BMS College of Engineering, Bangalore – 19

Autonomous College under VTU
Department of Electronics & Communication Engineering

3\textsuperscript{rd} - 8\textsuperscript{th} Semester Scheme and Syllabus
2014-15 Batch Onwards
INSTITUTE VISION
Promoting Prosperity of mankind by augmenting human resource capital through Quality Technical Education & Training

INSTITUTE MISSION
Accomplish excellence in the field of Technical Education through Education, Research and Service needs of society

PROGRAM VISION
To emerge as a Centre of Academic Excellence in Electronics, Communication and related domains through Knowledge acquisition, Knowledge dissemination and Knowledge Generation meeting global needs and standards

PROGRAM MISSION
Imparting Quality Education through state of the art curriculum, Conducive Learning Environment and Research with scope for continuous improvement leading to overall Professional Success

PROGRAM EDUCATIONAL OBJECTIVES
PEO 1: Graduates will Professionally Progress in Electronics, Communication and related areas with an inclination towards Continuous Learning
PEO 2: Graduates will work in Diversified Teams of Multidisciplinary Environment
PEO 3: Graduates will exhibit good Inter-personal skills, adapt themselves for changes in Contemporary Technology

PROGRAM SPECIFIC OUTCOMES
The students will be able to -
1. Analyse and design electronic systems for signal processing and communication applications.
2. Demonstrate the Conceptual domain Knowledge with respect to Architecture, Design, Analysis and Engineering deployment in Data communication and Computer networking.
3. Identify and apply domain specific tools for design, analysis, synthesis and validation of VLSI and Communication systems.
PROGRAM OUTCOMES

Program Outcomes (POs), are attributes acquired by the student 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 the outgoing Batch. The POs are addressed and attained through the Course Outcomes (COs) of various courses of the curriculum.

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 modelling 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.
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# BMS College of Engineering, Bangalore – 19
## Autonomous College under VTU

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**Institution Elective – 2**

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**MD – Multi Disciplinary**
### Life Skills:

<table>
<thead>
<tr>
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<th>Course Title</th>
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### Professional Skills:

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### Managerial Skills:

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3\textsuperscript{rd} – 4\textsuperscript{th} Semester Syllabus
COURSE CODE | 15MA3GCAEM | COURSE TITLE | Advanced Engineering Mathematics (Common To EC, TE, EE, IT, ML)  
CREDITS | 4 | L-T-P-S | 3-1-0-0

<table>
<thead>
<tr>
<th>CO Numbers</th>
<th>Course Outcomes</th>
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<tbody>
<tr>
<td>CO-1</td>
<td>Obtain numerical solution a system of algebraic equations, algebraic and transcendental equations and ordinary differential equations.</td>
</tr>
<tr>
<td>CO-2</td>
<td>Obtain numerical solution a system of algebraic equations, algebraic and transcendental equations and ordinary differential equations.</td>
</tr>
<tr>
<td>CO-3</td>
<td>Solve partial differential equations with appropriate boundary conditions using the method of separation of variables</td>
</tr>
<tr>
<td>CO-4</td>
<td>Construct analytic functions and simple conformal mappings</td>
</tr>
<tr>
<td>CO-5</td>
<td>Evaluate real and complex integrals using the calculus of residues</td>
</tr>
</tbody>
</table>

UNIT-I
MATRICES
7L+2T Hrs
Suggested Reading: Inverse of a matrix using Gauss-Jordan method. Largest eigenvalue and corresponding eigenvector using Rayleigh power method.

UNIT-II
NUMERICAL METHODS
interpolation formula, Lagrange's inverse interpolation Numerical integration:
Suggested Reading: Milne's method to solve ordinary differential equations. Solution of simultaneous differential equations by Runge-Kutta fourth order method.

UNIT-III
PARTIAL DIFFERENTIAL EQUATIONS
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 Hrs
Suggested Reading: Direct integration method, method of separation of variables, D'Alembert's solution of wave equation.

UNIT-IV
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 9 Hrs

UNIT-V
COMPLEX ANALYSIS-2
Complex integration: Line integral, Problems on line integral, Cauchy's theorem, Cauchy's integral formula.
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. Analysing AC circuits, Current in a field-effect transistor
MATHEMATICS LAB
2. LU decomposition of matrices.
3. Eigenvalues and eigenvectors of matrices.
4. Largest eigenvalue, smallest eigenvalue and corresponding eigenvectors of a matrix.
5. Solution of algebraic and transcendental equations using Newton- Raphson method.
7. Numerical solution of ordinary differential equations

TEXT BOOKS:

REFERENCE BOOKS

E-books
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
ASSESSMENT:

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. To set one question each from Units 1, 2, 4 and two questions from Unit 3 and Unit 5.

Questions for CIE (50%) and SEE(50%) will be designed to evaluate the various educational components (Blooms taxonomy) such as:

- Remembering and understanding the course contents (weightage: 40%)
- Applying the knowledge acquired from the course (weightage: 35%)
- Designing and analyzing various engineering problems (weightage: 15%)
- Understanding of various system models (weightage: 10%)
BMS College of Engineering, Bangalore – 19  
Autonomous College under VTU

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>DIGITAL ELECTRONICS</th>
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<td>CO-1</td>
<td>Apply the knowledge of digital circuit concepts to optimize a digital circuit.</td>
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<tr>
<td>CO-2</td>
<td>Analyze digital circuits and arrive at suitable conclusions</td>
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<td></td>
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<tr>
<td>CO-3</td>
<td>Design a digital circuit for given problem statement by applying the digital circuit concepts</td>
<td>3</td>
<td>1</td>
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<tr>
<td>CO-4</td>
<td>Conduct experiments using digital ICs to demonstrate a given application / problem statement</td>
<td>4, 10</td>
<td>1</td>
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<tr>
<td>CO-5</td>
<td>Work in a team to demonstrate an application of digital circuits by engaging in self-learning</td>
<td>4, 9, 10, 12</td>
<td>1, 3</td>
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UNIT - I

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 - II

Flip-Flops:

UNIT - III

Sequential Logic Circuits:
Shift Registers, Ripple Counters, Design of Synchronous Counters 8 Hrs

UNIT- IV

Sequential systems:
Analysis of Clocked Sequential circuits, State Reduction and Assignment, Design Procedure, Design with State Equations 7 Hrs

UNIT-V

Logic Families: Characteristic of Digital ICs, Transistor – Transistor Logic, Complementary MOS (CMOS) Logic, Comparison of TTL and CMOS families 6 Hrs

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

Text books:
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

EBooks
2. https://books.google.co.in/books/about/Fundamentals_of_Digital_Circuits.html?id=BOVkrtiLUcEC

MOOCs
4. Nptel.ac.in/courses/11710606
5. http://nptel.ac.in/courses/117105080
6. Digital Circuits and Systems Youtube - S. Srinivasan, IIT Madras

**DIGITAL ELECTRONICS**

**15ES3GCDEC Laboratory**

**Experiment List**

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<td>1</td>
<td>Applications of IC 7483 (Adders, Subtractors and Comparators)</td>
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<td>2</td>
<td>Multiplexers (using Gates and IC) and their applications</td>
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<tr>
<td>3</td>
<td>Decoders/DeMultiplexers (using Gates and IC) and their applications</td>
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<tr>
<td>4</td>
<td>BCD to Decimal decoder using 7-segment display</td>
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<tr>
<td>5</td>
<td>Verification of MSJK Flip-flop (using Gates and IC 7476)</td>
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<td>6</td>
<td>Asynchronous counters (using ICs 7476,7490,7493)</td>
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<tr>
<td>7</td>
<td>Synchronous Counters (using ICs 7476, 74190/74192)</td>
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<tr>
<td>8</td>
<td>Shift registers and their applications (using ICs 7476, 7495)</td>
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**BMS College of Engineering, Bangalore – 19**

**Autonomous College under VTU**

<table>
<thead>
<tr>
<th>COURSE CODE</th>
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<th>COURSE TITLE</th>
<th>ANALOG MICROELECTRONICS (Common to EC, TE, EE, IT, ML)</th>
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<th>CO-numbers</th>
<th>Course Outcomes</th>
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<th>PSOs</th>
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<tbody>
<tr>
<td>CO-1</td>
<td>Apply the knowledge of working principle of electronic devices to arrive at suitable conclusions for a given analog electronic circuits</td>
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<tr>
<td>CO-2</td>
<td>Analyze the given analog electronic circuit with a given specifications to compute required parameters</td>
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<tr>
<td>CO-3</td>
<td>Design analog electronic circuits for given problem statement by applying analog circuit concepts.</td>
<td>3</td>
<td>1</td>
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<tr>
<td>CO-4</td>
<td>Conduct experiments to demonstrate the application of analog electronic circuits using analog components.</td>
<td>4,9</td>
<td>1</td>
</tr>
<tr>
<td>CO-5</td>
<td>Work in a team to analyze and demonstrate an application using analog electronic components by engaging in self learning.</td>
<td>4,5,9,10,12</td>
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**UNIT - I**

**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 -The 3 frequency bands, the high frequency response, the low frequency response

**UNIT - II**

**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-VDS relationship, The P-Channel MOSFET, Complementary MOS or CMOS, Operating the MOS transistor in the sub-threshold region. Current voltage characteristics-Circuit symbol, Id-Vds 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 VGS. Biasing by fixing Connecting a resistor in the source, Biasing using a drain to gate feedback resistor, biasing using a current source

UNIT - III

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 trans conductance g_m, the T equivalent circuit model.


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 - IV

Feedback: Introduction, the general feedback structure, some properties of negative feedback: Gain density, bandwidth extension, noise reduction, reduction in non-linear distortion, the four basic feedback topologies: Voltage amplifiers, current amplifiers, Trans conductance amplifiers, practical circuits for current series and voltage series feedback

UNIT - V

Power Amplifiers: Introduction, The classification of output stages, Class A output stage, transfer characteristic, signal W/Fs, 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  

7 Hrs

Text Books:
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
2. Electronic Devices and Circuits-David A Bell - PHI 4th edition

On-line Reference:
1. www.pyroelectro.com/edu/analog
3. MOOCs
6. Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware | Reviews and Ratings

ANALOG MICROELECTRONICS
15ES3GCAME

Laboratory Experiment List

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<tr>
<th>Sl. No</th>
<th>Title of the Experiments</th>
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<td>1</td>
<td>Diode and Transistor as a switch.</td>
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<td>2</td>
<td>Zener diode characteristics and Zener as regulator.</td>
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<tr>
<td>3</td>
<td>Diode clipping circuits- Single/Double ended.</td>
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<tr>
<td>4</td>
<td>Diode clamping Circuits - positive clamping/negative clamping.</td>
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<tr>
<td>5</td>
<td>BJT as RC coupled amplifier.</td>
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<tr>
<td>6</td>
<td>BJT as RC phase shift oscillator.</td>
</tr>
<tr>
<td>7</td>
<td>Crystal Oscillator.</td>
</tr>
<tr>
<td>8</td>
<td>Power Amplifier.</td>
</tr>
<tr>
<td>9</td>
<td>Open ended experiments.</td>
</tr>
</tbody>
</table>
BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>15ES3DCLCA</th>
<th>COURSE TITLE</th>
<th>LINEAR CIRCUIT ANALYSIS (Common to EC, TE, EE, IT, ML)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CREDITS</td>
<td>4</td>
<td>L-T-P-S</td>
<td>3-1-0-0</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Apply the basic circuital laws and network theorems to linear circuits, and two port networks.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO-2</td>
<td>Formulate tie–set and cut-set matrices for network topology and Analyze a linear circuit in time and frequency domain.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO-3</td>
<td>Simulate a linear circuit using appropriate tool.</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

UNIT - I
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 super node and super mesh.  
5L+2T Hrs

UNIT - II
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, B and width
8L+3T Hrs

UNIT - III
Network Theorems: Super position, Reciprocity, Millman's, Thevinin's and Norton's theorems; Maximum Power transfer theorem
7L+3T Hrs

UNIT - IV
Transient behaviour and initial conditions: Behavior of circuit element sunders witching condition and their representation, evaluation of initial and final conditions in RL, RC and

10L+3T Hrs

UNIT - V

Two port network parameters and State Variable analysis: Definition of z, y, hand transmission parameters, modelling with these parameters, relationship between parameters sets. Writing state equations and solution using Laplace transforms.  

6L+1T Hrs

Text Books:

Reference Books:
5. Nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur
6. Nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi
7. www.electrodiction.com/circuit-theory

MOOCs:
1. http://elearning.vtu.ac.in/06ES34.html
2. https://www.coursera.org/course/circuits
UNIT - I

UNIT - II

UNIT -III
Time varying fields and Maxwell's equations: Faraday's Law, Displacement Current, Maxwell's Equations in Point and Integral Form, retarded potentials
UNIT - IV

Uniform plane waves: Wave equations, solution of wave equation, wave propagation through good dielectric, good conductor, skin effect, Poynting Theorem, wave polarization.

7L+3T Hrs

UNIT - V

Plane wave reflection and dispersion: Reflection of uniform plane waves at normal incidence, SWR, Wave reflection from multiple interfaces, plane wave propagation in general directions, plane wave reflection at oblique incidence angles, total reflection and total transmission of obliquely incident waves, wave propagation in dispersive media, pulse broadening in dispersive media

8L+2T Hrs

This course shall include an assessment based on the QEEE Phase IV on 'Electromagnetic Waves' taught by Prof. Deepa Venkatesh, IIT Madras

Text Books:

Reference Books:

On-line Reference:
1. http://nptel.ac.in/courses/108106073/
3. Transmission%20Lines%20and%20EM%20Waves/Course%20Objective.htm

MOOCs:
1. http://emt-iiith.vlabs.ac.in/
2. http://emt-iiith.vlabs.ac.in/Experiment.php?code=C001 to C010
3. http://nptel.ac.in/courses/108106073/1 to 108106073/42
PART – A
(MATLAB)

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make use of MATLAB features to represent data and model systems</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Examine simulated data in various formats for solving Engineering problems</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Model and simulate basic Engineering problem using MATLAB and SIMULINK</td>
<td>5,10</td>
<td>3</td>
</tr>
</tbody>
</table>

Experiments
PART A
(MATLAB)

1. Introduction: The MATLAB Environment, Data addressing, Language fundamentals, Operators, Functions & System objects, Data input & output, Matlab functions
4. Signal generation and system analysis- Using MATLAB commands, Solution of mesh current and node voltage equations using matrix operations. Obtain the time response of first and second order systems and the domain specifications.
Realize a logical expression using Boolean algebra

**PART B**

*(Simulink)*

1. Create mathematical models of systems, Interact with MATLAB workspace and obtain the plots.
2. Use of Simulink tool box, steps involved in creating system models using the Simulink Library, solver selection, creating model hierarchy
3. Obtain the transient response of first order and second order systems. Transfer of variables between Simulink and MATLAB workspace and obtain their plots.
4. Modelling Mechanical /Electrical systems-such as Full wave rectifier design, Op Amp Configuration, Digital system etc. (not limited)
UNIT - I

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 Hrs

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

UNIT – II

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

**Suggested Reading:** Lagrange's theorem and its consequences.

**UNIT - III**

**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 Hrs

**Suggested Reading:** Konigsberg bridge problem, Utility problem

**UNIT- IV**

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 Hrs

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

**UNIT - V**

**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 Hrs

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

**Mathematics Lab:**
1. Probability distributions
3. Shortest Path- Dijkstra's algorithm

**Text Books:**

Reference Books:

E books
   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

Assessment
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. To set one question each from Units 1, 4, 5 and two questions from Unit 2 and Unit 3.

Questions for CIE (50%) and SEE(50%) will be designed to evaluate the various educational components (Blooms taxonomy) such as:
- Remembering and understanding the course contents (weightage: 40%)
- Applying the knowledge acquired from the course (weightage: 35%)
- Designing and analyzing various engineering problems (weightage: 15%)
- Understanding of various system models (weightage: 10%)
UNIT – I

Overview of Digital Design with Verilog HDL:
Evolution of computer aided digital design, Emergence of HDLs, Typical design flow, importance of HDLs, Verilog HDL and Design. Methodologies, modules, instances, components of simulation, example, basic concepts.

Modules and ports: Modules, ports, Rules, Hierarchical Names. Gate Level modeling and Data flow modeling: Gate Types, Gate Delays, Examples, and Continuous assignment, Delays, Expressions, Operators, Operands, Operator Types and Examples. 8 Hrs

UNIT - II

Behavioural Modelling: Structured procedure, procedural assignments, timing control, conditional statements, multi way branching, loops, sequential and parallel blocks, generate blocks, Examples.
Tasks and Functions: Difference between task and functions, Tasks, functions, automatic functions, Constant function, signed function. 7 Hrs
UNIT - III
Logic synthesis with Verilog HDL:
Logic synthesis, Verilog HDL Synthesis, Interpretation of Verilog Constructs, Synthesis Design flow, examples, verification of the gate level netlist, modeling tips for logic synthesis.
Timing and delays: Types of delay models, modeling, timing checks and delay back annotation 7 Hrs

UNIT – IV
FPGA based systems:
Introduction, basic concepts, Digital design with FPGAs, FPGA based system design. FPGA Fabrics: FPGA architectures, SRAM based FPGAs, Chip I/O and Circuit design of FPGA fabrics, Architecture of FPGA fabrics, SPARTAN III and above 7 Hrs

UNIT – V
Synchronous sequential circuits:
Moore and Mealy machines, definition of state machines, state machine as sequence controller, Design of state machines, state table, state assignment, transition excitation table, logic realization, Design example- Serial adder 7 Hrs

Text Books:
2. Wayne Wolf, “FPGA based system design”, Reprint 2005, Pearson Education

Reference Books:

EBooks

MOOCs
1. Electronic Design Automation  http://nptel.ac.in/courses/106105083/
2. Digital system design with PLDs and FPGAs [http://nptel.ac.in/courses/117108040/](http://nptel.ac.in/courses/117108040/) Fundamentals of HDL (Lecture #008)

3. [https://www.youtube.com/watch?v=rdAPXzeaxs&index=8&list=PLE3BC3EBC9CE15FB0](https://www.youtube.com/watch?v=rdAPXzeaxs&index=8&list=PLE3BC3EBC9CE15FB0)

**Verilog HDL Programming**

**15EC4DCHDL**

**Laboratory Experiment List**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Title of the Experiments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Realization of logic gates and half adder</td>
</tr>
<tr>
<td>2</td>
<td>Implementation of MUX and DEMUX</td>
</tr>
<tr>
<td>3</td>
<td>Implementation of Decoder and Encoder</td>
</tr>
<tr>
<td>4</td>
<td>Implementation of Binary to Gray and Gray to Binary</td>
</tr>
<tr>
<td>5</td>
<td>Implement Comparator using different types of descriptions</td>
</tr>
<tr>
<td>6</td>
<td>Implement full adder using three descriptions</td>
</tr>
<tr>
<td>7</td>
<td>Implementation of 8 - BIT ALU</td>
</tr>
<tr>
<td>8</td>
<td>Realization of SR, D, JK &amp; T flip-flops.</td>
</tr>
<tr>
<td>9</td>
<td>Implementation a 4-bit (BCD/ Binary) Up/Down counter</td>
</tr>
<tr>
<td>10</td>
<td>Implementation of Sequence Generator</td>
</tr>
<tr>
<td>11</td>
<td>Seven-Segment display interface</td>
</tr>
<tr>
<td>12</td>
<td>Open Ended Experiments</td>
</tr>
</tbody>
</table>
UNIT- I

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. 8 Hrs

UNIT- II

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) 7 Hrs
UNIT- III
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- IV
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 - V

Text Book:
2. Op-Amps and Linear Integrated Circuits- Ramakanth A.Gayakwad, 4th ed, PHI

Reference Books:
2. “Opamps and Linear ICs”,David A.Bell(Prentice-Hall Publications)

E Books

MOOCs
2. Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware | Reviews and Ratings

ANALOG INTEGRATED CIRCUITS
15ES4GCAIC Laboratory
Experiments List

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Title of the Experiments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inverting and non-inverting amplifier, voltage follower</td>
</tr>
<tr>
<td>2</td>
<td>Inverting and non-inverting summing Amplifier</td>
</tr>
<tr>
<td>3</td>
<td>Differentiator and integrator</td>
</tr>
<tr>
<td>4</td>
<td>Precision half wave and full wave rectifier</td>
</tr>
<tr>
<td>5</td>
<td>Zero crossing detector and Schmitt trigger</td>
</tr>
<tr>
<td>6</td>
<td>Weinbridge Oscillator</td>
</tr>
<tr>
<td>7</td>
<td>First order active low pass filter</td>
</tr>
<tr>
<td>8</td>
<td>First order active high pass filter</td>
</tr>
<tr>
<td>9</td>
<td>555 as astable multivibrator</td>
</tr>
<tr>
<td>10</td>
<td>555 as monostable multivibrator</td>
</tr>
<tr>
<td>11</td>
<td>IC 723 as low voltage and high voltage regulators</td>
</tr>
<tr>
<td>12</td>
<td>D to A convertor</td>
</tr>
<tr>
<td>13</td>
<td>A to D convertor</td>
</tr>
<tr>
<td>14</td>
<td>Clipping Circuits</td>
</tr>
<tr>
<td>15</td>
<td>Clamping Circuits</td>
</tr>
</tbody>
</table>
UNIT - I

INTRODUCTION TO MICROCOMPUTER AND MICROCONTROLLER:

UNIT - II

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. 8 Hrs
UNIT - III

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 8 Hrs

UNIT - IV

INTERRUPTS AND INTERRUPT PROGRAMMING:
Concept of Interrupts, Interrupts in 8051. Programming Timer Interrupts, Programming External Hardware Interrupts, Programming Serial Communication Interrupts 7 Hrs

UNIT - V

Interfacing 8051 to LCD, DAC, ADC Stepper motor interfacing. Applications of microcontrollers 6 Hrs

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:

Reference Books:
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
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
UNIT - I
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 10 Hrs

UNIT- II
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 10 Hrs

UNIT – III
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. 8 Hrs
UNIT - IV

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.  

10 Hrs

UNIT - V


10 Hrs

Text Books:

Reference Books:

E Books
2. NPTEL lecture Video on Signals and Systems by Prof. T.K. Basu, IIT Kharagpur. http://www.nptel.ac.in/courses/108105065/

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 CODE | 15EC4DCTWD | COURSE TITLE | Technical Writing and Documentation
---|---|---|---
CREDITS | 1 | L-T-P-S | 0-0-1-0

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<thead>
<tr>
<th>COs</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Identify and understand the primary genres of technical writing, including, project reports, project proposals, technical descriptions (manuals), product documents, user manual, release notes, Technical paper, recommendation reports, letters, memos, resumes and cover letters.</td>
<td>10, 11</td>
<td>1</td>
</tr>
<tr>
<td>CO-2</td>
<td>Exposure to documentation deliverables</td>
<td>8, 10, 11</td>
<td>1</td>
</tr>
<tr>
<td>CO-3</td>
<td>Writing and documenting using industry standard tools</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

Concepts of Technical Writing and Documentation:
Documentation Standards, Documentation development life cycle, documents comparison tool, Industry standard Technical writing tools and benefit, Single sourcing and variance output, Content management system, Evolution of online help systems.


Tools for Technical Writing:

LATEX, MS Word, MS Excel, Power Point, Adobe Frame maker, Page maker, Photoshop, HTML/DHTML/XML (Flash), Adobe Robo Help Acrobat Reader, MS Visio, Snagit
Reference Book(S):


Methodology

1. 2 days workshop on Technical Writing and Documentation by Industry experts
2. In house lecture series and interactive session
3. Continuous Evaluation through hands on assignment
BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

MANDATORY MATHEMATICS COURSES FOR
LATERAL ENTRY STUDENTS

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>15MA3IMMAT</th>
<th>COURSE TITLE</th>
<th>Mathematics-I</th>
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<td>L-T-P-S</td>
<td>0-0-0-0</td>
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</tbody>
</table>

### COs

<table>
<thead>
<tr>
<th>CO-1</th>
<th>Understand the basic concepts of differentiation and integration.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-2</td>
<td>Apply the concepts of polar curves and multivariate calculus.</td>
</tr>
<tr>
<td>CO-3</td>
<td>Apply analytical techniques to compute solutions of first and higher order ordinary differential equations.</td>
</tr>
<tr>
<td>CO-4</td>
<td>Apply techniques of vector calculus to engineering problems</td>
</tr>
<tr>
<td>CO-5</td>
<td>Comprehend the generalization of vector calculus in curvilinear coordinate system.</td>
</tr>
</tbody>
</table>

### UNIT - I

DIFFERENTIAL AND INTEGRAL CALCULUS:

9 Hrs

### UNIT - II

POLAR COORDINATES AND PARTIAL DERIVATIVES:

10 Hrs
UNIT - III

UNIT - IV
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 Hrs

UNIT - V

Text books:

Reference Books:

Ebooks
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 CODE | 15MA41MMAT | COURSE TITLE | Mathematics-II
---|---|---|---
CREDITS | 0 | L-T-P-S | 0-0-0-0

<table>
<thead>
<tr>
<th>COs</th>
<th>Course Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Use Laplace transforms to solve differential equations</td>
</tr>
<tr>
<td>CO-2</td>
<td>Apply double integrals to compute areas.</td>
</tr>
<tr>
<td>CO-3</td>
<td>Learn to use triple integrals in computing volumes.</td>
</tr>
<tr>
<td>CO-4</td>
<td>Use Gamma and Beta functions to evaluate integrals.</td>
</tr>
<tr>
<td>CO-5</td>
<td>Ability to understand the use of integral calculus in scalar and vector fields.</td>
</tr>
</tbody>
</table>

UNIT - I
LAPLACE TRANSFORMS:
Laplace transforms of standard functions. Properties and problems. Laplace Transform of Periodic functions with plotting. Unit step function. 6L+2T Hrs

UNIT - II
INVERSE LAPLACE TRANSFORMS:
Inverse Laplace transforms of standard functions. Properties and problems. Solution of ODE-Initial and Boundary value Problems. 7L+2T Hrs

UNIT - III
DOUBLE INTEGRAL:
Evaluation of double integral. Change of order of integration. Change of variables to polar coordinates. Application: Area. 8L+3T Hrs

UNIT - IV
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 Hrs

UNIT - V
VECTOR INTEGRATION:
Line integral. Green's theorem. Stokes' theorem. Gauss divergence theorem. 6L+2T Hrs
Text Books:

Reference Books:
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
5th – 6th Semester Syllabus
Program Core Course Syllabus
Course Outcomes

<table>
<thead>
<tr>
<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Apply various concepts of theorems and Transforms for computing parameters of Communication systems</td>
<td>1</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze performance of different types of Analog modulation Techniques for a given set of parameters</td>
<td>2</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design Analog Communication subsystems for given set of specifications</td>
<td>3</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-4</td>
<td>Simulate and conduct experiments on different types of Analog communication subsystems</td>
<td>4, 5</td>
<td>1,2,3</td>
</tr>
<tr>
<td>CO-5</td>
<td>Involve in independent/team learning, Communicate effectively and engage in life-long learning</td>
<td>9, 10,12</td>
<td>1,2,3</td>
</tr>
</tbody>
</table>

UNIT- I
Random variables, Gaussian distribution, random processes, Stationarity, Mean, Correlation and Covariance functions, Transmission of random signals through linear systems. NOISE: Introduction, shot noise, thermal noise, white noise, Noise equivalent bandwidth, Narrow bandwidth.  

7 Hrs

UNIT- II
Amplitude Modulation (AM), DSBSC- time-domain and Frequency domain representation, Generation and Detection. Quadrature carrier multiplexing, Noise in AM receivers- AM and DSBSC.  

7 Hrs

UNIT- III
Hilbert transform, properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals Single side band modulation: Frequency domain description, Generation and Demodulation, noise in SSB receiver.
VESTIGIAL SIDE BAND MODULATION (VSB): Time and Frequency domain description, Generation and detection. Frequency translation, Frequency division multiplexing.  

UNIT- IV


UNIT- V

Digital Communication: Basic operations in Digital Communications, Sampling Theorem, Quadrature Sampling of Band pass signals, Practical aspects of sampling and signal recovery, Pulse amplitude Modulation and TDM.  

List of Experiments:
1. Conduction of 2\textsuperscript{nd} order filters.
2. Conduction of mixer.
3. Generation and detection of AM, DSBSC waves.
4. FM wave generation.
5. Generation and detection of PAM.
6. TDM and Demultiplexing.
7. Verification of sampling theorem.

Text Books:

Reference Books:
<table>
<thead>
<tr>
<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
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<tr>
<td>CO-1</td>
<td>Apply the concepts of transform techniques in realizing Discrete time signal and Digital filters</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze various transform techniques for discrete time signals and various methods to design digital Filter</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design of Analog and Digital Filters for given specifications.</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CO-4</td>
<td>Simulation and verification of various transform techniques and filter Design</td>
<td>4, 5</td>
<td>1,3</td>
</tr>
<tr>
<td>CO-5</td>
<td>Engage in self-study to design and demonstrate an application of digital signal processing</td>
<td>4,5, 9, 10, 12</td>
<td>1, 3</td>
</tr>
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</table>

**UNIT - I**

Introduction to DSP, Frequency-domain Sampling (Sampling of DTFT), DFT and its Inverse, DFT as a Linear Transformation (Matrix formulation), Properties of DFT: Periodicity, Linearity, Circular Time shifting, Circular Frequency Shifting, Circular Time Reversal, Conjugation and Conjugate Symmetry (Symmetry properties), Duality, Circular Convolution (Multiplication of two DFTs), Circular correlation, Multiplication(or Modulation) property, Parseval’s Relation. **8 Hrs**

**UNIT - II**

Linear convolution using Circular Convolution, Filtering of long data sequences using DFT: Overlap save method, overlap Add method, Relation between DFT and other transforms. Computational complexity of Direct Computation of DFT **7 Hrs**
UNIT- III

UNIT- IV

UNIT- V
Properties of FIR Digital Filters, Design of FIR Filters using Windows: rectangular, triangular, Hamming, Hanning , Blackman window, Kaiser Window. Design of FIR Filters using frequency Sampling Method Realization of Finite Impulse Response (FIR) systems: Direct Form, Linear Phase Form Gibbs phenomenon (qualitative discussion only), comparison between IIR and FIR filters

Lab Experiments:
Display of basic elementary signals, sampling theorem, basic operations on sequences (shifting, folding, time scaling and multiplication), linear and circular convolution, cross and auto correlation, linear convolution and correction using FFT algorithm, FFT of Sequence, FIR Filter design-LP, HP, BP and Notch filter, FIR filter design using Hamming and Kaiser window for the given order and cut-off frequency, Design of IIR FILTER-LP,HP (using both hardware and software)

Text Books:
1. Discrete-Time Signal Processing (Second Edition), Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck, Pearson Education India

Reference Books:


E-books:

MOOCs:
1. https://www.coursera.org/course/dsp
2. https://www.edx.org/course/discrete-time-signal-processing-mitx-6-341x-0
BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

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<th>FUNDAMENTALS OF VLSI</th>
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<tr>
<td>CO-1</td>
<td>To Apply the knowledge of CMOS technology to construct basic and advanced CMOS logic circuit like memory &amp; array subsystems</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyse the ideal &amp; non ideal IV effects of MOSFET and DC transfer characteristics CMOS circuit</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design of CMOS based combinational and sequential circuits for given specification</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>

UNIT- I
MOS Transistor: Introduction, Ideal I-V characteristics, C-V Characteristics, Simple MOS Capacitance Models, Detailed MOS Gate Capacitance Model, Non ideal I-V Effects, Mobility Degradation and Velocity Saturation, Channel Length Modulation, Threshold Voltage Effects, Junction Leakage, Body effect, Tunneling. **7 Hrs**

UNIT- II
CMOS Processing Technology: CMOS Technologies, Wafer Formation, Photolithography, Well and Channel Formation, Silicon Dioxide (SiO2), Isolation, Gate Oxide, Gate and Source/Drain Formations, Contacts and Metallization, Passivation, Metrology, Layout design rules, CMOS Process enhancements. **7 Hrs**

UNIT- III
DC Transfer Characteristics: Static CMOS Inverter DC Characteristics, Beta Ratio Effect, Noise Margin, Pass Transistor DC Characteristics.
Combinational Circuit Design: CMOS Logic, Inverter, NAND Gate, NOR Gate
CMOS, Logic Gates, The Compound Gates, Pass Transistors and Transmission Gates,
Tristate buffer, Multiplexers. 7 Hrs

UNIT- IV
Sequential MOS logic circuitry: Behavior of Bistable element, SR Latch Circuitry, Clocked
latch and Flip Flop Circuitry, C-MOS D-Latch and Edge Triggered Flip-Flop.
Sequencing Static Circuits: Sequencing Methods, Max-Delay Constraints, Min-Delay
Constraints, Time Borrowing, Clock Skew 7 Hrs

UNIT- V
Array Sub system: SRAM: Memory cell Read/Write operation, Decoder, Bit-line
conditioning and Column Circuitry, Multi-Ported SRAM and Register Files, Large SRAMs.
DRAM: Subarray Architectures, Column Circuitry, Embedded DRAM.
Read-Only Memory: Programmable ROMs, NAND ROMs. 8 Hrs

Text Books:

Reference Books:
UNIT- I


Transmission line theory: Introduction, Transmission line equations, Characteristic and input Impedances, reflection and transmission coefficients, standing waves and SWR, Mismatch losses in transmission lines, Smith chart, Application of smith chart.

Microwave transmission lines (Qualitative analysis only): Co axial line, Planar transmission lines, Strip lines, Micro strip lines, slot lines and Coplanar lines

UNIT- II

Microwave network theory: Introduction, Symmetrical Z and Y parameters, for reciprocal Networks, S matrix representation of multi-port networks- Properties of S parameters, S –
parameters of a Two – port network with mismatched load, Comparison b/n [S], [Z], and [Y] matrices, Relations of Z, Y, ABCD parameters with S-Parameters.  

UNIT- III
Passive Devices: Introduction, Coaxial cables, connectors and adapters, Wave guide sections, matched terminations, Wave guide corners, bends, Twists, Coaxial line to waveguide adapters, Attenuators, Phase shifters, Waveguide Tees, Magic tees, circulators and isolators, directional couplers- Bethe-hole coupler, Multi-hole directional coupler(Qualitative analysis Only).  

UNIT- IV

UNIT- V

Text Books:

Reference Books:
2. Microwave Devices and circuits- Liao / Pearson Education.
3. Rizzi P.A., "Microwave Engineering, Passive Circuits Hall of India
5. Chatterji R., Microwave Engineering, Special topics, East West Press
BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

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<td>CO-1</td>
<td>Understand Basic control systems and applying different techniques to reduce system and determine stability.</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyzing system performance and stability using different approaches.</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO-3</td>
<td>Evaluation of system performance by varying system parameters of the control systems.</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CO-4</td>
<td>Create, Apply and analyze control system problems using MATLAB or Simulink tool</td>
<td>5, 10</td>
<td>1</td>
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UNIT- I
Mathematical Modeling of Linear Systems: Transfer functions determination of Mechanical and electrical systems (analogous systems) using various approaches: block diagram, Signal Flow Graph, state space modeling (include DC motor control and PID controller).

12L+4T Hrs

UNIT- II
Time response analysis of control systems: Step response of first order, second order systems, response specification, steady state error and error constants.

6L+3T Hrs

UNIT- III
Stability analysis: Concept of stability, RH criterion, applications of RH criterion with limitations, Polar plots, concept of Nyquist plot.

5L+2T Hrs
UNIT- IV

UNIT- V
Frequency response analysis: Bode plots, Relative stability, Frequency domain specifications.

Text Books:
1. Control Engineering by Nagrath & Gopal, New Age International Publishers
2. Control Engineering An introduction with the use of MATLAB Derek P. Atheron

Reference Books:
1. Modern control Engineering - Ogata, Prentice Hall
2. Automatic Control Systems - B.C Kuo, John Wiley and Sons
COURSE CODE: 16EC6DCCT2
COURSE TITLE: COMMUNICATION THEORY - 2
CREDITS: 6
L-T-P-S: 3-0-1-2

UNIT- I
Introduction to DCS, Pulse code modulation, generation and detection of PCM, need for Robust quantization-companding, differential PCM; Delta modulation, Adaptive delta modulation; Signal-to-Noise Ratio calculations, TDM-PCM, T1 and E1 digital Hierarchy. Line codes, ISI in band limited channels, Zero-ISI condition- the Nyquist criterion, Solution for zero ISI, Raised cosine filters, Duo binary encoding.  

UNIT- II
Optimum Receiver for AWGN channel, Matched filter and Correlation type receivers, Digital Modulations- Generation and detection of ASK, BPSK and BFSK, QPSK and DPSK. Signal space constellation, Computation of probability of bit error for BPSK, BFSK. Performance
analysis of all the schemes in terms of probability of bit error, BW and Power and their Comparison. Introduction to OFDM  

UNIT- III  
Need for Spread Spectrum Modulation, PN sequence and its properties, Direct sequence SS system- DS/BPSK Transmitter & Receiver, Processing gain, Jamming margin, Frequency hop SS system- FH-FSK transmitter and Receiver, Fast and slow hop. Application of DS SS and FHSS for multiuser environment – CDMA, Multipath fading. Introduction to diversity technique  

UNIT- IV  
Measurement of Information; Entropy and information rate, communication channels, Shannon’s Channel Capacity theorem and its trade off.  
Source encoding: Properties of codes, Shannon Fano Encoding Algorithm, Huffman’s coding algorithm.  

UNIT- V  
Channel coding: Linear Block codes, Error Detecting and Correcting capability, Binary Cyclic Codes, algebraic structure, Encoding using shift registers, Syndrome calculation Convolutional Encoding: Convolutional Encoder Representation in time and transform domain. Tree, trellis and state representation  

List of Hardware and Software Experiments  
1. Design TDM circuitry to demonstrate TDM of two band limited signals.  
2. Design and demonstrate PSK generation and detection.  
3. Design and demonstrate ASK generation & Detection.  
4. Design and demonstrate FSK generation & Detection.  
5. Demonstrate and analyse ISI from eye pattern.  
6. Demonstrate and analyse PCM coding and decoding.  
7. Demonstrate and analyse performance of Digital communication transmission and reception with and without channel coding.  
8. Demonstration and analysis of Spread spectrum for CDMA.  

Text Books:  
Reference Books:

2. Concepts of Information theory and coding, P.S. Satyanarayana, DYNARAM, 2005

E-books:

1. Digital communications by John Barry and Lee, Springer
2. NPTEL lecture series: Prof Bikas Kumar Dey, IIT Bombay.
## Course Details

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### Unit-I

Review of MOS Single-stage Amplifiers, Differential Amplifiers: basic differential pair (quantitative, qualitative analysis) half circuit concept, common mode response, current mirrors (only passive current mirror).

8 Hrs

### Unit-II

Operational Amplifiers: General considerations, One-Stage Op amps, Two-Stage Op amps, Gain Boosting, Input Range Limitations.

7 Hrs

### Unit-III

Oscillators and Phase Locked Loops: VCO, Mathematical Model of VCO, Simple PLL, Charge pump PLL.

7 Hrs

### Course Outcomes

<table>
<thead>
<tr>
<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
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<tr>
<td>CO-1</td>
<td>Apply the knowledge of basic CMOS technology to understand and explain the concepts of analog integrated circuits and mixed signal circuits</td>
<td>1</td>
<td>1, 3</td>
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<tr>
<td>CO-2</td>
<td>Analyze CMOS based Analog, ADC and DAC circuits</td>
<td>2</td>
<td>1, 3</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design analog CMOS integrated circuits and mixed signal circuits</td>
<td>3</td>
<td>1, 3</td>
</tr>
<tr>
<td>CO-4</td>
<td>Conduct experiments on Analog and mixed signal CMOS circuits using modern EDA tools</td>
<td>4, 5</td>
<td>1, 3</td>
</tr>
<tr>
<td>CO-5</td>
<td>Engage in self learning to design and demonstrate an application using CMOS based mixed signal circuits</td>
<td>4, 5, 9, 10, 12</td>
<td>1, 3</td>
</tr>
</tbody>
</table>
UNIT- IV

7 Hrs

UNIT- V
DAC Architectures: Digital Input Code, Resistor String, R-2R Ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, Pipeline DAC.
ADC Architectures: Flash ADC, Two-Step Flash ADC, Pipeline ADC, Integrating ADCs, Successive Approximation ADC, Oversampling ADC.

7 Hrs

Text books:

Reference Books:

Lab Experiments:
All experiments must be implemented using Industry standard EDA tools

1. Design the analog circuits using MOS transistors:
   a. Draw the schematic and verify the following
      (i) DC Analysis
      (ii) AC Analysis
      (iii) Transient Analysis
   b. Draw the Layout and verify the DRC, ERC
   c. Check for LVS.
2. Design a two stage op-amp with given specification using given differential amplifier, Common Source and Common Drain amplifier in library and complete the design flow mentioned below:
   a. Draw the schematic and verify the following
      (i) DC Analysis
(ii) AC Analysis
(iii) Transient Analysis

b. Draw the Layout and verify the DRC, ERC

c. Check for frequency response, slew rate, offset effects and Noise.

3. Design a simple ADC/DAC and measure the data conversion time.
4. To measure INL and DNL of converter.
COURSE CODE | 16EC6DCCCN | COURSE TITLE | COMPUTER COMMUNICATION NETWORKS
---|---|---|---
CREDITS | 3 | L-T-P-S | 3-0-0-0

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<tr>
<td>CO-1</td>
<td>Apply the concepts of Computer Networks and Networks Models for Data Communication.</td>
<td>1</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze networking architecture and infrastructure for wired and wireless link.</td>
<td>2</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-3</td>
<td>Skill to substantiate design and performance issues in LANs for a given specification.</td>
<td>3</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-4</td>
<td>Ability to submit a report on the impact/growth of wired and wireless network for societal and sustained development.</td>
<td>7, 10</td>
<td>1,2</td>
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</table>

UNIT - I
Introduction to Building a Network, Applications, Requirements, Network Models, Data and signals, Digital transmission, analog Transmission, Multiplexing and Spreading  
6 Hrs

UNIT- II
Transmission Media, Switching, Telephone Networks and Cable networks for data transmission  
6 Hrs

UNIT- III
Error detection and Correction, Data link control  
10 Hrs

UNIT- IV
Multiple Access, Wired LANs, Wireless LAN  
8 Hrs

UNIT - V
Connecting LANs, Back bone Networks, Virtual LANs, Virtual Circuit Networks (ATM and Frame Relay)  
6 Hrs
Text Books:

1. Data Communication and Networking, Farouzan, Mc Graw Hill Education.
2. Computer Networks, Andrew S.Tanenbaum
## Course Content

### UNIT- I

Antenna Basics: Physical concept of radiation, near and far field regions, basic antenna parameters: radiation patterns, beam area, radiation Intensity, beam efficiency, reciprocity, directivity and gain, antenna apertures, effective height, bandwidth, radiation efficiency, radio communication Link, antenna temperature and antenna field zones. Short electric dipole, fields of a short dipole, radiation resistance of dipole, Half wave dipole antenna, folded dipole antennas  

7L+3T Hrs

### UNIT- II

Point Sources & their arrays: Arrays, Point source, Power theorem and its application, Examples of power patterns, Field patterns, Phase patterns, Array of isotropic point sources-different cases, non-isotropic sources, principle of pattern multiplication, linear arrays of n elements of equal amplitude & spacing, broad side, end fire arrays, radiation pattern, directivity, beam width and null directions, array factor, Directions of maxima, Linear broadside arrays with non-uniform amplitude distributions-general condition. Phased arrays.  

8L+2T Hrs

### Course Outcomes

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<td>CO-1</td>
<td>Apply the concepts &amp; properties of Electro-Magnetism to obtain parameters of antennas and Wave Propagation</td>
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<td>2</td>
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<tr>
<td>CO-2</td>
<td>Analyze different types of antennas, characteristics of radio-waves and their propagation in the atmosphere</td>
<td>2</td>
<td>2</td>
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<tr>
<td>CO-3</td>
<td>Effectively prepare and present a seminar/case study on assigned topics related to Advanced topics/Safety measures/antenna design as an individual/team</td>
<td>5, 6, 10</td>
<td>2</td>
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</table>
UNIT- III
Loop, Slot, Patch and Horn Antenna: Introduction, small loop, far fields of small loop, far field patterns of circular Loop, radiation resistance, directivity, slot antenna, Babinet’s Principle and complementary antennas, patch antennas, horn antennas, rectangular horn antenna  

7L+2T Hrs

UNIT- IV
Antenna types: Helical antenna, YagiUda array, parabolic reflectors, Log periodic antenna, Antenna design considerations for satellite communication, Antennas for mobile communications systems: Mobile Terminal antennas, Base station antennas, Introduction to MIMO  

7L+2T Hrs

UNIT- V
Radio Wave Propagation: Introduction, ground wave propagation, free space propagation, Ground reflection, surface wave, diffraction Troposphere wave propagation Tropospheric scatter, ionosphere propagation, electrical properties of the ionosphere, effects of Earth’s magnetic field.  

7L+3T Hrs

Text Books:
Department Elective Course Syllabus
DEPARTMENTAL ELECTIVE - 1

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### COURSE OUTCOMES

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<td>Apply enhancement and restoration techniques to 2D images in spatial and frequency domain for required visualization.</td>
<td>1</td>
<td>1</td>
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<tr>
<td>CO-2</td>
<td>Analyze and represent an image using transform techniques in different domains.</td>
<td>2</td>
<td>1</td>
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<tr>
<td>CO-3</td>
<td>Interpret image in various data formats by applying image transformation / processing techniques for different applications.</td>
<td>4</td>
<td>1</td>
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**UNIT-I**

Introduction to Image Processing: Introduction, Fundamental steps in DIP, Components of DIP system, A simple image formation model, Image sampling and quantization, Basic relationship between pixels, Arithmetic and Logical operations on images, Fundamentals of color image processing, Color models, Conversion of color models from one form to other form.

5L+3T Hrs

**UNIT- II**


4L+2T Hrs

**UNIT- III**

Image Restoration: Image degradation/restoration model, Inverse filter, Pseudo Inverse

**UNIT-IV**

Morphological Image Processing: Preliminaries, Dilation and erosion, opening and closing, Basic morphological operations: Boundary extraction, Region filling, extraction of connected components, convex hull, thinning, thickening, skeleton, pruning.  

**UNIT-V**


**Text Book:**


**Reference Book:**

**Course Outcomes**

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<tr>
<td>CO-1</td>
<td>Apply the concepts of Digital design to create digital building blocks using Verilog.</td>
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<tr>
<td>CO-2</td>
<td>Analyze the RTL timing to report violations and synthesize to generate gate level netlist.</td>
<td>2</td>
<td>3</td>
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<tr>
<td>CO-3</td>
<td>Design of RTL using finite state machines along with design optimization.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO-4</td>
<td>Simulate and debug the design using test benches and analyze the synthesis timing and power reports.</td>
<td>4,5,9,10</td>
<td>3</td>
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**UNIT-I**

Logic Design Using Verilog: Moore’s law, Technology Scaling, Die size growth, Frequency, Power dissipation, Power density, Challenges in digital design, Design metrics, and Cost of Integrated circuits, Digital Combinational & Sequential circuits. Lexical Conventions, Data Types, Levels of Abstraction, Modules, Nets, Values, Comments, arrays in Verilog, Expressions, Operators, Operands, Arrays, memories, Strings, Delays, parameterized designs, Procedural blocks, Blocking and Non-Blocking Assignment, looping, flow Control, Task, Function, basic test bench generation and Simulation, Verilog modeling of combinational and sequential logic  

6L+4T Hrs

**UNIT-II**


6L+2T Hrs
UNIT - III
Introduction to Timing concepts: Setup and hold times. Setup and hold time equalities and inequalities, timing paths. Static timing delay calculation for basic flip flop & sequential circuits, Clock Domain Crossing.  
4L+2T Hrs

UNIT- IV
Synthesis, Libraries and Technology Mapping: Introduction to synthesis, logical synthesis of basic combinational and sequential circuits, Synthesis Methodologies, Pre and post synthesis mismatch, Translation, mapping and optimization. Overview of Libraries, design constraints, importance of wire load models  
4L+2T Hrs

UNIT- V
Design and simulation of Finite state Machines: FSM Design – overlapping and non-overlapping Mealy and Moore state machine design  
4L+2T Hrs

Reference Books:
3. Verilog HDL Synthesis A Practical Primer by J. Bhasker
# DEPARTMENTAL ELECTIVE-1

## COURSE CODE
16EC5DE1EI

## COURSE TITLE
EMI AND EMC

## CREDITS
3

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<td>CO-1</td>
<td>Apply the knowledge of EMI/EMC in prototyping an electronic system design</td>
<td>1</td>
<td>2</td>
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<tr>
<td>CO-2</td>
<td>Ability to analyse/apply reasoning through knowledge acquisition with regard to Noise Coupling, Noise reduction, EMI suppression</td>
<td>2,6</td>
<td>2</td>
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<tr>
<td>CO-3</td>
<td>Understand the impact of EMI compliance, IEEE EMI Standards and measurements, which is important in Electronic system design in modern era with an example of SMPS.</td>
<td>7</td>
<td>2</td>
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## UNIT- I

Introduction of EMC, Electromagnetic environment, History, concept, Natural and intentional source of EMI, EMC in Commercial, automobile, defence and Aviation product. Introduction to radiated and conducted emissions testing and limits. Electromagnetic field theory - Description of electromagnetic disturbances, classification based on frequency, transmission and character. Unintentional antennas; Near field vs Far field.  

5 Hrs

## UNIT- II


5 Hrs
UNIT- III
Techniques to Optimize power delivery network, grounding, shielding, bonding, reducing internal EMI, EMI Filter design. Insertion loss versus frequency of EMI filter. Cable radiation and interference. EM coupling wiring layout and PCB design considerations, shielding-coaxial cables, shielding of equipment, EMC suppression cable, EMC gaskets, Isolation transformer. 5 Hrs

UNIT- IV
Introduction to signal integrity and EMI, Impedance mismatches, reflections, vias and manufacturing effects, Termination methods and routing topologies, Crosstalk and guarding, causes of EMI from high speed digital circuits,. SMPS design for low conducted emissions, need for Shielding. 5 Hrs

UNIT- V
Introduction to IEEE Standards - EMC compliance, testing of Electrical/ Electronic product for Conducted and Radiated emission, Conducted and Radiated immunity parameters as Per standards. EMI measuring instruments, spectrum analyser, LISN, Current probe, EMC Antenna, anechoic chambers, Field Probe. 4 Hrs

Reference Books:
4. EMI Standards : Prasad Kadali.
BMS College of Engineering, Bangalore – 19  
Autonomous College under VTU

DEPARTMENTAL ELECTIVE-1  
SEMESTER 5

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>16EC5DE1OP</th>
<th>COURSE TITLE</th>
<th>OOPS USING C++</th>
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<table>
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<tr>
<td>CO-1</td>
<td>Apply knowledge of object-oriented concepts to implement a given problem statement.</td>
<td>1</td>
<td>2</td>
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<tr>
<td>CO-2</td>
<td>Design and analyze solution to a given problem using C++.</td>
<td>2</td>
<td>2</td>
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<tr>
<td>CO-3</td>
<td>Simulate and document the given application using Object Oriented approach.</td>
<td>3, 4, 5</td>
<td>2</td>
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</table>

UNIT- I
Migration to CPP syntax from C - Benefits and applications beginning with C++: Definition, application, structure of C++ program, compiling and linking Tokens, expressions and control structures: Tokens, keywords, identifiers and constants, data types, symbolic constants, variables, operators, manipulators, control statements and loops. OOP Concepts, Program construction, directives, pre-processor directives, header files and library files.  
5L+2T Hrs

UNIT- II
Functions in C++: Function prototype, argument passing, recursion, inline functions, friend and virtual functions Classes and objects: Class definition and declaration, member functions, static data members and member functions, arrays of objects, returning objects.  
5L+2T Hrs

UNIT- III
OOPS concepts: Constructors, parameterized constructors, multiple constructors in a class, copy constructor, dynamic constructors, destructors, Operator overloading: Overloading unary and binary operators, overloading using friends, rules for overloading. Inheritance: Single and multiple inheritances, public, private and protected inheritance. Pointers to objects, this pointer, pointers to derived classes, virtual functions.  
8L+4T Hrs
UNIT - IV
Templates and exceptions: Class templates, function templates, overloading template functions, member function templates and non-type template arguments. Exception handling: Basics, throwing and catching mechanisms, re-throwing an exception, specifying exceptions.  
4L+2T Hrs

UNIT - V
Other aspects: Pointers to objects, this pointer, pointers to derived classes, virtual functions. Managing console I/O operations: C++ streams, C++ stream classes, I/O operations, managing O/P with manipulators, classes for file stream operations, opening and closing a file, detecting end of file, more about open():file modes.  
4L+2T Hrs

Text Books:

Reference Books:
1. Let Us C++, Yashavanth P. Kanetkar, BPB Publications
2. Programming With C++-Schaum’s series, TMH Publications
3. Programming With C++, Schaum’s series, TMH Publications
DEPARTMENTAL ELECTIVE-1        SEMESTER 5

<table>
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<th>COURSE CODE</th>
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### Course Outcomes

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</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Apply the knowledge of the hardware and software systems of computer to develop efficient coding for sequential and pipeline architectures.</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze various aspects of code optimization, storage technologies and impact of cache memory on the program performance on modern processors.</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO-3</td>
<td>Analyze the exceptional control flow of program and the compilation process to create executable object files.</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO-4</td>
<td>Communicate on advanced system engineering trends with effective presentations and report writing skills, following professional ethics.</td>
<td>8, 10</td>
<td>2</td>
</tr>
</tbody>
</table>

#### UNIT- I

Fundamentals of Computer Systems: Hardware organization of a system, Caches and storage devices, Operating system manages the hardware: processes, threads, virtual memory and file system, Concurrency and parallelism, Importance of abstractions in a computer system. **5 Hrs**

#### UNIT- II

Processor Architecture: Y86 instruction set architecture: instructions, instruction encoding, CISC & RISC instruction set, Y86 exceptions, Y86 programs, Sequential Y86 implementations, General principles of pipelining, pipelined Y86 implementation. **8 Hrs**

#### UNIT- III

Optimizing Program Performance: Capabilities and limitations of optimizing compilers, Expressing Program Performance, program example, Eliminating loop inefficiencies and
memory references, Reducing procedure calls, Understanding modern processors, Loop unrolling, Enhancing parallelism.  

UNIT- IV


UNIT- V

Running Programs on a System: Compiler Drivers, Static Linking, Object Files, Relocation, Loading Executable Object Files.

Exceptional Control Flow: Exceptions, Processes, System Call Error Handling, Process Control.

Text Books:


Reference Books:

UNIT-I
4L+2T Hrs

UNIT-II
6L+2T Hrs

UNIT-III
Randomization. 6L+2T Hrs

UNIT-IV
System Verilog – 3: Assertions: Introduction to Assertion based verification, Immediate and concurrent assertions. 4L+2T Hrs

UNIT-V
System Verilog – 4: Coverage driven verification: Motivation, Types of coverage, Cover Group, Cover Point, Cross Coverage, Concepts of Binning and event sampling, Layered Test Bench Architecture. 4L+ 4T Hrs

References:
1. Janick Bergeron, Writing Testbenches Using SystemVerilog
2. Chris Spear, SystemVerilog for Verification

Tools:
1. NC Verilog, NC Sim for System Verilog

Reference Websites:
wwwasic-world.com
www.testbench.in
UNIT-I
Introduction, Maximum unambiguous range, Radar Waveforms, simple form of Radar equation, Block diagram, application and types of radars

UNIT-II
Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise and SNR, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative analysis only)

UNIT-III

UNIT-IV
MTI Radar Parameters, Limitations to MTI Performance. Non-coherent MTI, MTI versus Pulse Doppler Radar.  

UNIT-V
Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two- coordinates), Phase Comparison Monopulse. Target Reflection Characteristics and Angular Accuracy. Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers  

Text Books:
3. http://www.nptel.ac.in/syllabus/101108056/
COURSE CODE | 16EC6DE2OS | COURSE TITLE | OPERATING SYSTEM |
<table>
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<table>
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<tr>
<th>Course Outcomes</th>
<th>CO-1</th>
<th>CO-2</th>
<th>CO-3</th>
</tr>
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<tr>
<td>Apply the knowledge of different classes and structure of operating system and requirement of system protection.</td>
<td>1</td>
<td>1,2</td>
<td>1,2</td>
</tr>
<tr>
<td>Analyze the scheduling, page replacement policies for the process requirement, memory management in an operating system</td>
<td>1,2</td>
<td>1,2</td>
<td>1,2</td>
</tr>
<tr>
<td>Analyze the device management and identify need for operating systems in the field of communication and computer networks and pursue life-long learning in it.</td>
<td></td>
<td></td>
<td>1,2</td>
</tr>
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</table>

UNIT-I
Introduction and overview of operating systems: Abstract views of an Operating system, Computing environment and nature of computations Classes of operating systems: O.S and the computer system, Batch processing system, Multi programming systems, Time sharing systems, Real time operating systems, distributed operating systems ,modern operating system, Operation of an O.S, Structure of an operating system, Operating system with monolithic structure, layered design of operating system, Virtual machine operating systems, Kernel based operating systems.  
8L+4T Hrs

UNIT-II
5L+3T Hrs
UNIT-III
Memory management: Static and Dynamic memory allocation, Memory allocation to a process, Reuse of memory, Contiguous memory allocation, Non-contiguous memory allocation, Paging, Segmentation  \[5L+1T \text{ Hrs}\]

UNIT-IV
Interrupt handlers, Device drivers, Device independent I/O software, user space I/O software  \[3L+1T \text{ Hrs}\]

UNIT-V
Distributed operating system: features of distributed operating system, nodes of distributed operating system, integrating operation nodes of a distributed operating system, reliable inter process communication, distributed computation paradigm.  \[3L+3T \text{ Hrs}\]

Text Books:
1. “Operating Systems - A Concept based Approach”, D. M. Dhamdhare, TMH,
2. “modern operating systems” , Andrew S Tanenbaum, Herbert Boss 4th edition,

Reference Books:
BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

DEPARTMENTAL ELECTIVE-2

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<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
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<tbody>
<tr>
<td>CO-1</td>
<td>Apply the knowledge of sensors, control theory, instrumentation and AUTOSAR to develop automotive embedded sub systems</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze model based design approach in realizing automotive subsystems</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design automotive subsystems for specified applications using model based or/and conventional approach</td>
<td>3</td>
<td>1,2</td>
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UNIT-I
6 Hrs

UNIT-II
The systems approach to control and instrumentation: Concept of a system, block diagram representation of a system, electronic system performance, instruments, basic measurement system, signal processing, control systems: P, PI, PID controllers.  
Model Based Design approach: Definition, driving force for MBD, benefits of MBD, contextual requirements of MBD, MBD technology.  
6 Hrs

UNIT-III
Case studies of MBD (Block diagram approach only). Electronics engine Control: Motivation for electronic engine control, concept of electronic engine control system, electronic fuel
Department of Electronics & Communication Engineering

control system: configuration and control sequence, electronic ignition, automatic cruise control, antilock braking system (ABS), electronic suspension system, electronic steering control.

9 Hrs

UNIT-IV

Sensors: Air flow rate sensor, engine crankshaft angular position sensor, magnetic reluctance position sensor, engine speed sensor, hall-effect sensor, throttle angle sensor, typical coolant sensor, exhaust gas oxygen sensor.

6 Hrs

UNIT-V


9 Hrs

Text books:
Cluster Elective Course
BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

CLUSTER ELECTIVE-1

SEMESTER 6

<table>
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<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>DATA STRUCTURES AND ALGORITHM</th>
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<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
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<tr>
<td>CO-1</td>
<td>Apply programming concepts to realize various data structures</td>
<td>1</td>
<td>2</td>
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<tr>
<td>CO-2</td>
<td>Analyze the suitability of a given data structure for a given application</td>
<td>2</td>
<td>2</td>
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<tr>
<td>CO-3</td>
<td>Develop a data structure for a given application/s</td>
<td>3,5,10</td>
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UNIT I
Introduction: Data Representation, Introduction, Linear lists, Formula-based representation linked representation, Indirect addressing, simulating pointers. 5L+1T Hrs

UNIT II
Arrays and Matrics: Arrays, Matrices, Special matrices, spare matrices. 5L+1T Hrs

UNIT III
Stacks: The abstract data types, Derived classed and inheritance, Formula-based representation, Linked representation, Applications. 5L+2T Hrs

UNIT IV
Queues: The abstract data types, Derived classes and inheritance, Formula based representation, Linked representation, Applications. 5L+2T Hrs

UNIT V
Hashing and Trees: Dictionaries, Linear representation, Hash table representation. Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, Heaps – Min and Max, insertion into heaps, Binary Search Trees, AVL trees. 4L+6T Hrs
Reference books:
2. Data structures, Algorithms, and applications, Vaidyanathan
UNIT-I
Sensor Characteristics: Transfer function, span, accuracy, calibration, hysteresis, non-linearity, saturation, dead band, resolution, special properties, output impedance, excitation, dynamic characteristics, environmental factors, reliability, application characteristics, and uncertainty.  
6 Hrs

UNIT-II
Physical principles of sensing: Electric charges, fields and potentials, capacitance, magnetism, induction, resistance, piezoelectric effect, pyro-electric effect, hall effect, Peltier effect and seebeck effect, sound waves, temp and thermal props of mats, heat transfer, light, dynamic models of sensor elements.  
8 Hrs

UNIT-III
Sensors for embedded systems application_1: Photoelectric sensors, detection methods, proximity sensors: Inductive and capacitive, limit switches, LED, microwave sensors, laser sensors, bar code identification systems, OCRs, position sensors.  
8 Hrs

UNIT-IV
Sensors for embedded systems application_2: Displacement and level sensors, velocity and acceleration sensors, force, strain and tactile sensors, pressure sensors.  
8 Hrs
UNIT-V

Digital transducers and applications: Adv of digit ran, shaft encoders, optical encoders, digital tachometer, Hall effect sensors, linear encoders, Moire Fringe displacement sensors, binary transducers.

6 Hrs

Text Books:

BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

CLUSTER ELECTIVE - 1

SEMESTER 6

<table>
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<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>VLSI TESTING AND DESIGN FOR TESTABILITY</th>
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<th>Description</th>
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<tr>
<td>CO-1</td>
<td>Apply the concept of faults and failure models to generate the number of fault models &amp; Automatic Test Pattern Generator (ATPG) for the given design under test (DUT)</td>
<td>1</td>
<td>3</td>
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<tr>
<td>CO-2</td>
<td>Analyze and identify the given fault in given CUT (can be logic circuit or memory) and conclude the solution to test these faults</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO-3</td>
<td>Ability to generate the Automatic Test Pattern Generator (ATPG) with different techniques using CAD tool.</td>
<td>5</td>
<td>3</td>
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UNIT-I

Introduction: Testing Philosophy, Role of testing, Digital and Analog VLSI Testing. How to Test chips- types of Testing, Automatic Test equipment (ATE), Electrical parametric testing, Yield, Defects, Errors and Faults 4 Hrs

UNIT-II

Fundamentals of VLSI testing: Fault models, Fault equivalence, Fault collapsing, Automatic test pattern generation: Path sensitization technique, Boolean difference, D-algorithm, PODEM algorithm, IdQ testing, Delay fault testing. Example problems. CAD tool usage for ATPG 10 Hrs

UNIT-III

Design for testability: Controllability and observability, Scan design and scan based testing, Level sensitive scan Design (LSSD), Test interface and boundary scan. 8 Hrs

UNIT-IV

Memory testing: Memory fault models, Test algorithms for RAMs, Detection of pattern sensitive faults Example problems 6 Hrs
UNIT-V

Built in self-test (BIST): BIST process, BIST implementation, BIST pattern generation methods, output response analysis  

8 Hrs

Text Book:


Reference Books:

BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

CLUSTER ELECTIVE-1

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<tbody>
<tr>
<td>CO-1</td>
<td>Apply the advanced concepts of modern VLSI system design flow including standard cells, cell libraries, IPs etc in physical design</td>
<td>1</td>
<td>3</td>
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<tr>
<td>CO-2</td>
<td>Analyze the power planning, floor planning through partitioning the system into sub blocks.</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design solutions to fix timing violations after clock tree synthesis and routing</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO-4</td>
<td>Simulate and analyze various timing, area and power reports after physical back end flow</td>
<td>4,5,9, 10</td>
<td>3</td>
</tr>
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UNIT-I


8 Hrs

UNIT-II

Partitioning and Floor planning: Approximation of Hyper Graphs with Graphs, Kernighan-Lin Heuristic Ratio cut partition, Fiduccia & Mattheyses, Technology File, Circuit Description Design Constraints, Design planning, Pad placement, power planning, Macro placement, Clock planning.

7 Hrs

UNIT-III

Placement: Global Placement, detail placement, clock tree synthesis, power analysis

7 Hrs

UNIT-IV

Routing (clock, power/ground, signal nets): Special routing, Global routing, Detailed routing,
UNIT-V
Verification: Functional Verification, Timing verification (STA), Physical Verification, SI analysis, Power Analysis

Text Book:

Reference books:
CLUSTER ELECTIVE-1

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<th>COURSE TITLE</th>
<th>PROBABILITY AND RANDOM PROCESS</th>
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<tbody>
<tr>
<td>CO-1</td>
<td>Understand and apply the underlying concepts of probability, random variables and stochastic processes</td>
</tr>
<tr>
<td>CO-2</td>
<td>Develop an analytical problem solving approach for real life problems using the theoretical concepts</td>
</tr>
<tr>
<td>CO-3</td>
<td>Nurture teamwork skills by working on problem assignments in groups throughout the semester</td>
</tr>
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</table>

**UNIT-I**
Introduction to Probability theory: Experiments and Sample space, Events, Probability definition and Axioms, Joint and conditional probabilities, Baye’s theorem- Independent events, Bernoulli Trials.  
8 Hrs

**UNIT-II**
7 Hrs

**UNIT-III**
Operation on a single random variable: Expectation, EV of random variables, EV of functions of random variables, Moments, Central moments, Conditional expected values  
7 Hrs

**UNIT-IV**
7 Hrs
UNIT-V
Spectral properties of random processes – power spectral density and its properties, relation with autocorrelation, cross PSD and cross correlation

Text Books:
3. http://nptel.ac.in/courses/117105085/
## Course Information

### CLUSTER ELECTIVE

**Autonomous College under VTU**

**SEMESTER 6**

<table>
<thead>
<tr>
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<table>
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<tr>
<th>UNIT-I</th>
<th>Migration from 8051 to 32bit cores, RISC design and ARM Design Approach, Advantages of ARM, ARM Organization, Registers, Pipeline, Exceptions &amp; Interrupts, Introduction to Cortex M3 Processor &amp; its applications.</th>
<th>5L+2T Hrs</th>
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<table>
<thead>
<tr>
<th>UNIT-II</th>
<th>Cortex M3 Architecture and Registers, Operation Modes, Thumb2 Technology &amp; Instruction Set Architecture, Exceptions &amp; Nested Vector Interrupt Controller, Memory Systems: Bit banding.</th>
<th>6L+3T Hrs</th>
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<table>
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<tr>
<th>UNIT-III</th>
<th>Cortex M3 Programming: A typical development flow, Using C, CMSIS, Using Assembly, Exception Programming.</th>
<th>5L+3T Hrs</th>
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<table>
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<tr>
<th>UNIT-IV</th>
<th>Introduction to Firmware, Boot-loader and Embedded Operating Systems, MPU &amp; MMU, Working With I2C, SPI, CAN &amp; USB protocols.</th>
<th>4L+2T Hrs</th>
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<tbody>
<tr>
<td>CO-1</td>
<td>Apply the acquired knowledge on ARM7 and ARM Cortex m3 architecture, their features and instruction set in programming the ARM processor.</td>
<td>1</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze the architectural features of ARM7 and Cortex M3, concepts on system software and communication protocols to design ARM based embedded applications.</td>
<td>2</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design and develop ARM based embedded applications.</td>
<td>3,5,9,10</td>
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**Course Outcomes**

- **CO-1**: Apply the acquired knowledge on ARM7 and ARM Cortex m3 architecture, their features and instruction set in programming the ARM processor.
- **CO-2**: Analyze the architectural features of ARM7 and Cortex M3, concepts on system software and communication protocols to design ARM based embedded applications.
- **CO-3**: Design and develop ARM based embedded applications.
Applications of ARM Cortex M3: Robotics & Motion Control, WSN, IoT, ARM Cortex for DSP applications.  

4L+2T Hrs

Text books:
2. ARM System Developer's Guide By Andrew N Sloss, Dominic Symes, Chris Wright

Reference books:
7th – 8th Semester Syllabus
Program Core Course Syllabus
# BMS College of Engineering, Bangalore – 19

**Autonomous College under VTU**

<table>
<thead>
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<th>COURSE TITLE</th>
<th>CREDITS</th>
<th>L-T-P-S</th>
<th>CO-1</th>
</tr>
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<tbody>
<tr>
<td>16EC7DCDCN</td>
<td>Data Communication Networks</td>
<td>5</td>
<td>3-0-1-1</td>
<td></td>
</tr>
</tbody>
</table>

### Course Outcomes

<table>
<thead>
<tr>
<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Apply the concepts of Networks layer protocols to deliver packets across Multiple Networks (links).</td>
<td>1</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze issues of routing and congestion mechanism for independent and internetworking networks for wired and wireless link.</td>
<td>2</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design, calculate, and apply subnet masks and routing addresses to fulfill networking requirements.</td>
<td>3</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-4</td>
<td>Create Network for given specification and conduct experiments within a simulated networking environment.</td>
<td>4,5</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-5</td>
<td>Involve in independent learning on contemporary issues in networking technologies, Communicate effectively and prepare a report.</td>
<td>9, 10</td>
<td>1,2</td>
</tr>
</tbody>
</table>

### Units

**UNIT - I**

Network Layer, Logical Addressing, Internet protocol, Address Mapping  

7 Hrs

**UNIT - II**

Routing, RIP, OSPF, BGP, Multicast  

8 Hrs

**UNIT - III**

End to End Protocols, Congestion Control and Resource Allocation, Quality of Service  

8 Hrs

**UNIT - IV**

Multimedia, Network Security  

7 Hrs

**UNIT - V**

Traditional Application, Multimedia Application, Infrastructure Services, Overlay Networks  

6 Hrs
Text Books:

1. Data Communication and Networking, Farouzan, McGraw Hill Education.
2. Computer Networks, Andrew S. Tanenbaum

http://nptel.ac.in/video.php?subjectId=106105081
http://freevideolectures.com/Course/2278/Data-Communication
COURSE CODE | 16EC7DCESD | COURSE TITLE | Embedded System Design
|------------|-------------|--------------|
CREDITS | 5 | L-T-P-S | 3-0-1-1

CO-numbers | Course Outcomes | POs | PSOs
---|---|---|---
CO-1 | Apply the embedded system models, features of processors, memory and I/O systems in developing embedded System. | 1 | 1,2
CO-2 | Analyze the embedded OS functionality and device drivers used in multitasking embedded applications. | 2 | 1,2
CO-3 | Design embedded applications using given specifications and concepts of development process. | 3 | 1,2
CO-4 | Demonstrate practical experiments on developing embedded systems. | 4,5 | 2
CO-5 | Engage in self learning in analyzing and carrying out embedded projects. | 4, 5, 9, 10, 12 | 2

UNIT- I
5 Hrs

UNIT - II
6 Hrs

UNIT - III
7 Hrs
UNIT - IV

Embedded Software: Device Drivers: Device Drivers for Interrupt-Handling, Memory Device Drivers, On-board Bus Device Drivers, Board I/O Driver.


UNIT - V


Implementing the Design: Main Software Utility Tool: Writing Code in an Editor or IDE, Interpreters, Compilers, and Linkers, Debugging Tools, System Boot-Up.

Text Book:


Reference Books:

2. Embedded system Design –Steve Heath , second edition
COURSE CODE | 16EC7DCPEL | COURSE TITLE | Power Electronics
--- | --- | --- | ---
CREDITS | 3 | L-T-P-S | 2-0-1-0

<table>
<thead>
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<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Apply basic circuit theory concepts to solve Power and control circuits in power electronics domain</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO-2</td>
<td><strong>Identify</strong> and <strong>Analyze</strong> power electronics circuits for a given task/application and draw valid conclusions with suitable assumptions</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO-3</td>
<td><strong>Design</strong> solutions to meet the given specifications of controlled rectifiers, dc-dc converters, inverters and few basic triggering circuits</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CO-4</td>
<td><strong>Conduct experiments</strong> &amp; carry out data interpretation on power electronic circuits with valid conclusions and individually / in a team to prepare a report and make an effective <strong>presentation</strong>.</td>
<td>4, 9, 10</td>
<td>1</td>
</tr>
</tbody>
</table>

**UNIT - I**

Introduction, Applications of power electronics, Power semiconductor device (SCR, IGBT, TRIAC & DIAC), Types of power electronics circuits  

**4 Hrs**

**UNIT - II**

INTRODUCTION TO THYRISTORS: Two transistor model, Turn-on Methods, Dynamic Turn-on and turn-off characteristics, Gate characteristics, Gate trigger circuits, di / dt and dv/dt protection  

**5 Hrs**

**UNIT - III**

CONTROLLED RECTIFIERS: Introduction, Principles of phase controlled converter operation, 1 Ф semi converters, 1 Ф fully controlled converters, Dual converters, (all converters with R & RL load). Design examples.  

**4 Hrs**
UNIT - IV
DC-DC CONVERTERS: Introduction, principles of step down (buck) and step up (boost) choppers (R-load only), performance parameters. Switched mode regulators: buck regulator, boost regulator, Buck boost regulator 6 Hrs

UNIT - V
INVERTORS: Introduction, Principles of operation, Performance parameters, 1 Ф bridge inverter, current source invertors, Variable DC link inverter. 5 Hrs

List of Experiments:
1. Static Characteristics of an SCR
2. Static Characteristics of DIAC
3. Static Characteristics of TRIAC
4. Static characteristics of IGBT
5. UJT firing circuit for HWR and FWR circuits.
7. Voltage (Impulse) commutated chopper both constant frequency and variable frequency operations.
8. Parallel / series inverter

Text Books:
BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>16EC8DCECS</th>
<th>COURSE TITLE</th>
<th>Electronics and Communication for sustainable Developments</th>
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<tr>
<td>CREDITS</td>
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<td>L-T-P-S</td>
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<tr>
<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Apply the concepts of Electronics and Communication Engineering to solve societal issues</td>
<td>1</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>CO-2</td>
<td>Review and analyse the performance of the Electronic system for the specific societal issues.</td>
<td>2</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>CO-3</td>
<td>Able to identify and develop process that meets specified needs with appropriate considerations for environment</td>
<td>3</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>CO-4</td>
<td>Understand the impact of Electronics &amp; communication Engineering for the sustainable development</td>
<td>7</td>
<td>1, 2, 3</td>
</tr>
</tbody>
</table>

UNIT - I
Agriculture: A Review of Applications for sensor networks in Smart Agriculture, Wireless sensor networks with dynamic nodes for water and crop health management

UNIT - II
Environment: Scaling Smart Environments, Localization of a wireless sensor network for environment monitoring using likelihood Estimation with negative Constraints, Reconfigurable Intelligent Space and the mobile module for Flexible Smart Space

UNIT - III

UNIT - IV
Healthcare: Sensor networks in healthcare, Use of Body Sensor networks in Clinical settings and Medical Research
UNIT - V
Transportation: Social sensor networks for Transportation Management in smart cities, Applying RFID Techniques for the Next generation automotive services 7 Hrs

Reference Book:

Department Elective Course Syllabus
**COURSE CODE** | **16EC7DE3CV** | **COURSE TITLE** | **Computer Vision**
---|---|---|---
**CREDITS** | **3** | **L-T-P-S** | **2-1-0-0**

<table>
<thead>
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<th>CO-numbers</th>
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<th>POs</th>
<th>PSOs</th>
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<tbody>
<tr>
<td>CO-1</td>
<td><strong>Apply</strong> various segmentation, feature extraction and representation techniques for a given pattern analysis problem</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO-2</td>
<td><strong>Analyse</strong> various pattern recognition and classification schemes to perform a specific computer vision task</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO-3</td>
<td><strong>Design</strong> 3D visualization models to process a 3D object and perform a specific computer vision task</td>
<td>3</td>
<td>1</td>
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</tbody>
</table>

**UNIT - I**

Pattern Analysis: Clustering: K-Means, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models

**5L +2T Hrs**

**UNIT - II**

Feature extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH

**5L+3T Hrs**

**UNIT - III**

Shape representation and segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors

**5L+3T Hrs**

**UNIT - IV**

3D Image Visualization: Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images

**5L+2T Hrs**

**UNIT - V**

Modern Trends: Biometrics – fingerprint, face, iris, digital signature; super resolution, Introduction to Augmented Reality

**4L+2T Hrs**
Text Books:


Reference Books:

BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

<table>
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<tr>
<th>COURSE CODE</th>
<th>16EC7DE3LV</th>
<th>COURSE TITLE</th>
<th>Low Power VLSI</th>
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<td>CREDITS</td>
<td>3</td>
<td>L-T-P-S</td>
<td>3-0-0-0</td>
</tr>
</tbody>
</table>

**UNIT - I**
Basics of MOS circuits: MOS Transistor structure and device modeling, MOS Inverters, MOS Combinational Circuits - Different Logic Families  
6 Hrs

**UNIT - II**
Sources of Power dissipation: Dynamic Power Dissipation -Short Circuit Power, Switching Power, Glitching Power, Static Power Dissipation, Degrees of Freedom  
6 Hrs

**UNIT - III**
Supply Voltage Scaling Approaches: Device feature size scaling Multi-Vdd Circuits  
Architectural level approaches: Parallelism, Pipelining Voltage scaling using high-level transformations Dynamic voltage scaling Power Management  
8 Hrs

**UNIT - IV**
Switched Capacitance Minimization Approaches: Hardware Software Tradeoff Bus Encoding Two’s complements v/s Sign Magnitude Architectural optimization Clock Gating Logic styles.
Leakage Power minimization Approaches: Variable-threshold-voltage CMOS (VTCMOS) approach Multi-threshold-voltage CMOS (MTCMOS) approach Power gating Transistor stacking Dual-Vt assignment approach (DTCMOS)

UNIT - V

Special Topics: Adiabatic Switching Circuits, Battery-aware Synthesis, Variation tolerant design, CAD tools for low power synthesis

Text Books:

Reference Books:

NPTEL http://nptel.iitm.ac.in Computer Science and Engineering, Department of Computer Science and Engineering, IIT Kharagpur
UNIT - I
7 Hrs

UNIT - II
Typical goals in SoC design: Cost reduction, power reduction, design effort reduction, performance maximization. Productivity gap issues and the ways to improve the gap – IP based design and design reuse.  
7 Hrs

UNIT - III
7 Hrs
UNIT - IV
Hardware-Software co design: Design for timing closure, Logic design issues, Verification strategy, On chip buses and interfaces, Low Power, Hardware Accelerators in Soc.  

UNIT-V
Interconnect architectures for SoC: Bus architecture and its limitations. Network on Chip (NOC) topologies. Mesh-based NoC. Routing in an NoC. Packet switching and wormhole routing

Text Books:

Reference Books:

E-books
MOOCs
### COURSE TITLE
Network Security and Cryptography

### CREDITS
3

<table>
<thead>
<tr>
<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
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<tbody>
<tr>
<td>CO-1</td>
<td>Apply the knowledge of encryption and security techniques along with cyber forensics to fulfil the societal needs</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyse the different types of encipherment techniques along with key exchange mechanisms.</td>
<td>2</td>
<td>1, 2</td>
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</table>

**UNIT - I**

7 Hrs

**UNIT - II**
Simplified DES, Simplified DES, Data encryption Standard, mode of Block cipher operation, Principles of public key cryptosystems, Principles of public key cryptosystems, The RSA algorithm, Diffe-Hellman key exchange  

8 Hrs

**UNIT - III**

7 Hrs

**UNIT - IV**
Intruders, Intruder detection, Password management, Viruses and related threats, Viruses and related threats, Firewalls design principles  

7 Hrs
UNIT - V


Text Books:

Reference Books:
Course Outcomes

<table>
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<th>CO-numbers</th>
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<th>POs</th>
<th>PSOs</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Acquire Knowledge of techniques, algorithms and schemes in wireless communication, Apply this for effective wireless communication</td>
<td>1</td>
<td>2, 3</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyse the performance of wireless communication system</td>
<td>2</td>
<td>2, 3</td>
</tr>
<tr>
<td>CO3</td>
<td>Investigate on methodologies for improving effective wireless communications</td>
<td>4</td>
<td>2, 3</td>
</tr>
<tr>
<td>CO4</td>
<td>Use Modern tools to simulate and analyse a given problem statement in wireless communication</td>
<td>5, 10</td>
<td>2, 3</td>
</tr>
</tbody>
</table>

UNIT - I

Introduction to Wireless communication, Application and requirements of wireless services, The Cellular concept: System design fundamentals: Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and Grade of service, Improving coverage and capacity in cellular system. 8 Hrs

UNIT - II

UNIT - III
Equalization and Diversity: Fundamentals of Equalization, Equalizers in communication receiver, Algorithms for Adaptive Equalization, Diversity techniques; Space Diversity, Time Diversity, Polarization Diversity, Frequency Diversity , RAKE receivers.(Qualitative Analysis only)  

UNIT - IV

UNIT - V
UMTS: System overview, Channels, Transmission mechanism, Handover and power control. Interconnectivity between 2G and 3G systems  

Text books:

Nptel lectures:
1. Wireless Communications by Dr.Ranjan Bose, Department of Electrical Engineering, IIT Delhi.
2. Principles of Modern CDMA/ MIMO/ OFDM Wireless by Prof Aditya Jaganthan, IIT Kanpur
Cluster Elective Course Syllabus
UNIT - I
Overview of basic Nano electronics: Recent past, the present and its challenges, Future of Nano electronics 5 Hrs

UNIT - II
Nanocomputer architectures: Introduction to Nanocomputers, Nanocomputer Architecture, Quantum DOT cellular Automata (QCA), QCA circuits, Single electron circuits, molecular circuits, Logic switches – Interface engineering – Properties (Self-organization, Size-dependent) – Limitations 9 Hrs

UNIT - III

UNIT - IV
Spintronics: Introduction, Generation of Spin Polarization Theories of spin Injection, spin relaxation and spin dephasing, Spintronic devices and applications, spin diodes, spin transistors. 6 Hrs
UNIT - V


7 Hrs

Text books:

1. Nanoelectronics & Nanosystems: From Transistor to Molecular & Quantum Devices: Karl Goser, JanDienstuhl and others.
2. Nano Electronics and Information Technology: Rainer Waser

Reference Books:

1. Concepts in Spintronics – Sadamichi Maekawa
2. Spin Electronics – David Awschalom
Course: Electronics and Packaging

COURSE CODE: 16EC7GE2EP
COURSE TITLE: Electronics and Packaging
CREDITS: 3
L-T-P-S: 3-0-0-0

CO-1: Apply the knowledge of semiconductors for Microelectronics system packaging.
POs: 1
PSOs: 1

CO-2: Analyze the Different types of packaging methodologies like Multichip modules (MCM)-types, System-in package (SIP), Packaging roadmaps, Hybrid circuits.
POs: 2
PSOs: 1

CO-3: Design considerations in systems packaging and Design issues related to Surface Mount Technology
POs: 3
PSOs: 1

UNIT - I
Overview of electronic systems packaging: Introduction and Objectives of the course, Definition of a system and history of Semiconductors, Products and levels of packaging, Packaging aspects of handheld products, Definition of PWB.
7 Hrs

UNIT - II
Semiconductor Packaging Overview: Basics of Semiconductor and Process flowchart Wafer fabrication, inspection and testing Wafer packaging; Packaging evolution; Chip connection choices, Wire bonding.
7 Hrs

UNIT - III
Semiconductor Packages: Why packaging? & Single chip packages or modules (SCM), Commonly used packages and advanced packages, Materials in packages, Advances packages Thermal mismatch in packages, Current trends in packaging, Multichip modules (MCM)-types; System-in package (SIP), Packaging roadmaps, Hybrid circuits.
8 Hrs
UNIT - IV
6 Hrs

UNIT - V
Surface Mount Technology: SMD benefits, Design issues, Introduction to soldering, Reflow and Wave Soldering methods to attach SMDs ,Solders, Wetting of solders; Flux and its Properties , Defects in wave soldering Vapour phase soldering, BGA soldering and DE soldering /Repair, SMT failures.  
8 Hrs

Text Books:

Reference Books:
2. Web-based Current literature.
BMS College of Engineering, Bangalore – 19
Autonomous College under VTU

<table>
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<tr>
<th>COURSE CODE</th>
<th>16EC7GE2IT</th>
<th>COURSE TITLE</th>
<th>Internet of Things</th>
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<td>CREDITS</td>
<td>3</td>
<td>L-T-P-S</td>
<td>3-0-0-0</td>
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<tr>
<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Apply the Knowledge of architecture, algorithms and schemes in Internet of things from a global context</td>
<td>1</td>
<td>2, 3</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze the data base using efficient Algorithms</td>
<td>2</td>
<td>2, 3</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design protocols and test on scenarios for improving effective implementation of IOT</td>
<td>4,10</td>
<td>2, 3</td>
</tr>
<tr>
<td>CO-4</td>
<td>Implement IOT applications and open source platform for data analytics</td>
<td>5,10</td>
<td>2, 3</td>
</tr>
</tbody>
</table>

UNIT-I

UNIT-II
Overview of End to End wireless communications (layers, evolution, including IP based networks), Intro to standard forums (IETF, 3GPP), roles of each with examples, Introduction to 2G and 3G network, core, call flows, architecture. Introduction to 4G, evolution from 3G, current status. Introduction to Cellular IoT standards (LTE-M, LTE-NB, EC-GPRS, Clean Slate IOT etc)

UNIT-III
M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics
M2M to IoT -An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.
UNIT-IV

IOT use case: representing usecase, design, test scenarios. Introduction to Raspberry Pi (to be done by BMS faculty). GUI design for Device/Sensor management and analytics, GUI testing, automation. Communication Protocol design (One or more of the wireless Protocols): call flows, information elements, protocol testing, library design for encoding/decoding. Database design for storing sensor information: sql vs. nosql, graph db, correlation, queries, report.

IoT Architecture-State of the Art Reference Model-Introduction 7 Hrs

UNIT-V

Sensor programming (Based on Pi framework): activating, init, extracting data, controlling. GUI programming: hands on with stub based backend. Protocol abstractions: stub based programs on protocol testing (client server based), with open source SW. Introduction to testing methods, metrics, integration testing, sub-system testing. 7 Hrs

Text Books:

Reference Books:

Ebooks:
1. https://www.youtube.com/watch?v=co2MLqkJVXs
2. https://www.youtube.com/watch?v=9znRbMTimvc
UNIT-I
Information Representation Multimedia information representation: Introduction, Digitization Principles, Representation of Text, Images, Audio & Video; Multimedia applications: Media composition, Media communication, Media entertainment

UNIT-II

UNIT-III

UNIT-IV
Internetworking QoS: Admission Control, Integrated & Differentiated Services, RSVP; Internet Applications: DNS, Name Structure and Administration, DNS Resource Records;
Electronic Mail Message Structure, Content Transfer, Basic Concept of Internet Telephony, World Wide Web.  

UNIT - V

Broadband Internet, Broadband ATM Networks, Entertainment Networks, High-Speed Modems; Multimedia over Wireless Channel, Communication Protocols for Multimedia Applications; Streaming Protocol: Progressive, Adaptive, On-Demand, Real-Time Transport Protocol;  

Text Books:

3. www.nptel.ac.in/courses/117105083
### Course Information

**COURSE CODE**: 16EC7GE2SR  
**COURSE TITLE**: Software Defined Radio  
**CREDITS**: 3  
**L-T-P-S**: 2-1-0-0

<table>
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<th>CO-numbers</th>
<th>Course Outcomes</th>
<th>POs</th>
<th>PSOs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Acquire knowledge on SDR, design principles, challenges and issues in SDR. Apply this for digital communication system</td>
<td>1</td>
<td>2, 3</td>
</tr>
<tr>
<td>CO2</td>
<td>Analyse the Performance of RF Receiver Design</td>
<td>2</td>
<td>2, 3</td>
</tr>
<tr>
<td>CO3</td>
<td>Investigate and identify Digital Hardware Choices Key Hardware Elements, DSP Processors, FPGA, through case study of different SDR platforms.</td>
<td>4, 5</td>
<td>2, 3</td>
</tr>
</tbody>
</table>

### UNIT- I

Introduction to SDR, Application of SDR in advanced communication systems, challenges and issues regarding the implementation of SDR, Adaptive wireless communication systems, Spectrum efficiency and soft spectrum usage, Spectrum sensing, design principles of SDR  

*(5L + 2T) Hrs*

### UNIT- II

Challenge of Receiver Design, RF Receiver Front-End Topologies, Enhanced Flexibility of the RF Chain with Software Radios, Importance of the Components to Overall Performance, Transmitter Architectures and Their Issues, Noise and Distortion in the RF Chain  

*(5L + 2T) Hrs*

### UNIT- III

UNIT- IV
Digital Hardware Choices Introduction, Key Hardware Elements, DSP Processors, FPGA, Trade-offs in using DSPs FPGAs and ASICs, Power Management Issues, Combinations of DSPs, FPGAs and ASICs  

(4L + 2T) Hrs

UNIT- V
Introduction to cognitive radio, case study of different SDR platforms. Hands on demos / on SDR platform to conduct digital communication experiments.

Case studies
1. Application of SDR in advanced communication systems
2. Challenges and issues regarding the implementation of SDR
3. Adaptive wireless communication systems
4. Different SDR architectures
5. Emerging standards – 3G, LTE, 802.11n, WiFi, TVWS  

(5L + 3T) Hrs

Text Books:

E-books
1. e-learning: sdrforum.org
COURSE CODE 16EC7GE2SN  COURSE TITLE Wireless Sensor Networks
CREDITS 3  L-T-P-S  3-0-0-0

<table>
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<th>Course Outcomes</th>
<th>POs</th>
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</thead>
<tbody>
<tr>
<td>CO-1</td>
<td>Apply the Concepts of Sensor Networks for Data Communication.</td>
<td>1</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Analyze Sensor Node and Network architecture and infrastructure.</td>
<td>2</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-3</td>
<td>Design Energy Efficient MAC protocols for a given specification.</td>
<td>3</td>
<td>1,2</td>
</tr>
<tr>
<td>CO-4</td>
<td>Ability to Perform node level simulation in a simulation Environment and submit report.</td>
<td>5, 10</td>
<td>1,2</td>
</tr>
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</table>

UNIT - I
OVERVIEW OF WIRELESS SENSOR NETWORKS Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks 5 Hrs

UNIT - II

UNIT - III
UNIT - IV
INFRASTRUCTURE ESTABLISHMENT: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control 6 Hrs

UNIT – V
SENSOR NETWORK PLATFORMS AND TOOLS: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming 5 Hrs

Text books:

References books:
Department of Electronics & Communication Engineering

Institution Elective Course Syllabus
Brain Style Metaphor: Adaptive system and Neural networks, The nature of computation in the human brain, A historical tour of brain science, Inspiration for neural networks, Classical AI and Neural networks, Natural computing for intelligent information processing, soft computing and computational intelligence, application domains of computational intelligence, the human brain, Biological neurons.

UNIT - I


UNIT - II

UNIT - IV
Fuzzy sets, fuzzy Systems and applications: Need for numeric and linguistic processing, Fuzzy uncertainty and linguistic variable, fuzzy set, membership functions, geometry of fuzzy sets, simple operations on fuzzy sets

UNIT - V

Text book:

Reference books:
1. A brief introduction to Neural networks by David Kriesel
2. Fuzzy logic with engineering Applications by Timothy J.Ross , second edition
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<table>
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<tr>
<th>COURSE CODE</th>
<th>16EC7IE1MC</th>
<th>COURSE TITLE</th>
<th>Fundamentals of Mobile Communication</th>
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<th>CO- numbers</th>
<th>Course Outcomes</th>
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<tr>
<td>CO-1</td>
<td>Acquire the knowledge of mobile communications fundamental and standards, GSM, GPRS and 3G systems. And apply this concepts in solving fundamental traffic problems</td>
<td>1</td>
<td>2</td>
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<tr>
<td>CO-2</td>
<td>Investigate on m commerce life cycle, financial services, entertainment services, content development and distribution and caching, through literature survey and use cases</td>
<td>4</td>
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UNIT- I
Introduction to mobile communication, spectrum allocation, services and range of operation. Wireless 2G, 3G, 4G networks, WLL, WLAN, Bluetooth, PAN. 7 Hrs

UNIT- II
Cellular Concepts, Frequency reuse, channel assignment strategies, call establishment, handoff mechanism, trunking concepts, cell splitting, sell sectoring 7 Hrs

UNIT- III
GSM architecture, frequency allocation, channels in GSM, handoff mechanisms, security mechanism, EDGE and GPRS features, data services 7 Hrs

UNIT- IV
Emerging telecommunication technologies: Wireless LAN – Wi-Fi, Wireless broadband, UMTS architecture, channels, services, handoff mechanisms, Mobile IP architecture, IMS – IP multimedia subsystem 8 Hrs

UNIT- V
Mcommerce-framework, different players, lifecycle, Different Mobile commerce applications and services, content development and distribution, technologies - LAN, 3G,
Text Books:

1. Theodore Rappaport “wireless Communications, Principle and practise” Prentice hall
   2005
   Wiley 2001
   Applications”, IdeaGroupPublishing,
4. Mobile Commerce Applications, Upkar Vrshney, A tutorial at IEEE internationa;
   conference on wireless communicaions.
COURSE CODE 16EC7IE1EM COURSE TITLE Electronic Engineering Materials
CREDITS 3 L-T-P-S 3-0-0-0

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<tr>
<td>CO-1</td>
<td>Apply concepts of physics and chemistry to identify the application of materials in various engineering domains</td>
<td>1</td>
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<tr>
<td>CO-2</td>
<td>Analyze the various material preparation and characterization techniques available and hence infer on the selection of a method to suit requirements</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO-3</td>
<td>Conduct survey on recent application of materials and write a report/survey paper while following professional ethics</td>
<td>8,10,12</td>
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UNIT - I
Introduction: Classification of engineering materials, levels of structure, structure-property relationships in materials, units, constants and conversion factors, basic thermodynamic functions, statistical nature of entropy, kinetics of thermally activated processes, Novel materials for sensing applications 6 Hrs

UNIT - II
Electrical properties of materials: Electrical conduction, conductivity, conduction in terms of band and atomic bonding models, electron mobility, electrical resistivity of metals, electrical char of commercial alloys, semi conductivity, temp dependence of carrier concentration, factors that affect carrier mobility, Hall effect, dielectric behaviour, types of polarization, frequency dependence of the dielectric constant, Ferro electricity, piezoelectricity 12 Hrs

UNIT - III
Optical properties: Basic concepts, Absorption process, Tauc relation to calculate band gap of materials, Refractive index. Applications of optical properties: photoconductivity, fluorescence and luminescence 6 Hrs
UNIT - IV
Fabrication methods: Thermal Evaporation, e-beam evaporation, sputtering: DC, RF, magnetron sputtering, spin coating, CVD techniques 6 Hrs

UNIT - V
Characterization of materials: XRD, SEM, AFM, TEM, Van der Pauw method of resistance measurement 6 Hrs

Text Books:
2. Material Science and Engineering, William D. Callister Wiley India (P) Ltd. 2007
3. A review of Material Science M.Ohring

References:

Journals on material science:

MOOCs
NPTEL lectures on basic material science
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Autonomous College under VTU

**Course Details**

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<tr>
<th>COURSE CODE</th>
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<tbody>
<tr>
<td>CO-1</td>
<td>Apply the knowledge of concepts and principles of Economics for effective functioning of a firm/organization under different market conditions</td>
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<tr>
<td>CO-2</td>
<td>Analyse the various marketing and Financial management strategies adopted by various organization</td>
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**UNIT - I**
Introduction to Economics; Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity. Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical

8 Hrs

**UNIT - II**
Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly) National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP, NDP, Personal income, disposal income. Basic economic problems; Poverty-meaning, absolute & relative poverty, causes, measures to reduce Unemployment: meaning, types, causes, remedies Inflation; meaning, types, causes, measures to control

7 Hrs
UNIT - III
Money; meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR. Introduction to Management; Definitions, Nature, scope Management & administration, skill, types and roles of managers Management Principles; Scientific principles, Administrative principles, Maslow’s Hierarchy of needs theory

UNIT - IV
Functions of Management; Planning, Organizing, Staffing, Directing, Controlling ( meaning, nature and importance) Organizational Structures; meaning, principles of organization, types-formal and informal, line, line & staff, matrix, hybrid (explanation with merits and demerits), span of control, departmentalization. Introduction to Marketing management; Marketing Mix, concepts of marketing, demand forecasting and methods, market segmentation Introduction to Finance Management; meaning, scope, sources, functions

UNIT - V
Introduction to Production Management; definitions, objectives, functions, plant layout-types & factors affecting it, plant location- factors affecting it. Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection. Corporate Social Responsibility; meaning, importance Business Ethics; meaning, importance

Textbooks:
1. Engineering Economics, R.Paneerselvam, PHI publication

Reference Books:
3. Principles and Practices of Management by L.M.Prasad
4. Principles of Management by Tripathy and Reddy
5. Modern Economic Theory, By Dr. K. K. Dewett & M. H. Navalur, S. Chand Publications

Ebooks:
1. https://www.youtube.com/watch?v=Pr9Rti69QZM
UNIT- I
7 Hrs

UNIT- II
7 Hrs

UNIT- III
7 Hrs

UNIT- IV

Actuators: Fuel Metering Actuator, Fuel Injector, Ignition Actuator and EGR Actuator

UNIT - V

Vehicle Motion Control: Electronic suspension system, Antilock Brake System (ABS), Electronic Steering Control


Text Books:


E-books:

1. www.engineering108.com/.../Automobile.../Understanding-Automotive-Electronics-e...
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<table>
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<tr>
<th>COURSE CODE</th>
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<th>COURSE TITLE</th>
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**UNIT- I**

Introduction: Definition of Organizational behaviour and Historical development, Environmental context (Information Technology and Globalization, Design and cultural, Reward Systems).

The Individual: Foundations of individual behaviour, individual differences. Ability, Attitude, Aptitude, interests, values.  

**7 Hrs**

**UNIT- II**

Learning: Definition, Theories of learning, Individual decision making, Classical conditioning, operant conditioning, social learning theory, continuous and intermittent reinforcement.

Perception: Definition, Factors influencing perception, attribution theory, selective perception, projection, stereotyping, Halo effect.  

**7 Hrs**

**UNIT- III**

Motivation: Maslow’s Hierarchy of needs, Me. Gregor’s theory X and Y, Herzberg’s motivation Hygiene theory, David Me Cleland three needs theory, Victor vroom’s expectancy theory of motivation.
The Groups: Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making.  

UNIT- IV
Conflict & Stress management: Definition of conflict, functional and dysfunctional conflict, stages of conflict process. Sources of stress, fatigue and its impact on productivity. Job satisfaction, job rotation, enrichment, job enlargement and reengineering work process.

UNIT- V
Principles of Communication: Useful definitions, communication principles, communication system, role of communication in management, barriers in communication, how to overcome the barriers, rule of effective communication.

Text Books:

Reference Books:
Group Core Syllabus (HSS)
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<table>
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<tr>
<th>COURSE CODE</th>
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<th>COURSE TITLE</th>
<th>Project Management and Finance</th>
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<tr>
<td>CO-1</td>
<td>Apply the Knowledge of project management principles and to implement project management methodologies required for successful project completion</td>
<td>1</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>CO-2</td>
<td>Develop Ethical principles in project planning and execution as a team and documentation in project implementation</td>
<td>8, 9, 10</td>
<td>1, 2, 3</td>
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<tr>
<td>CO-3</td>
<td>Identify and Apply finance aspects for project implantation in time</td>
<td>11</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>CO-4</td>
<td>Use modern tools to simulate their respective projects, case studies and investigate the behaviour under various operating conditions.</td>
<td>5, 12</td>
<td>1, 2, 3</td>
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UNIT- I
Concepts of Project Management - Concepts of project, Categories of project, Project life cycle phases, Project management concepts, Tools and techniques for project management, The project manager, Basic education for a project manager, Roles and responsibilities of project manager, Project manager as profession, Summary 5 Hrs

UNIT- II
Establishing the Project - Scope, Time, Cost and performance goals, Feasibility report, Financing Arrangements, Preparation of cost estimates, Finalization of project implementation schedule, Evaluation of the project profitability, appointing a project manager, Fixing the Zero date, Summary 4 Hrs
UNIT- III
Organizing Human Resources and Contracting - Delegation , Project managers authority, Project organization, Accountability in Project Execution, Contracts, R’s of contracting, Tendering and Selection of Contractors, Team building, Summary 5 Hrs

UNIT- IV
Organizing Systems and Procedures for Project Implementation - Working of systems, Design of Systems, Project work system design, Work breakdown structure, Project execution plan, Project procedure manual, Project control system, Planning, Scheduling and Monitoring, Monitoring contracts, Project diary, Summary 5 Hrs

UNIT- V
Financing of Projects - Capital structure, Menu of financing, Internal accruals, Equity capital, Preference capital, Debentures (or bonds), Methods of offering term loans, Working capital advances, Miscellaneous sources, Raising venture capital, Project financing structures, Financial closure, Financial institutions, Summary 5 Hrs

Text Books:
1. Project Management, S Choudary, Tata McGRAW Hill Publishing Company Limited

Reference Books:
1. Project Management, David I Cleland – Mcgraw Hill International edition
2. Project Management, Gopalakrishnan – Mcmillan India Ltd
3. Project Management, Harry – Maylor - Peason Publication

E Books:
1. Nptel lecture on Introduction to project management by prof. Arun Kanda
2. https://www.youtube.com/watch?v=5pwc2DYlKQU
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<table>
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**UNIT- I**

Basic principles of IP laws & Patents: Introduction, Concept of property, Constitutional aspects of IP, Evolution of the patent system in UK, US and India, Basis for protection, Origin and meaning of the term patent, Objective of a patent law, principles underlying the patent law in India, the legislative provisions regulating patents, Non – patentable inventions.

4 Hrs

**UNIT- II**

Procedure for obtaining patent: Submission of application, Filing provisional and complete specification, Examination of the application, advertisement of the acceptance, opposition, Grant and sealing of patent, Term of the patent, compulsory license.

Provisional and complete specification: Definition of Specification, Kinds of specification, provisional specification, complete specification, Claims, Conditions for amendment.
Rights conferred on a patentee: Patent rights, Exception and limitations, Duties of a Patentee.
Transfer of patent: Forms of transfer of Patent rights, Assignment, kinds of assignment, License, kinds of license, Rights conferred on a licensee, Transmission of patent by operation of law.
Infringement of patents: Construction of claims and infringement, patents held to be infringed, patents held to be not infringed.
Action for Infringement: Where a suit is to be instituted, procedure followed in the suit, Onus of establishment infringement, Defence by the defendant, The Relief’s, Injunction, Damages or account of profits, patent agents, patent drafting, database searching, and Case studies.

UNIT- III
Copy Right: Meaning and characteristics of copy right, Indian copy right law, requirement of copy right, Illustrations copy right in literary work, Musical work, Artistic work, work of architecture, Cinematograph film, sound recording.
Author and Ownership of copy right: Ownership of copy right, Contract of service, Contract for service, rights conferred by copy right, terms of copy right, license of copy right.
Infringement of copy right: Acts which constitute infringement, general principle, direct and indirect evidence of copying, Acts not constituting infringements, Infringements in literary, dramatic and musical works, Remedies against infringement of copy right, Case studies
Trade Marks: Introduction, Statutory authorities, procedure of registration of trademarks, rights conferred by registration of trademarks, licensing in trade mark, infringement of trade mark and action against infringement

UNIT- IV

UNIT- V
Indian Cyber law: Protecting Indian children online, Spam, contempt in cyber space, Indian consumers & cyber space, E-courts of India.

Text Books:

Reference books:
Project Work & Internship/Seminar
## Project for Community Service

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<tr>
<td>CO-1</td>
<td>Ability to apply knowledge to identify, gather information and analyse to formulate the problem definition for project through detailed investigation.</td>
<td>1,2,4</td>
<td>1, 2</td>
</tr>
<tr>
<td>CO-2</td>
<td>Ability to use appropriate tool/tools to implement and demonstrate the defined project.</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>CO-3</td>
<td>Ability to design and develop sustainable solution/system for the betterment of the society.</td>
<td>3,6,7</td>
<td>1, 2</td>
</tr>
<tr>
<td>CO-4</td>
<td>Ability to make effective presentation of the work with professional ethics as an individual or a member of a team.</td>
<td>8,9,10, 11</td>
<td>2</td>
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<tr>
<td>CO-5</td>
<td>Ability to develop sustainable system with scope for enhancement and continue life-long learning.</td>
<td>12</td>
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# Major Project

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## Course Outcomes

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<td>CO-1</td>
<td>Ability to apply knowledge to identify, gather information and analyse to formulate the problem definition for project through detailed investigation.</td>
<td>1,2,4</td>
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<td>Ability to design and develop sustainable solution/system for the betterment of the society.</td>
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<tbody>
<tr>
<td>CO-1</td>
<td>Develop awareness about current global and contemporary issues in technology and science and skills to be life-long learners</td>
<td>6, 8, 9, 10, 12</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>CO-2</td>
<td>Investigate some of the current scientific trends/issues facing society</td>
<td>7, 8, 10</td>
<td>1, 2, 3</td>
</tr>
<tr>
<td>CO-3</td>
<td>Practice skills that are necessary for any engineer/academic learner</td>
<td>9, 10, 12</td>
<td>1, 2, 3</td>
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