT II		[9 hours]

INVERSE LAPLACE TRANSFORMS:

Inverse Laplace transforms of standard functions. Properties and problems. Solution of ODE-Initial and Boundary value Problems.

(7L+2T)

UNIT III		[11 hours]

DOUBLE INTEGRAL:

Evaluation of double integral. Change of order of integration. Change of variables to polar coordinates. Application: Area.

(8L+3T)

UNIT IV		[8 hours]

TRIPLE INTEGRALS AND IMPROPER INTEGRALS:

Evaluation of triple integral. Application: Volume. Gamma and Beta functions-definition Relation between Gamma and Beta functions. Properties and Problems. **(6L+2T)**

UNIT V				[8 hours]

VECTOR INTEGRATION:
Line integral. Green's theorem. Stokes' theorem. Gauss divergence theorem.

(6L+2T)

Text Books:

1.	Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Precise Textbook series, Vol. 1 and Vol. 2, 10th edition, 2014, Wiley- India.
2.	Advanced Engineering Mathematics, 4th edition, 2011, by Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd

Reference Books:

1.	Higher Engineering Mathematics, B.S. Grewal, 43rd edition, 2014, Khanna Publishers.
2.	Higher Engineering Mathematics, B.V. Ramana, 7th reprint, 2009, Tata Mc. Graw Hill.

E Books:

1.	(1) Engineering Mathematics, K. A. Stroud, Dexter J. Booth, Industrial Press, 2001 http://books.google.co.in/books/about/Engineering_Mathematics.html?id=FZncL-xB8dEC&redir_esc=y.
2.	Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.
3.	http://ocw.mit.edu/courses/mathematics/ (online course material)

Moocs:

1.	https:// www.khanacademy.org/Math
2.	https:// www.class-central.com/subject/math (MOOCS)
3.	E-learning: www.vtu.ac.in

Course Outcomes At the end of the course, the student will have the ability to
CO-1: Use Laplace transforms to solve differential equations.
CO-2: Apply double integrals to compute areas.
CO-3: Learn to use triple integrals in computing volumes.
CO-4: Use Gamma and Beta functions to evaluate integrals.
CO-5: Understand the use of integral calculus in scalar and vector fields.

Assessment Pattern

Continuous Internal Evaluation (CIE) includes test, quiz, assignment, seminar, term paper, open ended experiments, mini-projects, two minute videos, MOOCs etc.

Alternative Assessment:
Alternative Assessment Tool (AAT) includes seminar, assignments, term paper, open ended experiments, mini-projects, two minute videos, MOOCs etc.

Semester End Examination (SEE) – A written examination for theory courses and practical/design examination with built-in oral part(Viva-Voce).

Both CIE and SEE have equal (50:50) weightage. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

ASSESSMENT PATTERNS WITH 20% WEIGHTAGE FOR AAT
Assessment pattern for Regular/Normal courses:

COMPONENT	THEORY		TOTAL MARKS
Type of Assessment	Test	Quiz or AAT	
Max. CIE Marks	40	10	50

Assessment pattern for Integrated Courses:

COMPONENT	THEORY		PRACTICAL			Total Marks
Type of Assessment	Test	Quiz or AAT	Records & Performance	LabTest	Viva-voce/ AAT	
Max. CIE Marks	20	05	10	10	05	50

Assessment pattern for Comprehensive Courses
(Applicable for the batches admitted from 2014-15 onwards):

Component	Theory (50%)		Practical (30%)		Self-Study (20%)	Total Marks
Type of Assessment	Test	Quiz	Lab Performance/ Record	LabTest	AAT	
Max CIE Marks	20	05	10	05	10	50

ASSESSMENT PATTERNS WITH 40% WEIGHTAGE FOR AAT

A faculty, who wishes to design AAT with more than 20% weightage, shall create a new pattern for assessment indicating weightages for all the three components.

Note: Students must secure a minimum of 40% in CIE and should have 85% attendance.

In case of integrated and comprehensive courses, a student must secure a minimum of 40% marks and 85% attendance in both theory and practical components. In addition, the overall CIE marks including theory, practical and self-study components shall not be less than 40%.

Note - For a detailed Assessment pattern refer Rules and Regulation book (2015-16)