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**School of Engineering**

**Course Structure and Syllabi**

**B. Tech. (Electronics & Communication Engineering)**

**Academic Programs**

**July, 2018**

**B.Tech. in Electronics & Communication Engineering (Total Credits: 221)**

**Course Structure**

**Total Credit for the Session 2018-2019= 221Credits**

* **Min. Credit Required= 221**
* **Total Credit Relaxation = Nil**
* **No Relaxation in Core & Foundation Subjects.**
* **Option can be availed in Specialized, Interdisciplinary and General Subjects.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Core** | **Foundation** | **Specialized** | **Interdisciplinary** | **General** | **Total** |
| **82** | **42** | **57** | **27** | **13** | **221** |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Semester** | **Ist Sem** | **IInd Sem** | **IIIrd Sem** | **IVth Sem** | **Vth Sem** | **VIth Sem** | **VIIth sem** | **VIIIth Sem** | **Total** | **Minimum Credit Required to Earn Degree** |
| **Credit** | **26** | **27** | **28** | **28** | **28** | **28** | **28** | **28** | **221** | **221** |

**Program outcomes (POs):**

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. 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.

PO4. 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.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. 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.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, Manual for Affiliated / Constituent Colleges NAAC for Quality and Excellence in Higher Education 126 and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. 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.

PO11. 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.

PO12. 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.

**B. Tech (Electronics & Communication Engineering) July 2018**

**Semester I/II**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subject Code** | **Subject** | **Contact Hours**  **L-T-P** | **Credits** |  |
| BMC120C  BMC121B | English  Communication Technique Lab | 2-0-0  0-0-2 | 4 | F |
| BAS001C | Engineering Mathematics-I \* | 3-1-0 | 4 | F |
| BAS010B | Applied Physics | 3-1-0 | 4 | F |
| BES001B | Basic Electronics Engineering | 3-0-0 | 3 | F |
| BES011A | Computer Programming-I\* | 3-0-0 | 3 | F |
| BAS012A | Applied Physics Lab | 0-0-2 | 2 | F |
| BES002A | Engineering Graphics | 0-0-2 | 2 | F |
| BES012A | Computer Programming-1 Lab\* | 0-0-2 | 2 | F |
| BES004A | Basic Electronics Engineering Lab | 0-0-2 | 2 | F |
|  | Environmental Sciences/Indian Constitution |  | NC |  |
|  | **TOTAL** | **14-2-10** | **26** |  |

\* **In semester I common to all sections**

**NC- Non Credit Course, It is mandatory to clear for completion of degree.**

**Semester I/II**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subject Code** | **Subject** | **Contact Hours**  **L-T-P** | **Credits** |  |
| BAS002C | Engineering Mathematics-II \*\* | 3-1-0 | 4 | F |
| BAS011B | Engineering Chemistry | 3-1-0 | 4 | F |
| BES005A | Basic Electrical Engineering | 3-0-0 | 3 | F |
| BES013A | Computer Programming II\*\* | 3-0-0 | 3 | F |
| BES007A | Engineering Mechanics | 2-1-0 | 3 | F |
| BES003A | Engineering Workshop | 0-0-2 | 2 | F |
| BES008B | Basic Electrical Engineering Lab | 0-0-2 | 2 | F |
| BAS015A | Chemistry Lab | 0-0-2 | 2 | F |
| BES014A | Computer Programming II Lab\*\* | 0-0-2 | 2 | F |
| BES010A | Engineering Mechanics Lab | 0-0-2 | 2 | F |
|  | Essence of Indian Traditional Knowledge/Indian Constitution | | NC |  |
|  | **TOTAL** | **14-3-10** | **27** |  |

**\*\* In semester II common to all sections**

**NC- Non Credit Course, It is mandatory to clear for completion of degree.**

**Semester III**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subject Code** | **Subject** | **Contact Hours**  **L-T-P** | **Credits** |  |
|  | **Advanced Engineering Mathematics** | **2-1-0** | **3** | S |
| **BCO 002B** | **Data Structure and Algorithm** | **3-0-0** | **3** | ID |
| BEE001A | Electronics Devices | 3-1-0 | 4 | C |
| BEE002A | Digital Electronics | 3-1-0 | 4 | C |
| BEE003A | Network Theory & System | 3-1-0 | 4 | ID |
| BEE004A | Electronic Measurement & Instrumentation | 2-0-0 | 2 | C |
| BMC009A | Energy Studies | **2-0-0** | **2** | ID |
| BEE005A | Electronics Devices Lab | 0-0-2 | 2 | C |
| BEE006A | Digital Electronics Lab | 0-0-2 | 2 | C |
| BEE007A | Electronic Measurement Lab | 0-0-2 | 2 | C |
| BHS 010A | Professional Skills-Communication skills-III | **2-0-0** |  | F |
|  | **TOTAL** | **21-3-6** | **28** |  |

**Semester –IV**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subject Code** | **Subject** | **Contact Hours**  **L-T-P** | **Credits** |  |
|  | **Random Variables & Stochastic Processes** | **2-1-0** | **3** | **S** |
| BEE012A | Analog Electronics | 3-1-0 | 4 | C |
| BEE013A | Signal and Systems | 3-1-0 | 4 | C |
| BEE014A | Principle of Communication | 3-1-0 | 4 | C |
| BEE015A | Electromagnetic Field Theory | 3-1-0 | 4 | C |
| BEE016A | Object Oriented Programming | 2-0-0 | 2 | ID |
| BEE017A | Electronic Workshop | 0-0-2 | 2 | C |
| BEE018A | Analog Electronics Lab | 0-0-2 | 2 | C |
| BEE019A | Object Oriented Programming Lab | 0-0-2 | 2 | ID |
| BHS004A | Professional Skills-IV | **2-0-0** |  | F |
| BEE075A | Seminar | 0-0-1 | 1 | S |
|  | **TOTAL** | **18-5-7** | **28** |  |

**Semester –V ECE**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subject Code** | **Subject** | **Contact Hours**  **L-T-P** | **Credits** |  |
|  | **Numerical Methods and Optimization Techniques** | **2-1-0** | **3** | **S** |
| BEE020A | Microprocessor & Microcontroller System | 3-1-0 | 4 | C |
| BEE021A | Digital Communication | 3-1-0 | 4 | C |
| BEE022A | Microprocessors & Microcontroller System Lab | 0-0-2 | 2 | C |
| BEE023A | Communications Engineering Lab | 0-0-2 | 2 | C |
| BEE024A | Basic Simulation Lab | 0-0-2 | 2 | C |
|  | Program Elective –I | 3-**0-**0 | **3** | S |
|  | Program Elective –II | 3-1-0 | 4 | S |
|  | Open Elective –I | 3-0-0 | 3 | ID |
| BHS005A | Professional Skills-V | **2**-0-0 |  | F |
| BEE076A | Seminar | 0-0-1 | 1 | S |
|  | **TOTAL** | **19-4-7** | **28** |  |
|  |  |  |  |  |

|  |  |
| --- | --- |
| **Program Electives – I** | BEE025A Microwave Theory and Techniques  **BCO010BData Base Management System**  BEE027AIC Technology |
| **Program Electives – II** | BEE028AInformation Theory and Coding  BEE029AComputer Organization & Architecture  BEE030APower Electronics |

**Semester –VI**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subject Code** | **Subject** | **Contact Hours**  **L-T-P** | **Credits** |  |
| BEE033A | Digital Signal Processing | 3-**1**-0 | **4** | S |
| BEE034A | VLSI Design | 3-**0**-0 | **3** | S |
| BEE035A | Control System | 3-**1**-0 | **4** | S |
| BEE036A | Digital Signal Processing Lab | 0-0-2 | 2 | S |
| BEE037A | VLSI Design Lab | 0-0-2 | 2 | S |
| BEE038A | Control System Lab | 0-0-2 | 2 | S |
|  | Program Elective –III | 3-1-0 | 4 | S |
|  | Program Elective –IV | 3-**0**-0 | **3** | S |
|  | Open Elective –II | 3-0-0 | 3 | ID |
| BHS006A | Professional Skills-VI | 2-0-0 |  | F |
| BEE077A | Seminar | 0-0-1 | 1 | S |
|  | **TOTAL** | **20-3-7** | **28** |  |

|  |  |
| --- | --- |
| **Program Electives - III** | BEE039AAntennas and Wave Propagation  BEE040AOptimization Techniques  BEE041A Embedded System  **BEE 081A Programming in JAVA** |
| **Program Electives – IV** | BEE042ARadar &Satellite Communication  **BEE082A Web Designing Techniques**  BEE044ADigital Hardware Design  **BEE083AOperating Systems** |

**Semester –VII**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subject Code** | **Subject** | **Contact Hours**  **L-T-P** | **Credits** |  |
| BEE049A | Communication Networks | 3-0-0 | 3 | S |
| BEE050A | Fiber Optic Communication | 3-0-0 | 3 | S |
| BEE051A | Mobile Communication | **3**-1-0 | **4** | S |
| BEE052A | Communication Networks Lab | 0-0-2 | 2 | S |
|  | Program Elective –V | 3-1-0 | 4 | S |
|  | Program Elective –VI | 3-1-0 | 4 | S |
|  | Open Elective –III | 3-0-0 | 3 | ID |
| BEE053A | Project | 0-0-4 | 4 | C |
| BHS007A | Professional Skills-VII | **2** |  | F |
| BEE078A | Seminar | 0-0-1 | 1 | S |
|  | **TOTAL** | **19-4-7** | **28** |  |

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| --- | --- |
|  |  |
| **Program Electives – V** | BEE054A Adaptive Signal Processing  BEE055A Speech and Audio Processing  BEE056A ASIC & FPGA  BEE057A Micro Electro Mechanical systems |
| **Program Electives – VI** | BEE058A Broad Band Communication  BEE059A Image &Video Processing  BEE060AArtificial neural Network  BEE061A Mixed Signal Design  BEE062ADSP Processors and Applications |

**Semester –VIII**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Subject Code** | **Subject** | **Contact Hours**  **L-T-P** | **Credits** |  |
| BEE063A | Industrial Project/Dissertation | ------- | 28 | C |
|  | **TOTAL** |  | **28** |

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***Faculty of Engineering & Technology* Hours: 36**

**B. Tech. (common to all disciplines)-I/II Semester**

**Contact Hours (L-T-P): 3-0-0**

**Basic Electronics Engineering(BES001B)**

**Course Objectives of Basic Electronics Engineering:**

* *To understand basic concepts required in understanding electronic circuits*
* *To understand the concept of Semiconductor Diode and their applications.*
* *To understand the concept of Opto-Electronic Devices.*
* *To understand the concept of BJT and their configurations. As well as the concept of Field Effect Transistor with their various configuration.*
* *The student will be able to understand fundamental circuit analysis techniques and basic electronics backgrounds, including PN Diode, BJT and MOSFET.*
* *The student will be able to understand the concept of Various Binary Number Systems and conversions.*
* *To understand Logic Gates and Logic Circuit focussing on basic and universal gates.*

**Unit 1:**Comparison of Insulator, conductor and semiconductor with energy band diagrams. Semiconductor materials-Intrinsic and Extrinsic semiconductor (P-type and N-type SC),Crystal structures of p-type and N type materials, resistivity, conductivity, mobility.

**Unit 2:** Semiconductor Diode,PN diode-construction, working and V-I plot, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters with calculation of ripple factor and efficiency, Breakdown Mechanisms, Zener Diode – construction, Operation, characteristics; Opto-Electronic Devices – LEDs, Photo Diode, SCR.

**Unit 3:** Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations-(construction, Properties, Input and output graphs), Operating Point, Biasing configurations: Fixed Bias, Emitter bias and Voltage Divider Bias Configuration;

**Unit 4:** Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs (Construction, Input characteristics and transfer characteristics).

**Unit 5:** Number Systems: Binary system, Hexadecimal System, Octal system, Decimal system, Code conversions, Basic Logic Gates(AND, OR , NOT), Universal Gates(NAND and NOR) and other gates(EX-OR,EX-NOR),Truth Tables, Boolean Algebra, De Morgan’s Theorems, Realization of other gates using NAND and NOR.

***Course Outcome (CO):***

At the end of this course students will have:

CO1-Ability to understand the physical properties of different types of semiconductors used in fabricating devices.

CO2- Ability to understand the functioning of PN junction diode and explains its main application as rectifiers and opto-electronic devices.

CO3-Ability to understand the surprising action of BJT and explains its working and biasing in three configurations

CO4-Ability to understand the working of JFET and MOSFET.

CO5-Ability to understand the concept *of Various Binary Number Systems and Codes, Logic Gates and Logic Circuit.*

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | M | H |  |  |  |  |  |  |  | M |  |  |  | L |  |
| CO2 | M | H |  |  |  |  |  | H |  |  |  |  | L | H | L |
| CO3 |  |  | H | M | L |  |  |  | L |  |  |  |  |  | M |
| CO4 |  |  |  | H | H |  |  |  |  |  | L |  | H |  |  |
| CO5 |  |  |  |  |  | H | H |  |  |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

1. R. L. Boylestad & Louis Nashlesky (2007), Electronic Devices &Circuit Theory, Pearson Education

**Reference Books**

1. Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India

2. David A. Bell (2008), Electronic Devices and Circuits, Oxford University Press

3. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals, Pearson Education

4. R. S. Sedha (2010), A Text Book of Electronic Devices and Circuits, S.Chand & Co.

5. R. T. Paynter (2009), Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education

JECRC UNIVERSITY

***Faculty of Engineering & Technology***

**B.Tech.(common to all disciplines)-I/II Semester**

**Contact Hours (L-T-P): 0-0-2**

**Basic Electronics Engineering Lab (BES004A)**

1. Familiarization of electronics component and equipment’s like C.R.O, Function generator and power supplies etc. Generate a sine wave using a function generator and measure its amplitude and frequency using C.R.O.

2. Determine static resistance and dynamic resistance of p-n junction diode and plot the V-I characteristics

3. Plot the V-I characteristics of Zener diode and hence determine the dynamic resistance from the characteristics.

4. Design and test, diode clipping circuits for peak clipping and peak detection.

5.Design and test, positive and negative clamping circuit for a given reference voltage.

6.i)Observe output waveform of half wave rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor.

6.ii)Observe output waveform of full wave rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor.

7. Observe waveform at the output of Bridge rectifier with and without filter capacitor and measure DC voltage, DC current, ripple factor with and without filter capacitor.

8.Design a half wave rectifier using discrete components on a breadboard and measure DC voltage, DC current, ripple factor, with and without filter capacitor.

9.Design afull wave rectifier using discrete components on a breadboard and measure DC voltage, DC current, ripple factor with and without filter capacitor.

10. Obtain the input and output characteristics of common emitter transistor

11. Obtain the input and output characteristics of common base transistor.

12. DrawDC load line of transistor working as a switch.

13. Obtain V-I characteristics of field effect transistor (FET).

14. Design a circuit for inverting amplifier using op amp IC741.

15. Verification of Truth table of basic & universal Gates using ICs.

***Course Outcome (CO):***

CO1- Ability to understand the working of diodes

CO2- Ability to understand the use of CRO and Function Generator

CO3- Ability to understand the operation of PN diode and rectifiers.

CO4- Ability to understand the circuitry which converts an AC to digital DC.

CO5- Ability to understand the designing of different types of filters and logic gates.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | M | H |  |  |  |  |  |  |  | M |  |  |  | L |  |
| CO2 | M | H |  |  |  |  |  | H |  |  |  |  | L | H | L |
| CO3 |  |  | H | M | L |  |  |  | L |  |  |  |  |  | M |
| CO4 |  |  |  | H | H |  |  |  |  |  | L |  | H |  |  |
| CO5 |  |  |  |  |  | H | H |  |  |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

R. L. Boylestad& Louis Nashlesky (2007), Electronic Devices &Circuit Theory, Pearson Education

**Reference Books**

SantiramKal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India

David A. Bell (2008), Electronic Devices and Circuits, Oxford University Press

Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals, Pearson Education

R. S. Sedha (2010), A Text Book of Electronic Devices and Circuits, S.Chand& Co.

R. T. Paynter (2009), Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education

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***Faculty of Engineering & Technology* Hours: 36**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 2-1-0**

**Advanced Engineering Mathematics ()**

**Course Objectives:**

***Module1:***

LAPLACE TRANSFORM - Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant co-efficients with special reference to the wave and diffusion equations.

***Module 2:***

FOURIER SERIES & Z TRANSFORM – Expansion of simple functions in fourier series. Half range series, Change of intervals, Harmonic analysis. Z TRANSFORM - Introduction, Properties, Inverse Z Transform.

***Module3:***

FOURIER TRANSFORM - Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant coefficient with special reference to heat equation and wave equation.

***Module 4:***

COMPLEX VARIABLES - Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy;s theorem. Cauchy’s integral formula.

***Module5:***

COMPLEX VARIABLES -Taylor’s series Laurent’s series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.

|  |
| --- |
| **OUTCOMES:** At the end of the course, the student should be able to:  CO1: Compute dot and cross product of vectors. Use Calculus to compute quantities from  physics such as: motion of a particle (velocity, acceleration, distance travelled).  Find derivation of vector or scalar point function, gradient, divergence and curl.  CO2: Apply Fundamental Theorem of Line Integrals, Green’s Theorem, Stokes’ Theorem, or  Divergence Theorem to evaluate integrals.  CO3: Familiar with Orthogonalcurvilinearcoordinates, polar spherical coordinates and  cylindrical coordinates, change of variables (Jacobian).  CO4: Use the gamma function, beta function and special functions to evaluate different types  of integral calculus problems.  CO5: To approximate polynomials in terms of Legendre’s and Bessel’s Functions and able to  solve Linear differential equations using power series method. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specifice Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M |  |  |  |  |  | L |  |  | M | M | L | H | M |
| CO2 | H | M |  |  | M |  | L |  | M |  |  | M |  | H | L |
| CO3 | H | M |  | M |  | L |  |  |  |  |  |  | L | H |  |
| CO4 | H | M |  |  |  |  |  |  | L |  | L | H |  | H | L |
| CO5 | H | M | M |  |  |  | M |  |  | M |  | L |  | H | M |

H = Highly Related; M = Medium L=Low

***Recommended Books:***

1. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley (2010)

2. Engineering Mathematics: A Foundation for Electronic, Electrical, Communications and Systems Engineers, 3/e Croft, Pearson (2009)

3. Mathematical methods of science and engineering, Cengage Learning,Datta(2006)

4. Advanced engineering mathematics, Cengage learning,O’neil (2012)

5. Engineering Mathematics, T Veerarajan, TMH (2005)

6. Advance Engineering Mathematics, Potter, Oxford (2005)

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***Faculty of Engineering & Technology* Hours: 36**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 3-0-0**

**DATA STRUCTURES AND ALGORITHMS (BEE079A)**

|  |  |
| --- | --- |
| **UNIT 1** | Introduction: Notions of data type, abstract data type and data structures. Importance of algorithms and data structures in programming. Notion of Complexity covering time complexity, space complexity, Worst case complexity & Average case complexity. BigOh Notation, Omega notation, Theta notation. Examples of simple algorithms and illustration of their complexity. Sorting- Bubble sort, selection sort, insertion sort, Quick sort; Heap sort; Merge sort; Analysis of the sorting methods. Selecting the top k elements. Lower bound on sorting. |
| **UNIT 2** | Stack ADT, Infix Notation, Prefix Notation and Postfix Notation. Evaluation of Postfix Expression, conversion of Infix to Prefix and Postfix Iteration and Recursion- Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion. |
| **UNIT 3** | List ADT. Implementation of lists using arrays and pointers. Stack ADT. Queue ADT. Implementation of stacks and queues. Dictionaries, Hash tables: open tables and closed tables. Searching technique- Binary search and linear search, link list- single link list, double link list, Insertion and deletion in link list. |
| **UNIT 4** | Binary Trees- Definition and traversals: preorder, post order, in order. Common types and properties of binary trees. Binary search trees: insertion and deletion in binary search tree worst case analysis and average case analysis. AVL trees. Priority Queues -Binary heaps: insert and delete min operations and analysis. |
| **UNIT 5** | Graph: Basic definitions, Directed Graphs- Data structures for graph representation. Shortest path algorithms: Dijkstra (greedy algorithm) and Operations on graph, Worshall’s algorithm , Depth first search and Breadth-first search. Directed acyclic graphs. Undirected Graphs, Minimal spanning trees and algorithms (Prims and Kruskal) and implementation. Application to the travelling salesman problem. |

Course Outcomes:

* To study various data structure concepts like Stacks, Queues, Linked List, Trees and Files
* To overview the applications of data structures.
* To be familiar with utilization of data structure techniques in problem solving.
* To have a comprehensive knowledge of data structures and algorithm.
* To carry out asymptotic analysis of algorithm

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specifice Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M |  |  |  |  |  | L |  |  | M | M | L | H | M |
| CO2 | H | M |  |  | M |  | L |  | M |  |  | M |  | H | L |
| CO3 | H | M |  | M |  | L |  |  |  |  |  |  | L | H |  |
| CO4 | H | M |  |  |  |  |  |  | L |  | L | H |  | H | L |
| CO5 | H | M | M |  |  |  | M |  |  | M |  | L |  | H | M |

H = Highly Related; M = Medium L=Low

**Text Books:**

1. Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman and John E. Hopcroft , Addison-Wesley Series (1983)

**Reference Books:**

1. T.H. Cormen, C.E. Leiserson, and R.L. Rivest. Introduction to Algorithms.The MIT Press and
2. McGraw-Hill Book Company, Cambridge, Massacusetts, 1990 (Available in Indian Edition).
3. Steven S. Skiena. The Algorithm Design Manual.Springer, Second Edition, 2008.
4. Data Structures and Algorithm Analysis in Java (3rd Edition) by Mark Allen Weiss, Addison Wesley(2011).

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***Faculty of Engineering & Technology* Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 3-1-0**

**Electronics Devices (BEE001A)**

**Course Objectives:**

1. *Understand the working of diodes, transistors.*
2. *Understand the application of different electronic devices and simple circuits.*
3. *This course gives an overview of various semiconductor devices.*
4. *At the end of this course, the students will be able to analyze and design amplifier circuits, Oscillators and filter circuits employing BJT, FET devices.*
5. *To develop the knowledge of semiconductor devices and circuits, and explain their use in communication applications.*
6. *To inculcate circuit analysis capabilities in students.*
7. *To make students aware of various types of integrated circuits that can be used in computer applications.*
8. *To make students aware that knowledge gained in electronic devices and circuits is useful in real life applications.*

**Unit 1:**Semiconductor physics: Allowed and forbidden energy bands, electrical conduction in solids, Density of state function, Statistical mechanics, Charge carriers in semiconductors, dopant atoms and energy levels, Extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi level, Carrier drift, Carrier diffusion, graded impurity distribution, Hall effect, Carrier generation and recombination, characteristics of excess carriers, Ambipolar Transport.

**Unit 2:**The pn junction: basic structure of pn junction, zero applied bias, non-uniformly doped junctions, pn junction current, small signal model of the pn junction, generation and recombination currents, junction breakdown, charge storage and diode transients, the tunnel diode, schottky barrier diode, metal semiconductor ohmic contacts, heterojunctions.

**Unit 3:**The bipolar transistor: The bipolar transistor action, minority carrier distribution, low frequency common base current gain, non-ideal effects, Ebers-Moll model,Gummel-poon model, Hybrid equivalent model, Hybrid-π Model, frequency limitations, large signal switching, polysilicon emitter BJT, silicon- germanium base transistor, heterojunction bipolar transistors.

**Unit 4:** Fundamentals of MOS field effect transistors: The two terminal MOS structure, capacitance voltage characteristics, basic MOSFET operation, Frequency limitations, CMOS technology, non ideal effects, MOSFET scaling, threshold voltage modifications, additional electrical characteristics, radiation and hot electron effects.

**Unit 5:**Discrete transistor amplifiers: Common-emitter fixed bias configuration, Voltage-divider bias, CE emitter bias configuration, Emitter follower configuration, Common-base configuration, Collector feedback configuration, Collector DC Feedback Configuration, Determining Current Gain, Effect of RL and RS, Two port systems approach, Cascaded systems, Darlington Connection.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understand semiconductor physics |
| CO2- Ability to understand diodes & its application. |
| CO3-Ability to understand & analyse transistors. |
| CO4-Ability to understand Mosfets. |
| CO5-Ability to understand small signal amplifiers. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | H |  | L |  |  |  | L |  |
| CO2 | L |  | L | L | M | L |  | L | L | M | L |  | L | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  |  | L |  |  | M |
| CO4 |  |  | L |  | H |  |  | L |  | H |  |  | H |  |  |
| CO5 | M | L |  | L |  | L | L |  | L |  | L | L | L | M |  |

H = Highly Related; M = Medium L = Low

**Text Books**

1. Semiconductor Physics and Devices, Donald A. Neamen, TMH
2. Electronic Devices And Circuit Theory, Boylestad, Pearson

**Reference books**

1. Semiconductor Devices: Modelling And Technology, Nandita Dasgupta, PHI.
2. Solid State Electronic Devices,B.G. Streetman, PHI.
3. Electronic Devices And Circuits, Salivahanan, TMH
4. Electronic Devices, Floyd, Pearson.
5. Electronic Devices And Circuits, Bell, Oxford

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 3-1-0**

**Digital Electronics (BEE002A)**

**Course Objectives:**

1. *To introduce number systems and codes.*
2. *To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions.*
3. *To introduce the methods for simplifying Boolean expressions.*
4. *To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.*
5. *To introduce the concept of memories, programmable logic devices and digital ICs*
6. *On completion of this course, the students can design combinational and sequential digital logic circuits. Also they will have knowledge on Programmable Logic devices and its usage.*
7. *To illustrate the concept of synchronous and asynchronous sequential circuits.*

**Unit 1:**Introduction- Digital Systems; Data representation and coding; Logic circuits, integrated circuits; Analysis, design and implementation of digital systems; CAD tools. Number Systems and Codes- Positional number system; Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers; Binary coded decimal codes; Gray codes; Error detection and correction codes - parity check codes and Hamming code.

**Unit 2:**Combinatorial Logic Systems- Definition and specification; Truth table; Basic logic operation and logic gates. Boolean Algebra and Switching Functions- Basic postulates and fundamental theorems of Boolean algebra, Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map and Quine-McCluskey tabular methods, Synthesis of combinational logic circuits.

**Unit 3:**Logic families-Introduction to different logic families; Operational characteristics of BJT in saturation and cut-off regions; Operational characteristics of MOSFET as switch; TTL inverter - circuit description and operation; CMOS inverter - circuit description and operation; Structure and operations of TTL and CMOS gates; Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product. Combinational Logic Modules and their applications-Decoders, encoders, multiplexers, demultiplexers and their applications, Parity circuits and comparators, Arithmetic modules- adders, subtractors and ALU, Design examples.

**Unit 4:**Sequential Logic systems- Definition of state machines, state machine as a sequential controller; Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop; Timing hazards and races; Analysis of state machines using D flip-flops and JK flip-flops; Design of state machines - state table, state assignment, transition/excitation table, excitation maps and equations, logic realization; Design examples. State machine design approach-Designing state machine using ASM charts, Designing state machine using state diagram, Design examples.

**Unit 5:**Sequential logic modules and their applications- Multi-bit latches and registers, counters, shift register, application examples.Memory- Read-only memory, read/write memory – SRAM and DRAM. Programmable Logic Devices-PLAs, PALs and their applications; Sequential PLDs and their applications; State- machine design with sequential PLDs; Introduction to field programmable gate arrays (FPGAs).

***Course Outcome (CO):***

CO1: Able to understand number system, basic logic gates and Boolean algebra.

CO2: Able to understand the various characteristics of Digital Logic circuits

CO3: Able to apply various minimization techniques to reduce complexity in Digital Circuits

CO4: Able to design various combinational circuits and & understand their utility

CO5: Able to understand various types of sequential circuits and their applications

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | H |  | L |  |  |  | L |  |
| CO2 | H | M |  |  |  |  | L |  |  |  |  | L |  |  | M |
| CO3 |  |  | L |  | H |  |  | L |  | H |  |  | H |  |  |
| CO4 | H |  | H |  | L |  |  | H |  | L |  |  |  | L |  |
| CO5 | M | L |  | L |  | L | L |  | L |  | L | L | L | M |  |

H = Highly Related; M = Medium L = Low

**Text Books**

1. Digital Design, M.Morris Mano, Pearson
2. Digital Design Principles – Fletcher.

**Reference books**

1. Modern Digital Electronics, R.P. Jain, TMH
2. Fundamentals of Digital Logic with VHDLDesignby  Stephen Brown, Zvonko Vranesic - McGraw-Hill Science.
3. Digital Principles And Applications (Special Indian Edition), Leach & Malvino, TMH
4. Digital Fundamental, Floyd & Jain, Pearson.
5. Digital Logic And Computer Design, Mano, Pearson
6. Digital Systems: Principles And Applications, Tocci, Pearson
7. Digital System Design – John Wakerley.

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 3-1-0**

**Network Theory & System (BEE003A)**

**Course Objectives:**

1. *To deal with elementary network Theory and transient response of circuit with various type of Signals. It also gives the students the knowledge of fundamental of network synthesis in order to solve the problem involved in design. It also includes two port network; electrical filter; and topology. All Topics are concerned with and are based on electric circuit theory and it is hoped that the students will find to this advantages to understand the basic approach from circuit view point.*
2. *Introduce students to different methods involves in analysis both linear and nonlinear networks.*
3. *Provide students with basic information on how to perform circuit analysis using network parameters and provide students with required knowledge on how to determine system stability using network stability criteria.*

**Unit 1:** NETWORK THEOREMS AND ELEMENTS:Introduction to basic circuit elements, KVL, KCL, Ohm’s Law. Theorems - Thevenin’s, Norton’s, Reciprocity, Superposition, Compensation, Miller’s, Tellegen’s and maximum power transfer theorems. Networks with dependent sources.

**Unit 2:**NETWORK GRAPH THEORY:Network Graph, Tree, Fundamental loop, Cut set, Incidence matrix, augmented Incidence matrix.

**Unit 3:** TRANSIENTS ANALYSIS: Response of circuits to Impulse, step, ramp and sinusoidal inputs. Analysis of first order and second order circuits. Time domain & frequency domain analysis. Initial and final value theorem. Complex periodic waves and their analysis by Fourier analysis. Different kinds of symmetry. Power in a circuit.

**Unit 4:** NETWORK FUNCTIONS & SYNTHESIS:Terminals and terminal pairs, driving point impedance transfer functions, poles and zeros. Procedure of finding network functions for general two terminal pair networks. Stability & causality. Hurwitz polynomial, positive real function. RL & RC networks synthesis, Foster First & Second forms, Cauer forms.

**Unit 5:** TWO PORT NETWORKS:Two port parameters and their interrelations, z –parameter, y- parameters, h-parameters, ABCD parameters. Equivalence of two ports, transformer equivalent, interconnection of two port networks, image parameters. Attenuation and phase shift in symmetrical T- and O –network.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-*Ability to understand the concept of circuit elements lumped circuits, waveforms, circuit laws and network reduction* |
| CO2- *Ability to solve the electrical network using mesh and nodal analysis by applying network theorems*. |
| CO3- *Ability to understand the concept of active, reactive and apparent powers, power factor and resonance in series and parallel circuits.* |
| CO4- *Ability to know the basic concepts of coupled circuits, three phase loads and power measurement.* |
| CO5- *Ability toanalyze the transient response of series and parallel A.C. circuits and to solve problems in time domain using Laplace Transform.*  **MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | | CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  | | CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L | | CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M | | CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  | | CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |   H = Highly Related; M = Medium L = Low |

**Text Book**

1. Engineering Circuit Analysis-Willian H. Hayt & Jack E. Kemmerly TMH.
2. Networks and Systems- “[D. Roy Choudhury](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22D.+Roy+Choudhury%22)” New Age International.

**Reference Book**

1. Circuits And Networks: Analysis And Synthesis, Sudhakar, TMH
2. Network Analysis And Synthesis, Ghosh & Chakrabarti, TMH
3. Schaum’s Outlines Of Electric Circuits (Sie), Nahvi, TMH
4. Basic Engineering Circuit Analysis, Irwin, Wiley
5. Network Analysis & Synthesis, Kuo, Wiley
6. Network Theory: Analysis And Synthesis, Smarjit Ghosh, PHI
7. Network Analysis- “[M.E. Van Valkenburg](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22M.E.+Van+Valkenburg%22)” Pearson Education.

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**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 2-0-0**

**Electronic Measurement & Instrumentation (BEE004A)**

**Course Objectives:**

1. *Understand principle, working and operation of various Electrical and electronic instruments.*
2. *Learn techniques for measuring electrical parameters and electrical components.*
3. *Applications of electrical and electronic instruments.*
4. *To understand basic functions and principle of working of sensors and components used in Electronic Measurement.*
5. *To understand principles of advanced electronic instruments and application in measurement of electronics parameters.*
6. *Students will learn measurement of physical parameters using various transducers and working of sensors.*
7. *They will become familiar with basics of instruments and details of operation of measuring instruments and their applications.*

**Unit 1:** SCIENCE OF MEASUREMENT: Measurement Systems, Instrumentation, Characteristics of measurement systems -Static and Dynamic, Errors in Measurements; Calibration and Standards.

**Unit 2:** TRANSDUCERS: Classification of Transducers – Variable Resistive transducers, Strain gauges, Thermistor, RTD, Variable Inductive transducers, LVDT, RVDT, Variable Capacitive Transducers, Capacitor microphone, Photo electric transducers, Piezo electric transducers, Thermocouple. IC sensors Fibre optic sensors, Smart/intelligent sensors.

**Unit 3:** SIGNAL CONDITIONING AND SIGNAL ANALYZERS: DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering Bridges; Preamplifier; Isolation amplifier, Filters – Data acquisition systems. Spectrum Analyzers –Wave and Logic analyzers.

**Unit 4:** DIGITAL INSTRUMENTS:Digital Voltmeters, Millimeters, automation in Voltmeter, Accuracy and Resolution in DVM, Guarding techniques, Frequency counter, Data Loggers, Introduction to IEEE 488/GPIB Buses.

**Unit 5:** DATA DISPLAY AND RECORDING SYSTEMS OSCILLOSCOPES: CRT Construction, Basic CRO circuits, CRO Probes, Oscilloscope Techniques of Measurement of frequency, Phase Angle and Time Delay, Multibeam, multi trace, storage & sampling Oscilloscopes. Curve tracers Dual trace CRO – Digital storage and Analog storage oscilloscope.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1 Able to understand about measurement and errors encountered in measurement. |
| CO2 Able to understand the working of electronic measurement instruments. |
| CO3 Able to understand working of different types of Oscilloscope. |
| CO4 Able to understand about different signals  and its generations. |
| CO5 Able to understand of different transducers and its applications. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | M |  |  | H | L | H |  | M | M |  |  | H | H | H |  |
| CO2 | L | H | M | H | M | M |  |  | L | L |  | H | H |  | M |
| CO3 | H | M |  | M |  |  | L |  |  |  |  |  |  |  | M |
| CO4 |  |  |  | L |  |  |  |  |  | M | M |  |  |  |  |
| CO5 | H | M | M | L |  | M | L |  |  |  | L |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Book**

1. A Course In Electrical & Electronic Measurement & Instrumentation, A.K.Sawhney, Dhanpatrai

**Reference books**

1. Electronic Instrumentation, H S Kalsi, TMH
2. Instrumentation Measurement & Analysis, B.C.Nakra, K.K. Chaudhry, TMH
3. Electronic Measurements And Instrumentation, Lal Kishore, Pearson
4. Electronic Instrumentation And Measurements, David A. Bell, PHI
5. Introduction To Measurements And Instrumetation, Arun K. Ghosh, PHI

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**Faculty of Engineering & Technology Hours:36**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 3-0-0**

**Energy Studies (BMC009A)**

**Unit 1:**Energy Sources - Fossil fuels, Nuclear fuels, hydel, solar, wind and bio fuels in India, Energy conservation, Nuclear energy through fission and fusion processes.

**Unit 2:**Energy Conversion- Energy conversion from source to utility, Solar, Nuclear, Geothermal, Tide and Wind Energies.

**Unit 3:**Global Energy Scenario- Role of energy in economic development and social transformation, Overall energy demand, availability and consumption, Depletion of energy resources and its impact on economy, Non-proliferation of nuclear energy. International energy policies of G-8, G-20, OPEC and European Union countries.

**Unit 4:**Indian Energy Scenario- Commercial and noncommercial forms of energy, Utilization pattern in the past, present and also future prediction, Sector wise energy consumption.

**Unit 5:**Energy Policy: Energy policy issues at global level, national level and state level, Energy conservation act 2001, Electricity act 2003, Energy pricing and its impact on global variations.

***Course Outcome (CO):***

1. Students will get the knowledge of various generation processes, energy demand and energy policy.
2. Students will more incline to energy conservation and can contact different government agencies for energy projects.
3. To know the Energy policy issues at global level
4. To know Indian Energy Scenario- Commercial and non-commercial forms of energy.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M |  | H | M | L |  | M | L | M | H |  | M | H |  |
| CO2 |  |  | L |  |  | H |  |  |  |  | H |  |  |  | M |
| CO3 |  | M |  | H |  |  | H |  | L | L |  | M |  | H | M |
| CO4 | H |  | M |  | H |  | M | M |  |  |  | M | L |  |  |

H = Highly Related; M = Medium; L = Low

**Text Books:**

1.Dr. A.N Mathur-Non Conventional resources of Energy

2. B.R Gupta-Generation of Electrical Energy

**Reference Books:**

1. Bukhootsow, B., Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.
2. TEDDY Year Book, The Energy Research Institute (TERI), 2011.
3. International Energy Outlook, EIA Annual Publication, 2011.
4. Jose Goldenberg, Thomas Johanson, and Reddy, A.K.N., Energy for Sustainable World, Wiley Eastern 2005.
5. Charles E. Brown, World Energy Resources, Springer Publication, New York, 2002.Culp, A.W., Principles of Energy Conversion, McGraw Hill New York, 2004.

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**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 0-0-2**

**Electronics Devices Lab (BEE005A)**

**List of Experiments**

**1.** Design and test diode clipping circuits on breadboard, using discrete components for peak clipping and peak detection.

i) Positive and Negative Clipping Circuit.

ii) Diode series positive and negative Clipping Circuit.

**2**. Design and test positive and negative clamping circuit on breadboard,using discrete componentsfor a given reference voltage.

**3.** Graphical measurement of forward and reverse resistance in Zener diode characteristics.

**4.** Application of Zener diode: Zener diode as voltage regulator. Measurement of percentage regulation by varying load resistor.

**5.** Plot the I-V characteristics of BJT in CB and CE configuration using suitable discrete components.

6. Design discrete transistor amplifier with common-emitter fixed bias configuration and plot the frequency response.

7. Design discrete transistor amplifier with Voltage-divider bias configuration and plot the frequency response.

**8.** Design and setup an RC Coupled amplifier using BJT & to plot the frequency response of the RC-Coupled amplifier.

**9.** Design a BJT Darlington Emitter Follower and determine the Gain andplot the frequency response.

**10.**Verify Thevenin’s theorem for DC Circuits.

**11.** Characteristic of FET: FET in common source configuration. Graphical measurement of its parameters gm and rd from input and output characteristics.

**12.** Characteristic of silicon-controlled rectifier.

**13.** To plot V-I Characteristics of DIAC.

**14.** To draw V-I characteristics of TRIAC for different values of Gate Currents.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understand semiconductor physics |
| CO2- Ability to understand diodes & its application. |
| CO3-Ability to understand & analyse transistors. |
| CO4-Ability to understand Mosfets. |
| CO5-Ability to understand small signal amplifiers. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | H |  | L |  |  |  | L |  |
| CO2 | L |  | L | L | M | L |  | L | L | M | L |  | L | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  |  | L |  |  | M |
| CO4 |  |  | L |  | H |  |  | L |  | H |  |  | H |  |  |
| CO5 | M | L |  | L |  | L | L |  | L |  | L | L | L | M |  |

H = Highly Related; M = Medium L = Low

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**Faculty of Engineering & Technology Hours:24**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 0-0-2**

**Digital Electronics Lab (BEE006A)**

**List of Experiments**

1. To study and verify the truth table of logic gates.
2. Design and implementation of Adder and Subtractor using logic gates.
3. Design and implementation of BCD to excess-3 code converter using logic gates.
4. Design and implementation of Binary to gray code converter using logic gates.
5. Design and implementation of 4 bit binary Adder/ subtractor using IC 7483
6. Design and implementation of 4 bit binary BCD adder using IC 7483
7. Design and implementation of 2 bit Magnitude Comparator using logic gates.
8. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
9. Design and implementation of multiplexer using logic gates, IC74150 and IC74154.
10. Design and implementation of De-multiplexer using logic gates, IC74150 and IC74154
11. Design and implementation of encoder using logic gates, IC7445 and IC74147
12. Design and implementation of decoder using logic gates, IC7445 and IC74147
13. Construction and verification of 4 bit ripple counter.
14. Design and implementation of 3-bit synchronous up/down counter.
15. Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- flops

***Course Outcome (CO):***

CO1: Able to understand number system, basic logic gates and Boolean algebra.

CO2: Able to understand the various characteristics of Digital Logic circuits

CO3: Able to apply various minimization techniques to reduce complexity in Digital Circuits

CO4: Able to design various combinational circuits and & understand their utility

CO5: Able to understand various types of sequential circuits and their applications

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | H |  | L |  |  |  | L |  |
| CO2 | H | M |  |  |  |  | L |  |  |  |  | L |  |  | M |
| CO3 |  |  | L |  | H |  |  | L |  | H |  |  | H |  |  |
| CO4 | H |  | H |  | L |  |  | H |  | L |  |  |  | L |  |
| CO5 | M | L |  | L |  | L | L |  | L |  | L | L | L | M |  |

H = Highly Related; M = Medium L = Low

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**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester III**

**Contact Hours (L-T-P): 0-0-2**

**Electronic Measurement Lab (BEE007A)**

**List of Experiments**

1. Measurement of displacement using LVDT.

2. Measurement of distance using LDR

3. Measurements of temperature using R.T.D.

4. Measurements of temperature using Thermocouple.

5. Measurements of pressure using Strain Gauge.

6. Measurements of pressure using Piezo – Electric Pick up.

7. Measurements of Angular Distance using capacitive pick up.

8. Measurements of distance using inductive transducer.

9. Measurements of speed of DC Motor using Magnetic Pick up.

10. Measurements of speed of DC Motor using Photo Electric Pick up.

11. To Determine the Thickness of a Given Object (within LVDT Range) Using LVDT.

12. Measurement of Intensity of Light using LDR Transducer.

13. To Study the Phase Shift on CRO Using LVDT.

14. To Plot and Studying the Characteristics of Thermocouple.

15. To Plot and Studying the Graph between Temperature and Resistance using RTD.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1 Able to understand about measurement and errors encountered in measurement. |
| CO2 Able to understand the working of electronic measurement instruments. |
| CO3 Able to understand working of different types of Oscilloscope. |
| CO4 Able to understand about different signals  and its generations. |
| CO5 Able to understand of different transducers and its applications. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | M |  |  | H | L | H |  | M | M |  |  | H | H | H |  |
| CO2 | L | H | M | H | M | M |  |  | L | L |  | H | H |  | M |
| CO3 | H | M |  | M |  |  | L |  |  |  |  |  |  |  | M |
| CO4 |  |  |  | L |  |  |  |  |  | M | M |  |  |  |  |
| CO5 | H | M | M | L |  | M | L |  |  |  | L |  |  |  | M |

H = Highly Related; M = Medium L = Low

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**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 2-0-0**

**Complex Analysis (BAS005A)**

**Course Objectives:**

*Module1:*

AnalyticFunctions; Cauchy RiemannEquations;Integrals,Cauchy theoremandCauchy integralformulae.

*Module 2:*

Singularpointsandpoles;Taylor’s series, Laurent’sseries,Residues,Residue theorem.

*Module3:Evaluationofdefiniteintegrals*,Conformalmapping,Riemann’s mapping theorem;Somegeneraltransformations,mappinga halfplane intoacircle.

*Module4:*The Schwarz- Christoffel transformation; Thesolution ofLaplace equation byconformalmapping.

*Module5:*

Analytic continuation, Applicationtoboundaryvalueproblems.

***CO1:*** Determine whether a given function is differentiable, and if so find its derivative.Use differentiation rules to compute derivatives.Express complex-differentiable functions as power series.Find parameterizations of curves, and compute complex line integrals directly.Use Cauchy’s integral theorem and formula to compute line integrals.

***CO2:*** Identify the isolated singularities of a function and determine whether they are removable, poles, or essential. Compute innermost Laurent series at an isolated singularity, and determine the residue.Use the residue theorem to compute complex line integrals and real integrals

***CO3:****discuss Definite integral in complex plane and solve the mapping.*

*CO4: Determine Schwarz-Christoffel transformation and Laplace equation by Conformal Mapping*

*CO5:Discuss Analytic continuation.*

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specifice Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  |  |  |  |  |  |  | M | M |  | M | M |  |  |
| CO2 |  | H | H |  |  |  |  |  |  |  | M | M | H |  |  |
| CO3 |  |  | H |  | M |  | M |  |  |  |  |  |  | H | M |
| CO4 |  |  |  | M | H |  |  | L |  |  | M | M |  |  | M |
| CO5 | H | H |  |  | M | L |  |  |  |  |  | M | M |  |  |

H = Highly Related; M = Medium L=Low

***Recommended Books:***

*1.Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand &Co.NewDelhi, 2002.*

*2.R.V. Churchil& J.W. Brown, Complex Variables and Applications, 5th Edition,McGraw-Hill, New York, 1990.*

*3.Mark J., Ablowitz& A.S. Fokas, Complex Variables: Introduction andApplications,Cambridge University Press. South Asian Edition, 1998.*

*4.Murray.R.Spiegel,Theory and Problems of Complex Variables-,Schaum outline series, 2004.*

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**Faculty of Engineering & Technology Hours: 36**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 2-1-0**

**Random Variables & Stochastic Processes ()**

**Course Objectives:**

**Unit 1:**

PROBABILITY- Introduction, definitions, conditional probability, combined experiments.

**Unit 2:**

RANDOM VARIABLES - Introduction, Distribution and density functions, Discrete and continuous random variables, (Gaussian), Exponential, Rayleigh, Uniform, Bernoulli, Binominal, Poisson, discrete Uniform and conditional distributions. Functions of one random variable: distribution, mean, variance, moments and characteristics functions.

**Unit 3:**

MULTIPLE RANDOM VARIABLES - distributions, Pne function of two random variables, Two functions of two random variables, Joint moments, Joint characteristics functions, Conditional distributions, conditional expected values, statistical independence. Multiple random variables: multiple functions of multiple random variables, jointly Gaussian random variables, sums of random variable, Central limit theorem.

**Unit 4:**

STOCHASTIC PROCESSES - Definitions, Random process concept, Statistics of stochastic processes: mean, autocorrelation, strict and wide sense stationary, random processes and Linear Systems.

**Unit 5:**

STOCHASTIC PROCESSES IN FREQUENCY DOMAIN - Power spectrum of stochastic processes, Transmission over LTI systems, Gaussian and White processes, Properties of power spectral density.

**Course Outcomes**

Upon successful completion of this course, the student will be able to:

1. Understand the Basic requirement and methods of Probability and probability laws

Understand the concepts of a random variable and a probability distribution.Distinguish between discrete and continuous random variables.

1. Compute and interpret the expected value, variance, and standard deviation for discrete and continuous probability distributions.
2. Understanding the basics concepts of Joint distributions, Conditional distribution, densities and moments
3. Understand the basics concepts of sample standard error,Strong and weak laws of large numbers, central limit theorem.
4. Understand the Properties of random processes: Stationarity, correlation function, power spectral density, spectral analysis

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specifice Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H | H |  |  | M |  | M |  |  |  |  | M | H | L |  |
| CO2 |  | M |  | L | M |  | H |  |  |  | L | M | M |  |  |
| CO3 | H | H | M |  | H |  | H |  |  | M | M | H | H | L |  |
| CO4 | H | M |  | M | L |  | M |  |  |  |  | M |  | M |  |
| CO5 | H | H |  |  | M |  | H |  |  |  |  | M | H | M |  |

H = Highly Related; M = Medium L = Low

***Recommended Books:***

1 Devor –Probability and statistics for engineering and sciences, Cengage learning 2011

2 Mendenhall – Introduction to probability and statistics, Cengage learning 2012

3 Probability, Random Variables And Random Signal Principles, Peebles, TMH 2002

4 Probability Theory and Stochastic Processes for Engineers, Bhat, Pearson 2011

5 Probability and Random Processes with Application to Signal Processing, 3/e, Stark,

Pearson 2002

6 Random Variables & Stochastic Processes, Gaur and Srivastava, Genius publications

2003

7 Random Processes: Filtering, Estimation and Detection, Ludeman, Wiley 2002 8 An

Introduction to Probability Theory & Its App., Feller, Wiley 1969

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 3-1-0**

**Analog Electronics(BEE012A)**

**Course Objective:**

* *The course aim is to review and study in depth various subjects of Analog Electronics, with an emphasis on contents related with circuit design and telecommunication applications.*
* *The most relevant issues related with analog and telecommunication subsystems are analyzed in detail, to establish a reference point for the following subjects like LIC Circuit analysis, which addresses more specific subjects.*
* *On the completion of this subject students would have the knowledge of basic electronics, ability to analyze electric networks and circuits.*
* *Knowledge of linear and large signal models of MOS and BJTs, and ability to use these models in basic amplifier circuits. Knowledge and design of most used functional units, such as filters, voltage regulators, and signal generators.*

**Unit 1:**Introduction: Scope and applications of analog electronic circuits. Amplifier models:Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT amplifiers, bias stability, various configurations (such as CE, CB, CC) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications.

**Unit 2:**Frequency response amplifiers:-Low frequency analysis: Effect of coupling, bypass and output capacitor at low frequency, high frequency transistor models, Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc. Power amplifiers: Class A, Class B, Class AB and Class C, their power efficiency and linearity issues.

**Unit 3**: OP-AMP design:design of differential amplifier for a given specification, design of gain stages and output stages, compensation.OP-AMP applications: review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications**.** Active filters: Low pass, high pass, band pass and band stop, design guidelines.

**Unit 4**: Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Collpitts etc.). Current mirror: Basic current mirror, Widlar current source etc.Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain and CMRR.

**Unit 5**: Multi-vibrator: Mono-stable and Astable multi-vibrator. 555 timer:Basic block diagram, 555 timer Applications: monostable and astable multivibrator, Schmitt trigger etc.

***Course Outcome (CO):***

|  |
| --- |
| CO1-Ability to understand the concept of *Feedback circuits.* |
| CO2- Ability to understand *Oscillator Circuits*. |
| CO3-Ability to understand*High frequency networks.* |
| CO4-Ability to understand *Tuned Amplifiers*. |
| CO5-Ability to understand *Power Amplifier.* |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M | M |  |  | H |  | H |  |
| CO2 | M |  | H | L | M | L |  |  | L | L |  | H | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  | M | M |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books**

1. Integrated Electronics J. Millman and Halkias McGraw Hill.
2. Microelectronic Circuits-“[Adel S. Sedra](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Adel+S.+Sedra%22), [Kenneth Carless Smith](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Kenneth+Carless+Smith%22)” Oxford.

**Reference Books:**

1. Introduction to Operational Amplifier theory and applications, J.V. Wait, L.P. Huelsman and GA Korn,McGraw Hill, 1992.

|  |  |  |
| --- | --- | --- |
| 4. | 2. Analysis and Design of Analog Integrated Circuits, Paul R.Gray \& Robert G.Meyer, John Wiley, 3rd Edition.  3.[Op-amps and Linear Integrated Circuits](http://books.google.co.in/books?id=m4D-nQEACAAJ&dq=ramakant+gayakwad&hl=en&sa=X&ei=U9nZU47_HNeJuASL04KADQ&ved=0CBoQ6AEwAA)-”[Ramakant A. Gayakwad](https://www.google.co.in/search?sa=X&biw=1366&bih=643&tbm=bks&tbm=bks&q=inauthor:%22Ramakant+A.+Gayakwad%22&ei=w9nZU-CGIJaJuATczYCwBg&ved=0CBwQ9AgwAA) ” Prentice Hall. | Micro |

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 3-1-0**

**Signals and Systems(BEE013A)**

**Course objectives:**

1. *To develop an understanding of the fundamental tools and concepts used in the analysis of signals and the analysis and design of linear shift-invariant systems.*
2. *To develop an understanding of their application in a broad range of areas, including electronics & electrical networks, telecommunications, signal-processing and automatic control.*

**Unit 1:Signals:** Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one-dimensional/multi-dimensional; commonly used signals: unit impulse, unit step, unit ramp, exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals.

**Systems:**Definition, types of systems: linearand non-linear, time invariant and time varying, Deterministic and Stochastic, Casual and non causal, Analog and Discrete/Digital, memory and memoryless.

**Unit 2:Linear Time-Invariant Systems:** Introduction, Continuous –time and Discrete-Time LTI Systems ,The Convolution Integral, Properties of the Convolution Integral, The Convolution sum, Properties of the Convolution sum, Properties of Linear Time-Invariant Systems, Relationship between LTI system properties and the Impulse response.System representation through differential equations and difference equations.

**Unit 3:Fourier Analysis for Continuous-Time Signals and Systems:** Introduction, The Response of Continuous-Time LTI Systems to Complex Exponentials, Representation of Periodic Signals: The Continuous-Time Fourier Series, Properties of Continuous-Time Fourier Series, Approximation of Periodic Signals Using Fourier Series and the Convergence of Fourier Series. Representation of Aperiodic Signals : The Continuous -Time Fourier Transform, Properties of the Continuous –Time Fourier Transform.

**Fourier Analysis for Discrete-Time Signals and Systems:** Introduction, Properties of Discrete Fourier series, Fourier Transform and Properties of Discrete Fourier Transform.

**Unit 4: The Laplace-Trasform:** Introduction, The Laplace-Transform, The Region of Convergence for the Laplace-Transform, Properties of Laplace-Transform, Inverse Laplace-Transform, Application & Characteristics of LTI System Using Laplace- Transform.

**Unit 5:The Z-Transform:** Introduction, The Z-Transform, The Region of Convergence for the Z-Transform, Properties of Z-Transform, The Inverse z-Transform, Application & Characteristics of LTI System Using Z Transform.

**Sampling:** Introduction, Representation of a Continuous- Time Signal by Its Samples , The Sampling Theorem, Reconstruction of a signal from its Samples, The Effect of Under sampling : Aliasing.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understand Definition, types of signals and their representations and types of systems. |
| CO2- Ability to understand LTI Linear Time-Invariant Systems. |
| CO3-Ability to understand Fourier Analysis for Continuous-Time and Discrete-Time Signals and Systems. |
| CO4-Ability to understand Laplace-Trasform |
| CO5-Ability to understand Z-Transform and ROC. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  | H | H |  |  |  |  | H | H |  | H | M |  | H |  |
| CO2 | H |  |  | H | M | M |  |  |  |  |  |  | M | M | M |
| CO3 | H | L | M |  |  |  | L | M |  | H | M | H |  |  | H |
| CO4 |  |  | L | M | H |  |  |  | M |  |  |  | H |  |  |
| CO5 | H | H |  |  |  | H | L |  |  | H |  | H |  |  | L |

H = Highly Related; M = Medium L = Low

**Text Book:**

1.A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

**Reference Books:**

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.
2. B.P. Lathi, "Signal Processing and Linear Systems", Oxford University Press, c1998.
3. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition: c1999.
4. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.
5. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.
6. I. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 3-1-0**

**Principles of Communication(BEE014A)**

**Course Objectives:**

*The aim of this course is to introduce the students to the basic concepts of communication systems. The main objective of this course is to understand basic analog communication techniques/ circuits with the help of theoretical problem solving. This course provides a thorough introduction to the basic principles and techniques used in analog communications. The course will introduce analog modulation techniques, communication receiver and transmitter design, baseband and bandpass communication techniques, noise analysis and multiplexing techniques. The course also introduces analytical techniques to evaluate the performance of communication systems.*

**Unit 1 :**Introduction: Communication channels and their characteristics (Wire line channels, Wireless Electromagnetic channels, Fiber optic channels), Mathematical model for communication channel (Additive noise channel, linear filter channel, linear time invariant channel), Basic properties of Fourier transform, power and energy signal.

**Unit 2 :**Amplitude Modulation: Introduction to modulation, conventional amplitude modulation (AM), Generation of single tone AM (Square law modulator, Switching modulator), Demodulation of AM (Square law demodulator, Envelope detector, Synchronous detector), Generation of DSB (Balanced Modulator, Ring modulator), DSB Demodulation using synchronous detector, Generation and Demodulation of SSB, VSB.

**Unit 3:** Angle Modulation: Introduction (Narrow band FM, Wideband FM), Mathematical representation of FM and PM, Frequency modulation (Direct method and indirect method) and de-modulation (PLL method), Mixer, Receivers (Tune radio frequency, Super hetro-dyne receiver), Pre-Emphasis and De-Emphasis, Phase modulation and de-modulation.

**Unit 4:**Random variables and Noise:Review of probability and random variables (PMF,CDF,PDF), Statistical averages of a random variables, uniform distribution, Gaussian distribution, Noise, Noise figure, Noise in amplitude modulation systems, Noise in Frequency modulation systems, Figure of Merit of AM and FM receivers.

**Unit 5:** Digital representation of analog signals: Introduction, Sampling process, Generation and demodulation of PAM, PPM and PWM, Time Division Multiplexing, Frequency Division Multiplexing.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understand Communication channels and their characteristics |
| CO2- Ability to understand Amplitude Modulation |
| CO3-Ability to understand Angle Modulation |
| CO4-Ability to understand probability and random variables (PMF,CDF,PDF) |
| CO5-Ability to understand Digital representation of analog signals: |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | | PSO2 | PSO3 |
| CO1 |  | H | H | M |  |  |  | H | H |  | H | M |  | | H |  |
| CO2 | H |  |  | H | M | H |  |  |  |  | M |  | M | | H | M |
| CO3 | H | L | H |  |  |  | L | M |  | H | M | H |  | |  | H |
| CO4 | M |  | H | M | H | M |  |  | H |  | L | H | H | |  |  |
| CO5 | H | H |  |  |  |  | L |  |  | H | L | H |  | |  | L |

H = Highly Related; M = Medium L = Low

**Text Book**

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.

**Reference Books:**

1. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.

2. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 3-1-0**

**Electromagnetic Field Theory (BEE015A)**

**Course Objectives:**

1. *To introduce the important physical concepts and mathematical methods used in treating all types of E.M. wave phenomena particularly importance in electrical & communication engineering.*
2. *To provide essential background and basic preparation for more advanced work in device physics, microwave and ultra-fast circuitry, antenna design, optics, optical communication and optoelectronics.*

**Unit 1:**Introduction to Vector Calculus- Scalars and Vectors, unit vector, vector addition and subtraction, position and distance vectors; vector multiplication; components of vector; Coordinate systems and transformation- Cartesian, Circular Cylindrical and Spherical; Differential Length, Area, and Volume; Line, Surface, and Volume Integrals; Del Operator; Gradient of a scalar; Divergence of a Vector; Curl of a Vector.

**Unit 2:**Electrostatics- Coulomb’s Law, Electric field intensity, Electric field due to point charge, line charge, sheet of charge, Electric Flux Density, Gauss’s law, Application of Gauss’s law: point charge , infinite line charge, infinite sheet of charge; Maxwell’s Equation for Static Electric Field, Divergence Theorem, Definition of Potential Difference and Potential, Potential Gradient, an Electric Dipole and Flux Lines.

**Unit 3:** Magnetostatics- Biot-Sevart Law, magnetic field due to finite and infinite length current element, Ampere’s Circuital Law, Stokes’s Theorem, Magnetic Flux and Magnetic Flux Density, Maxwell’s equations for static magnetic field, Magnetic force, Magnetic Energy.

**Unit 4:**Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Wave propagation in conducting medium, Wave propagation and phase velocity, Power flow and Poynting vector, Plane Waves at a Media Interface- Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction at media interface, Total internal reflection, Polarization at media interface, Reflection from a conducting boundary.

**Unit 5:**Waveguides**-** Parallel plane waveguide,Rectangular waveguide, TE mode, TM mode, TEM mode, Dominate mode, Critical Wave length, Phase and Group Velocity. Equations of Voltage and Current on TX line, Propagation constant, characteristic impedance and reflection coefficient, VSWR, Smith Chart, Impedance Matching.

**Course Outcome (CO):**

By the end of this course, students will be able to:

**CO1**- Ability to understand physical concepts and Mathematical methods used in E.M. wave

Phenomena.

**CO2**- Ability to understand Electrostatics concept of E M Wave.

**CO3**-Ability to understand Magnetostatics concept of E M Wave and also the importance, necessity & use of Maxwell’s Equations.

**CO4**- Ability to understand plane wave.

**CO5**- Ability to understand waveguide with various mdes

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | | PSO2 | | PSO3 | |
| CO1 | H |  | M |  | L |  |  | H |  |  | L |  |  | | L | |  | |
| CO2 | L |  | L | M | M | H |  |  |  | H |  | L | L | | H | | L | |
| CO3 | H | M |  |  |  |  | M |  | L |  | L |  |  | |  | | M | |
| CO4 |  |  | M |  | H |  | H |  |  |  |  |  |  |  | | H | |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | |  | | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

# Elements of Electromagnetics [Matthew N. O. Sadiku](https://www.google.co.in/search?hl=en&tbm=bks&tbm=bks&q=inauthor:%22Matthew+N.+O.+Sadiku%22&sa=X&ei=8NzZU73uI4u2uASug4DYBQ&ved=0CCcQ9AgwAA) Oxford University Press.

1. Engineering Electromagnetics, Hayt, TMH

**Reference Books**

1. Electromagnetics (Sie) (Schaum's Outlines Series), Edminister, TMH
2. Electromagnetics With Applications, Jd Kraus, TMH
3. Fundamentals Of Electromagnetics For Engineers, Rao, Pearson
4. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
5. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 2-0-0**

**Object Oriented Programming (BEE016A)**

**Course Objectives:**

1. *To consolidate and extend student's knowledge and skills in structured programming and to introduce them to the concepts and practice of object oriented programming.*
2. *To develop skills in using the object-oriented concepts of inheritance, encapsulation, construction, access control, overloading and messaging; develop and display competency in the design and implementation of object-oriented programs to solve business problems.*

**Unit 1:** C++ Overview, C++ Characteristics, Object-Oriented Terminology, Polymorphism, Object-Oriented Paradigm, Abstract Data Types, I/O Services, Standard Template Library, Standards Compliance, Functions and Variables.

**Unit 2:**Functions: Declaration and Definition, Variables: Definition, Declaration, and Scope, Variables: Dynamic Creation and Derived Data, Arrays and Strings in C++, Qualifiers, Classes in C++, Defining Classes in C++.

**Unit 3:**Classes and Encapsulation, Member Functions, Instantiating and Using Classes, Using Constructors, Multiple Constructors and Initialization Lists, Using Destructors to Destroy Instances.

**Unit 4:** Using Destructors to Destroy Instances, Operator Overloading, Operator Overloading, Working with Overloaded Operator Methods, Initialization and Assignment, Initialization vs. Assignment.

**Unit 5:** The Copy Constructor, Assigning Values, Specialized Constructors and Methods, Constant and Static Class Members, Inheritance, Overview of Inheritance, Defining Base and Derived Classes, Constructor and Destructor Calls, Input and Output in C++ Programs, Input and Output in C++ Programs, Standard Streams, Manipulators, Unformatted Input and Output.

***Course Outcome (CO):***

At the end of this course students will have:

CO1- To understand the differences between C and C++ characteristics.

CO2- Ability to understand the declaration and definition of functions.

CO3-Ability to understand the advantages of C++ like classes and encapsulation.

CO4-Ability to understand the usage of overloading.

CO5-Ability to understand the concept of Inheritance.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | M | H |  |  |  |  |  |  |  | M |  |  |  | L |  |
| CO2 | M | H |  |  |  |  |  | H |  |  |  |  | L | H | L |
| CO3 |  |  | H | M | L |  |  |  | L |  |  |  |  |  | M |
| CO4 |  |  |  | H | H |  |  |  |  |  | L |  | H |  |  |
| CO5 |  |  |  |  |  | H | H |  |  |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Textbooks:**

1. Programming with C, C++: Bala Guruswamy
2. Let Us C: Yashwant Kanitkar, TATA McGraw Hill.

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 0-0-2**

**Electronic Workshop (BEE017A)**

**Course Objective:**

*To enable the student to acquire competency in the safe use of electronic laboratory test equipment and to acquire competency in constructing and testing electronic assemblies. The practical element of the Electronic Production subject is considered to be of great importance. Students gain valuable experience in physical component identification and the use of supplier catalogues in the component identification and ordering procedure. The skill of electronic soldering is developed in this subject.*

1. Introduction & Hands on experience to use circuit creation & simulation software like TINAPRO, P-SPICE or ORCAD.
2. Design a half wave rectifier using ORCAD software. Calculateits Vrms, PIV, and Form Factor.
3. Design a full wave rectifierusing ORCAD software. Calculate its Vrms, PIV, and Form Factor.
4. Design a Hartley oscillator and to observe its output waveform using ORCAD software. Find its frequency of oscillation.
5. Design a Colpitts oscillator and to observe its output waveform using ORCAD software. Find its frequency of oscillation.
6. Design a Wien-Bridge oscillator and to observe its output waveform using ORCAD software. Find its frequency of oscillation.
7. Design and obtain the frequency response of second order low pass filter using IC-741 by ORCADsoftware.
8. Design and obtain the output waveform ofIntegrator and Differentiator circuit IC-741by ORCAD software.
9. Design and obtain the output waveform of Inverting, Non-inverting amplifier using IC -741by ORCAD software.
10. Design differential amplifier using BJT using ORCAD software. Calculate the itsCMRR.
11. Design of single stage class-C single tuned amplifier using ORCAD software. Plot its frequency response.
12. Design of current series feedback amplifier using ORCAD software. Plot its frequency response.
13. Design of voltage series feedback amplifier using ORCAD software. Plot its frequency response.
14. Design and obtain the output waveform of CMOS inverter by using ORCAD software.
15. Design and obtain the output waveform of CMOS NOR gate by using ORCAD software.
16. Design and obtain the output waveform of CMOS NAND gate by using ORCAD software.

***Course Outcome (CO):***

|  |
| --- |
| CO1-Ability to understand the concept of *Feedback circuits.* |
| CO2- Ability to understand *Oscillator Circuits*. |
| CO3-Ability to understand*High frequency networks.* |
| CO4-Ability to understand *Tuned Amplifiers*. |
| CO5-Ability to understand *Power Amplifier.* |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M | M |  |  | H |  | H |  |
| CO2 | M |  | H | L | M | L |  |  | L | L |  | H | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  | M | M |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 0-0-2**

**Analog Electronics Lab (BEE018A)**

1. Design a voltage amplifier using BJT in common emitter mode and
2. Plot I/P vs. O/P voltage and calculate voltage gain.
3. Draw gain-frequency response and determine band width.
4. Design a voltage amplifier using BJT in common base mode and
5. Plot I/P vs. O/P voltage and calculate voltage gain.
6. Draw gain-frequency response and determine band width.
7. Design a voltage amplifier using BJT in common collector mode and
8. Plot I/P vs. O/P voltage and calculate voltage gain.
9. Draw gain-frequency response and determine band width.
10. Design voltage series feedback amplifier using BJT / FET. Plot I/P vs. O/P voltage graph.
11. Design a class B Push-pull amplifier.
12. Design and verify adder and subtractor circuit using OP-AMP(IC-741).
13. Design and verify differentiator and integrator circuit using OP-AMP(IC-741).
14. Design the square wave oscillator using OP-AMP (IC-741). Find frequency of oscillation.
15. Design of RC phase shift oscillator. Find frequency of oscillation.
16. Design of Wien bridge oscillator. Find frequency of oscillation.
17. Design of Hartley oscillator. Find frequency of oscillation.
18. Design of Colpitts oscillator. Find frequency of oscillation.
19. Design of band pass and band stop filter using OP-AMP(IC-741). Draw frequency response. Find lower cut-off frequency (FL) and higher cut-off frequency (FH).
20. Design and verify 4 bit analog to digital converter.
21. Design and verify 4 bit digital to analog converter.

***Course Outcome (CO):***

|  |
| --- |
| CO1-Ability to understand the concept of *Feedback circuits.* |
| CO2- Ability to understand *Oscillator Circuits*. |
| CO3-Ability to understand*High frequency networks.* |
| CO4-Ability to understand *Tuned Amplifiers*. |
| CO5-Ability to understand *Power Amplifier.* |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M | M |  |  | H |  | H |  |
| CO2 | M |  | H | L | M | L |  |  | L | L |  | H | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  | M | M |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester IV**

**Contact Hours (L-T-P): 0-0-2**

**Object Oriented Programming Lab (BEE019A)**

**1.** To write a simple program for understanding of C++ program structure without any CLASS declaration. Program may be based on simple input output, understanding of keyword using.

**2.** Write a C++ program to demonstrate concept of declaration of class with public & private member, constructors, object creation using constructors, access restrictions, defining member functions within and outside a class. Scope resolution operators, accessing an object’s data members and functions through different type of object handle name of object, reference to object, pointer to object, assigning class objects to each other.

**3.** Program involving multiple classes (without inheritance) to accomplish a task. Demonstrate composition of class.

**4.** Demonstration Friend function friend classes and this pointer.

**5.** Demonstration dynamic memory management using new & delete & static class members.

**6.** Demonstration of restrictions an operator overloading, operator functions as member function and/ or friend function, overloading stream insertion and stream extraction, operators, overloading operators etc.

**7.** Demonstrator use of protected members, public & private protected classes, multilevel inheritance etc.

**8.** Demonstrating multiple inheritance, virtual functions, virtual base classes, abstract classes Object Oriented Programming Lab.

**9.** Write a C++ program to input the record of multiple students having multiple fields and changing a specific field of a specific student using array of objects.

**10.**  Write a C++ program to add more fields for all the students using inheritance of classes.

**11.**  Write a C++ program to input the time in 24 hour format from the user in hours, minutes and seconds and convert it into 12 hour format using a member function of a class.

**12.** Write a C++ program append the record of one student from multiple records using this pointer.

**13.** Write a C++ program to enqueue and dequeue a data in a queue using a classes.

**14.** Write a C++ program to develop a simple calculator using classes.

**15.** Write a C++ program to maintain an inventory of a company.

***Course Outcome (CO):***

At the end of this course students will have:

CO1- To understand the differences between C and C++ characteristics.

CO2- Ability to understand the declaration and definition of functions.

CO3-Ability to understand the advantages of C++ like classes and encapsulation.

CO4-Ability to understand the usage of overloading.

CO5-Ability to understand the concept of Inheritance.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | M | H |  |  |  |  |  |  |  | M |  |  |  | L |  |
| CO2 | M | H |  |  |  |  |  | H |  |  |  |  | L | H | L |
| CO3 |  |  | H | M | L |  |  |  | L |  |  |  |  |  | M |
| CO4 |  |  |  | H | H |  |  |  |  |  | L |  | H |  |  |
| CO5 |  |  |  |  |  | H | H |  |  |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours:24**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 2-1-0**

**Numerical Methods and Optimization Techniques()**

***Course Objectives:***

**UNIT-1:**

NUMERICAL ANALYSIS- Finite differences – Forward, Backward and Central differences. Newton’s forward and backward differences, interpolation formulae. Stirling’s formula, Lagrange’s interpolation formula.

**UNIT-2:**

NUMERICAL ANALYSIS- Integration-Trapezoidal rule, Simpson’s one third and three-eighth rules. Numerical solution of ordinary differential equations of first order - Picard’s mathod, Euler’s and modified Euler’s methods, Miline’s method and Runga-Kutta fourth order method, Differentiation.

**UNIT-3:**

SPECIAL FUNCTIONS – Bessel’s functions of first and second kind, simple recurrence relations, orthogonal property of Bessel’s, Transformation, Generating functions, Legendre’s function of first kind. Simple recurrence relations, Orthogonal property, Generating function.

**UNIT-4:**

LINEAR PROGRAMMING PROBLEMS - Linear Programming(Graphicaland Simplex solution);Transportation and Assignment Method.

**UNIT-5:**

CALCULUS OF VARIATIONS - Functional, strong and weak variations simple variation problems, the Euler’s equation.

**OUTCOMES:** At the end of the course, the student should be able to:

* Understanding the solutions methods for nonlinear programming problems.
* Methods for Linear programming, transportation and assignment problem.
* Develop an understanding of CalculusofVariations.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specifice Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  |  |  |  |  |  |  | M | M |  | M | M |  |  |
| CO2 |  | H | H |  |  |  |  |  |  |  | M | M | M |  |  |
| CO3 |  |  | H |  | M |  | M |  |  |  |  |  | L | M | M |
| CO4 |  |  |  | M | H |  |  | L |  |  | M | M |  |  | L |
| CO5 | H | H |  |  | M | L |  |  |  |  |  | M |  |  |  |

* H = Highly Related; M = Medium L=Low

***Recommended Books:***

1 Datta – Mathematical methods of science & engineering, Cengage learning 2012

2 O’neil – Advanced Engineering mathematics, Cengage learning 2007

3 Applied Statics & Probability, Montgomery, Wiley 2013

4 Engineering Mathematics, T Veerarajan, TMH 2011

5 Mathematical Techniques, Jordan, Oxford 2002

6 Engineering Mathematics IV, K.C. Sarangi and others, Genius publications 2011

7 Advance Engineering Mathematics, Potter, Oxford 2005

8 Advanced Engineering Mathematics, 2/e, Greenberg 1998

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**Faculty of Engineering & Technology Hours:24**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 2-0-0**

**Discrete Mathematics (BAS007A)**

***Course Objectives:***

Whereascontinuousprocessesareanalyticallytractable inanelegantmanner, mostreallife situationspresentthemselvesascomprisingofdiscretevariables.Itistherefore essentialtohave knowledgeofdiscretemathematicsinone‟stool-kit.Thiscourseismeanttodeeply familiarizethe studentswithdifferenceequationsandtheir solutiontechniques. Italsodealswithconceptsand techniques ofgraph theory,andLattices apart from applications using optimal control and filters.

*Module 1:*

Proposition, Compound Proposition, Conjunction, Disjunction, Implication, Converse, Inverse &Contrpositive, Biconditional statements, tautology, Contradiction &Contingency,Logicalequivalences,Quantifiers,Arguments.

*Module 2:*

Trivial, Direct, Indirect by contrapositive and contradiction, Constructive& Non constructive proof,Counterexample. Principle of mathematical induction,The second principle of mathematical induction

*Module 3:*

Networking Theory: PERT and CPM.

*Module 4:*

Graphs Directed,Undirected,Simple,.Adjacency &Incidence,Degreofvertex, Subgraph,Completegraph,Cycle&Wheelgraph,Bipartite &CompleteBipartitegraph,Weighed graph,Unionofsimple graphs.Complete graphs.Isomorphic graphs,Path,Cycles&Circuits Euclerian&Hamiltoniangraphs.

*Module 5:*

Basiccombinatorialanalysis;Introductionto number theoryand applications to cryptography.

**OUTCOMES:** Upon successful completion of this subject students should be able to:

* Demonstrate understanding and knowledge of properties of functions, which include evaluation, domain and range, related equations, and basic operations.
* Understand and use the language and notation of calculus.
* Provide an overview of discovering the experimental aspect of modern applied mathematics.
* Create the ability to model, solve and interpret any physical or engineering problem.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specifice Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  |  |  |  |  |  |  | M | M |  | M | M |  |  |
| CO2 |  | H | H |  |  |  |  |  |  |  | M | M | M |  |  |
| CO3 |  |  | H |  | M |  | M |  |  |  |  |  | L | M | M |
| CO4 |  |  |  | M | H |  |  | L |  |  | M | M |  |  | L |
| CO5 | H | H |  |  | M | L |  |  |  |  |  | M |  |  |  |

H = Highly Related; M = Medium L=Low

***Recommended Books:***

*1. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill,International Edition, 1986.*

*2.J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 1998.*

*3. N. Deo, Graph Theory with Applications to Computer Science, Prentice-Hall of India,2002.*

*4.Edgar G. Goodaire, Michael M. Parameter, Discrete Mathematics with Graph Theory (3rd Edition), Pearson, 2005.*

*5.Kenneth H Rosen, Discrete Mathematics and its applications with combinatorics and graph theory by ( 7th Edition), Tata McGraw-Hill Education private Limited, 2011.*

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 3-1-0**

**Microprocessor & Microcontroller System (BEE020A)**

**Course Objective:**

*Objective of this course is to introduce to the students the fundamentals of microprocessor and microcontroller.*

**Unit 1:**Evolution of microprocessors, technological trends in microprocessor

development. The Intel family tree. CISC Versus RISC. Applications of Microprocessors. 8086 Block diagram; description of data registers, address registers,pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module. Instruction formats, addressing modes.

**Unit 2:** Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions, process control instructions; Assembler directives. Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions. Writing procedures, Data tables, modular programming, Macros.

**Unit 3:**8086 Interrupt types and interrupt vector table. DOS interrupt INT 21 h functions. INT 10h and INT 16h functions. Intel 8086 bus cycles, instruction queue, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode, reset operation, wait state, halt state, hold state, lock operation, interrupt processing. Address decoding techniques.

**Unit 4:**Intel’s 8255 description, 8255 different modes operation and interfacing with 8086. Interfacing ADC(0808/0809),DAC-(0808) using 8255. Wave form generation. Intel’s 8251 description and operation. Intel’s 8259. DMA operation. Intel’s 8237. Intel’s 8279. Intel’s 8253. Introduction to i3,i5,i7 processors.

**Unit 5:**8051 microcontroller pin diagram, Block diagram, Flag, RAM configuration, Register Banks, addressing modes, instruction set, 8051 programming &,interfacing.

***Course Outcome (CO):***

At the end of this course students will have:

CO1-Ability to understand the evolution of microprocessor.

CO2- Ability to understand set of instructions supported by 8086 microprocessor.

CO3-Ability to understand the interrupt process and instructions functions in 8086 microprocessor process.

CO4-Ability to understand and design an interfacing structure of Intel’s 8255,8253,8278.i3,i7 processors.

CO5-Ability to understand the concept and working of 8051 microcontroller.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | M | H |  |  |  |  |  |  |  | M |  |  |  | L |  |
| CO2 | M | H |  |  |  |  |  | H |  |  |  |  | L | H | L |
| CO3 |  |  | H | M | L |  |  |  | L |  |  |  |  |  | M |
| CO4 |  |  |  | H | H |  |  |  |  |  | L |  | H |  |  |
| CO5 |  |  |  |  |  | H | H |  |  |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

1. DouglasHall Microprocessors Interfacing, Tata McGraw Hill, 1991
2. The 8051 Microcontroller and Embedded systems by Muhammad Ali Mazidi

Pearson Education Asia.

**Reference Books**

1. Computer Organization and Design, The hardware and software interface by D A Patterson and J H Hennessy, Morgan Kaufman Publishers.

2. The 8051 Microcontroller Architecture, programming and Applications by Kenneth Ayala, Penram International

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 3-1-0**

**Introduction to Digital Communication (BEE021A)**

**Course Objectives:**

*Subjectdeals with different features of digitized mode of communication. All the real time signals are analog, still we are using digital TV, Radio, Telephone Channel or Satellite Communication, so how we can convert a real time signal in digitized form, make it ready for transmission and again converting it in original signal is covered in this subject. Speed of transmission, Error control techniques, bandwidth utilization, limits of resources are different aspects we study.*

**Unit 1:**Review of Random Variables. Probability Theory- Joint probability, Conditional probability, Bay’s rule, Cumulative distribution function (CDF), Probability density function (PDF), Mean, Auto-coorelation, Cross- coorelation and their properties for random variables. Random Process, Energy density function (ESD), Power spectral density (PSD).

**Unit 2:**Introduction to Pulse modulation, PAM, PPM, PWM. Pulse code modulation- Generation, Sampling, Quantization, Quantization noise voltage, Quantization noise power, signal to noise ratio,SNR calculation with sinusoidal input. Companding in PCM- A-law and µ-law companding, Differential pulse code modulation, Delta modulation- step size, slope overload, threshold conditions, Adaptive Delta modulation.

**Unit 3:** Sampling and reconstruction of analog signal, natural sampling, sample and hold circuit, flat top sampling, Proof of sampling theorem, Sampling for Low pass signal as well as Band pass signal, Nyquist criteria for sampling, Intersymbol Interference (ISI), Interchannel Interference (ICI).

**Unit 4:** Digital Modulation schemes- Binary Phase Shift Keying (BPSK), Binary Frequency Shift Keying(BFSK),Concept of Quadrature Amplitude Modulation (QAM),Quadrature Phase Shift Keying(QPSK), Continuous Phase Modulation and Minimum Shift Keying (MSK). Signal point representation on orthonormal axis, Bandwidth requirement and symbol detection error probability for coherent BPSK, QPSK, BFSK.

**Unit 5:**. Transmission of digital signals over bandlimited channels- Shannon Hartley theorem. Coherent and non-coherent detection. Synchronization techniques in analog and digital transmission.

***Course Outcome (CO):***

At the end of this course students will have:

C0-1: The students will able to understand the evolution of different generation of Mobile.

CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.

CO3- The student will be able to analyze and design different accessing techniques.

C0-4:The student will be able to analyze and design different standard of communication system.

CO-5- The student can work in advanced research wireless and mobile cellular programs.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |
|  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  |
| CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M |
| CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H |
| CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  |
| CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

### [Digital Communications](http://books.google.co.in/books?id=lPiO8J6VC5YC&printsec=frontcover&dq=simon+haykin+digital+communication&hl=en&sa=X&ei=9d_ZU5iSJdOUuAS63oL4BA&ved=0CBwQ6AEwAA)- “Simon Haykin” wiley Publication.

**Reference Book:**

1.Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',John Wiley, 1965.

2.Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004.

3. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours:24**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 0-0-2**

**Microprocessors & Microcontroller System Lab (BEE022A)**

**Course Objective :**

*To understand the internal organization of INTEL 8085,8086 Microprocessors and Assembly Language Programs using the instruction sets of processors and to study the interfacing of the processor with various peripheral devices.*

1. a) Write a program using Microprocessor 8085 to add two 8 bits numbers.

b) Write a program using Microprocessor 8085 to subtract two 8 bits numbers.

c) Write a program using Microprocessor 8085 to add two 16 bits numbers.

1. a) Write a program using Microprocessor 8086 to add two 8 bits numbers.

b) Write a program using Microprocessor 8086 to subtract two 8 bits numbers.

c) Write a program using Microprocessor 8086 to add two 16 bits numbers.

d) Write a program using Microprocessor 8086 to add ten 16 bits numbers with carry.

1. (a) Write an assembly language program to find whether the given number is even or odd.

(b) Write an assembly language program to find the number of even and odd numbers from given series of 16 bit numbers.

(c) Write an assembly language program to find the number of 1’s in a given number.

(d) Write an assembly language program to find whether the given number has even parity or odd parity.

**4.** (a) Write an assembly language program to find the largest number from an array of 16 bit numbers.

(b) Write an assembly language program to find the smallest number from an array of 16 bit numbers.

(c) Write an assembly language program to arrange the given array of 16 bit numbers in ascending order.

(d) Write an assembly language program to arrange the given array of 16 bit numbers in descending order.

**5.** (a) Write an assembly language program to find the number of +ve and -ve numbers from given series of 16 bit numbers.

(b)Write an assembly language program to perform 1 byte BCD addition

(c) Write an assembly language program to perform addition, subtraction, Multiplication and Division of given operands. Perform BCD addition and subtraction.

(d) Write an assembly language program to move 16 bytes from the offset 0200H to 0300H.

**6.** (a) Write an assembly language program to find whether the given byte is present in the string or not.

(b) Write an assembly language program to compare two given strings.

(c) Write an assembly language program to find square of the given number.

(d) Write an assembly language program to find square of the given array of 16 bit number.

**7.** (a) Display a message “ very large scale integration”

(b) Write an assembly language program to convert BCD number 0 to 9 to their 7 segment codes, using look up table.

(c) Write an ALP for (i) addition and (ii) Multiplication of two 3x3 Matrices.

**8.** a) Write a program to calculate squares of BCD number 0 to 9 and store then sequentially from 2000H offset onward in the current data segment. The number and their square are in BCD format. Write a subroutine for the calculation of square of number.

b) Write a program to change a sequence of 16 two byte number from ascending to descending order and store them in same data segment.

**9.** a) Write a program to generate a delay of 100ms using an 8086 system that runs on 10MHz frequency.

(b) Write a program to generate delay of 1Minutes.

**10.** (a)Write a program in 8051

(i) to clear the accumulator and add 3 to accumulator 10 times.

(ii) to load accumulator with the value 55H and complement the accumulator 700Times.

(b) Write a program to toggle all the bits of port1. put a time delay in between each issuing of data to port 1.

**11.** (a) Write a program to generate a delay of 1µsec. assuming that crystal frequency is 11.05MHz.

(b) Write a program in 8051 to perform the following

(i) Keep monitoring the port P2.2 bit until it becomes high

(ii) When it becomes high write a value 45H to port 0 send a high to low pulse to P3.3.

**12.** (a) Write a program to get X value from P1 and send X2 to P2 continuously.

(b) Assume P1 is I/P port and connected to a temperature sensor. Write a program to read the temperature and test it for the value 75. according to test result place the temperature value into the registers indicated by the following

If T = 75 then A = 75

If T < 75 then R1 = T

If T > 75 then R2 = T

**13.** (a) Write a program to find number of 1’s in given number.

(b) Write a program tfor conversion of packed BCD to ASCII

**14.** Write a program to Interface 7-segment LED displays to a microprocessor and displaying a real-time clock.

1. Write a program for the implementation of a traffic signal controller.
2. Write a program for implementation of a programmable frequency synthesizer using timers.
3. Write a program to interfacing ADC & DAC -capturing a waveform from signal generator and CRO display.
4. Write a program to interfacing a stepper motor to a 8051 microcontroller.

**Conclusion:**The whole conclusion of this lab is that now the students can make their final year projects based on microprocessor.

***Course Outcome (CO):***

At the end of this course students will have:

CO1- Understand and apply the fundamentals of assembly level programming of microprocessors.

CO2- To work with standard microprocessor real time interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters

CO3- Analyze abstract problems and apply a combination of hardware and software to address the problem

CO4- Learn to troubleshoot interactions between software and hardware

CO5- Understand and apply the fundamentals of assembly level programming of microcontroller.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | M | H |  |  |  |  |  |  |  | M |  |  |  | L |  |
| CO2 | M | H |  |  |  |  |  | H |  |  |  |  | L | H | L |
| CO3 |  |  | H | M | L |  |  |  | L |  |  |  |  |  | M |
| CO4 |  |  |  | H | H |  |  |  |  |  | L |  | H |  |  |
| CO5 |  |  |  |  |  | H | H |  |  |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 0-0-2**

**Communications Lab (BEE023A)**

**List of Experiments**

1. Perform Full- and suppressed-carrier AM DSB modulation and Calculate Depth of Modulation.

2 Perform Demodulation for full-carrier as well as suppressed carrier AM DSB signal.

3. Observe FM modulation and demodulation and compare different modulator and demodulator also.

4. Study the concept of sampling and reconstruction of analog signal. Also see the effect of sampling frequency, duty cycle and order of low pass filter on quality of reconstructed signal.

5. Perform and observe Frequency Division Multiplexing (FDM).

6 Perform and observe Time Division Multiplexing (TDM).

7. Perform modulation and demodulation of Pulse Amplitude Modulation (PAM).

8. Perform and observe modulation and demodulation of Pulse Position Modulation (PPM).

9. Perform and observe modulation and demodulation of Pulse Width Modulation (PWM).

10. Perform PCM generation.

11. Perform different error checking codes Parity code and Hamming code.

12. Perform and observe Delta as well as Adaptive Delta modulation and demodulation.

13. Perform and observe MSK modulation and demodulation.

14 Perform A- law, u- law companding

15. Perform different line codes.

***Course Outcome (CO):***

At the end of this course students will have:

C0-1: The students will able to understand the evolution of different generation of Mobile.

CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.

CO3- The student will be able to analyze and design different accessing techniques.

C0-4:The student will be able to analyze and design different standard of communication system.

CO-5- The student can work in advanced research wireless and mobile cellular programs.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |
|  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  |
| CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M |
| CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H |
| CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  |
| CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |

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JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours:24**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 0-0-2**

**Basic Simulation Lab (BEE024A)**

(Simulation Lab. Experiments may be carried out using MATLAB/ SCILAB)

1. Creating a One-Dimensional Array (Row / Column Vector) Exercise – Creating a vector of even whole numbers between 31 and 75; Creating a Two-Dimensional Array (Matrix of given size) and (A). Performing Arithmetic Operations - Addition, Subtraction, Multiplication and Exponentiation. (B). Obtaining Modified Matrix - Inverse, Transpose, with Appended and Deleted Elements;

2. Performing Matrix Manipulations - Concatenating, Indexing, Sorting, Shifting, Reshaping, Resizing and Flipping about a Vertical Axis / Horizontal Axis; Creating Arrays X & Y of given size (1 x N) and Performing

(A) Relational Operations - >, <, ==, <=, >=, ~=

(B) Logical Operations - ~, &, |, XOR

3. Generating a set of Commands on a given Vector (Example: X = [1 8 3 9 0 1]) to

(A) Add up the values of the elements (Check with **sum**)

(B) Compute the Running Sum (Check with **sum**), where Running Sum for element j = the sum of the elements from 1 to j, inclusive.

(C) Compute the Sine of the given X-values (should be a vector).

Also, Generating a Random Sequence using **rand() / randn()** functions and plotting them.

4. Evaluating a given expression and rounding it to the nearest integer value using Round, Floor, Ceil and Fix functions; Also, generating and Plots of

(A) Trigonometric Functions - sin(t), cos(t), tan(t), sec(t), cosec(t) and cot(t) for a given duration’t’.

(B) Logarithmic and other Functions – log(A), log10(A), Square root of A, Real nth root of A.

**5.** Write a MATLAB program to generate an exponential Sequence.



**6.**Write a MatLab program to generate the signal corrupted by the noise resulting the signal.

Also down sample the corrupted signal

7. Creating a vector X with elements, Xn= (-1)n+1/(2n-1) and Adding up 100 elements of the vector, X; And, plotting the functions, x, x3, ex and exp(x2) over the interval 0 < x < 4 (by choosing appropriate mesh values for x to obtain smooth curves), on

(A) A Rectangular Plot

(B) A Semi log Plot

(C) A log-log Plot

8. Generating a Sinusoidal Signal of a given frequency (say, 100Hz) and Plotting with Graphical Enhancements - Titling, Labelling, Adding Text, Adding Legends, Adding New Plots to Existing Plot, Printing Text in Greek Letters, Plotting as Multiple and Sub- Plots; Also, Making Non-Choppy and Smooth Plot of the functions,

**9.** To Plot the following Functions:

h(n)={4rn cos[pi\*n(1+r)/m]+m sin[pi\*n(1-r)/m]}/[1-4rn/m)^2]\*pi\*nm

h (0)=(1/m)+(r/(m \* 4/pi -1))

h (|m/4|)=(-r/m)\*[(2\*cos{(pi/4\*r)\*(1+4)}-cos{pi\*(1-r)/4\*r}]

Given: - m=4, r=0.1

10. Creating A Structure, An Array of Structures and Writing Commands to Access Elements of the created Structure and Array of Structures; Also, Solving First Order Ordinary Differential Equation using Built-in Functions; And, Creating an M x N Array of Random Numbers using **rand** and setting any value that is and any value that is by moving through the Array, Element by Element.

11. Write a MatLab/SciLab program to generate a Fibonacci series up-to 20.

12. Write a MatLab/SciLab program to check whether a number is prime or not.

13.Write a MatLab/SciLab program to convert a decimal number to binary.

14.Generating normal and integer random numbers and plotting them;Also, Writing a Script (which keeps running until no number is provided to convert) that asks for Temperature in degrees Fahrenheit and Computes the Equivalent Temperature in degrees Celsius. [Hint: Function **is empty** is useful]

15. Writing brief Scripts starting each Script with a request for input (using input) to Evaluate the function using if-else statement, where

Exercise: Testing the Scripts written using

(A)

(B)

Also, Creating a Graphical User Interface (GUI); And, Curve Fitting using

(A) Straight line Fit

(B) Least Squares Fit

16.Interpolation based on following Schemes (A) Linear (B) Cubic (C) Spline Also, Generating the first Ten Fibonacci numbers according to the relation

with, and computing the ratio for the first Fibonacci numbers.

***Course Outcome (CO):***

CO1- Understand Basics of MATLAB syntax, functions and programming.

CO2- Analyze the generation Various Signals and Sequences in MATLAB, including the operations on Signals and Sequences

CO3- Applying the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

CO4- To analyze a given system and/or design for its specification based performance and to devise any design changes for performance improvement, if need be.

CO5- Learn to 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.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  | M |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  | L |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  | L | L |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

Brian R. Hunt, A Guide To Matlab: For Beginners And Experienced Users

**Reference Books**

Nicholas Higham, Desmond Higham (2000), MATLAB Guide

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| JECRC UNIVERSITY  **Faculty of Engineering & Technology Hours: 48**  **B.Tech in Electronics and Communication Engineering Semester V**  **Contact Hours (L-T-P): 3-1-0**  **Microwave Theory and Techniques(BEE025A)** |  |  |

**Course Objectives:**

1. *To introduce the history, applications(Civil and Military, Medical, EMI/ EMC) and basics of microwave.*
2. *To analysis Transmission line, waveguide and active passive component.*
3. *To study basics of antenna and its application and microwave instruments.*

**Unit 1**: Introduction to Microwaves-History of Microwaves, Microwave Frequency bands;Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. Mathematical Model of Microwave Transmission-Concept of Mode, Features ofTEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.

**Unit 2**: Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangularwaveguide, Circular waveguide, Strip line, Micro strip line. Microwave Network Analysis- Equivalent voltages and currents for non-TEMlines, Network parameters for microwave circuits, Scattering Parameters.

**Unit 3**: Passive and Active Microwave Devices- Microwave passive components:Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

**Unit 4**: Microwave Design Principles- Impedance transformation, Impedance Matching,Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas- Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.

**Unit 5**: Microwave Measurements- Power, Frequency and impedance measurement atmicrowave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters. Microwave Systems- Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

**Course Outcome (CO):**

By the end of this course, students will be able to::

**CO1**- Ability to understand the history, applications(Civil and Military, Medical, EMI/ EMC) and basics of microwave.

**CO2**- Ability to understand Transmission line, waveguide.

**CO3**-Ability to understand active and passive component.

**CO4**- Ability to understand Designing of microwave Filter, also basics of Antenna.

**CO5**- Ability to understand microwave measurement and Satellite communication.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  | M |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  | L |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  | L | L |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Book:**

1.R.E. Collins, Microwave Circuits, McGraw Hill.

**Reference Book**

1.K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house.

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 3-1-0**

**Database ManagementSystem (BEE080A)**

**OJECTIVE:**

* To provide a general introduction to relational model
* To learn about ER diagrams.
* To learn about Query Processing and Transaction Processing

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| **UNIT 1** | Introduction - Database Systems versus File Systems, View of Data, Data Models, database languages, Database Users and Administrators. Transaction Management, Decision Support Systems, Components of a Database management System. Distributed Processing and Client- Server Architecture. Entity-Relationship Model – Basic Concepts, Constraints,Keys, Design Issues, E-R Diagrams. |
| **UNIT 2** | Relational Model- Structures of relational databases, Integrity Constraints, Logical database Design, Tables, Views, Data Dictionary. Relational Algebra, Relational Calculus. SQL – Basic Structures, Query Handling, Embedded SQL, Open Database Connectivity (ODBC), Java Database Connectivity (JDBC), Triggers, Security and Authorization. Query by Example (QBE), User Interfaces and Tools, Forms and Graphical User Interfaces. Report Generators. Overview of Relational Query Optimization. |
| **UNIT 3** | Relational Database Design- Functional Dependencies, Multi-valued Dependencies, Normal Forms, Decomposition into Normalized Relations, Physical Database Design – File Structures. Object-Relational Databases – Nested Relations, Complex Data types, Object-Relational Features in SQL: 1999. |
| **UNIT 4** | Internet Databases- World Wide Web, Client Side Scripting and Applets, Web Servers and Sessions, Services, Server Side Scripting. XML – Structure of XML Data, XML Document Schema, XQuery, Storage of XML Data, XML Applications. |
| **UNIT 5** | Advanced Topics- Fundamental Concepts of Transaction Management, Concurrency Control, Recovery Systems, Data Analysis and OLAP. Introduction to Data Mining, Data Farming, Data Warehousing, Spatial and Geographic Databases, Temporal databases. |

**OUTCOMES**

At the end of the course, the student should be able to:

* CO1:Give a description of the Database Management structure and can define basic functional terms of Database
* CO2:Know the advantages and disadvantages of the different models compare relational model with the Structured Query Language (SQL)
* CO3:Know the constraints and controversies associated with RDBMS
* CO4:Compare and contrast the types of RDBMS based on several criteria and understand the concept of data planning and Database design
* CO5:Trace the history and development process of SQL and know the scope and extension of SQL

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  | M |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  | L |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  | L | L |  |  | M |

H = Highly Related; M = Medium L = Low

***Text Books:***

1. Database Systems Concepts by Korthet. Al.

2. An Introduction to Database Design by Date

3. Object-Oriented Database Design by Harrington

***Reference Books:***

1. Fundamentals of Database Systems – Elmasri and Navathe

2. Database Management and Design – Hansen and Hansen .

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 3-1-0**

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| **IC Technology** | **(BEE027A)** |
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**Course Objectives:**

*This course aims at understanding the manufacturing methods and their underlying scientific principles in  the context of technologies used in VLSI chip fabrication. This course follows a top to bottom approach. Right in the beginning of the course, we study a complete process flow for both CMOS and advanced bipolar technologies. The idea is to introduce you at an early stage to the complexities and challenges associated with VLSI chip fabrication. Discussions on the  unit steps  will follow in greater detail  in the context of the complete CMOS and bipolar process flow.  It is expected that this will help you in gaining a better understanding  of both the constituent processes and the global picture of VLSI  manufacturing.*

**Unit 1:**Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaningprocesses and wet chemical etching techniques. Impurity incorporation: Solid State diffusion modeling and technology; Ion Implantationmodeling, technology and damage annealing; characterization of Impurity profiles.

**Unit 2:**Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultrathin films.Oxidation technologies in VLSI Lithography: Photolithography, E-beam lithography and newer lithography techniquesfor VLSI/ULSI, Mask generation.

**Unit 3:**Chemical Vapour Deposition techniques: CVD techniques for deposition of polysilicon,silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modelling and technology.Metal film deposition: Evaporation and sputtering techniques. Failure mechanisms inmetal interconnects; Multi-level metallisation schemes.

**Unit 4:**Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques;RTP techniques for annealing, growth and deposition of various films for use in ULSI.

**Unit 5:**Process integration for NMOS, CMOS and Bipolar circuits; Advanced MOStechnologies.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understand basics of MOSFET fabrication. |
| CO2- Ability to understand oxidation techniques and how pattern transfer using lithography. |
| CO3-Ability to understand & analyse different deposition techniques. |
| CO4-Ability to learn etching process. |
| CO5-Ability to understand advance fabrication techniquies. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | L |  | H |  | L |  |  | M |  |  | L |  |  | H | L |
| CO2 |  | M |  | H | M | L |  |  |  | H |  | L | L |  | M |
| CO3 | L |  |  | H |  | M | L |  | M |  | L |  | L |  |  |
| CO4 |  | H | L |  | H |  |  |  |  | L |  |  | H |  | M |
| CO5 | H | M |  |  |  |  | H |  |  |  | L | L |  | M |  |

H = Highly Related; M = Medium L = Low

**Textbook:**

1. C.Y. Chang and S.M. Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.

**Reference Books**

1. S.K. Ghandhi, VLSI Fabrication Principles, John Wiley Inc., New York, 1983.
2. S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 3-1-0**

**INFORMATION THEORY AND CODING(BEE028A)**

**Course Objectives:**

* 1. *To impart the basic knowledge of Information Theory & Coding.*
  2. *To understand the different kind of codes and various coding techniques used in communication system.*
  3. *To find the different entropies, channel capacity & rate of information.*

**Unit 1:** Probability and random processes: Probability, random variables, Probability distribution and density functions, Joint Statistics, Conditional Statistics, independence, Functions of random variables & random vectors, Expectation, moments, Characteristic Functions, Convergence of a sequence of random variables, Central Limit Theorem, Random Processes, mean and Auto Correlation, Stationary ergodicity,

**Unit 2:** Power Spectral density, Response of memory- less and linear systems, Gaussian Poisson, Markov processes.Elements of information theory and source coding: Introduction, information as a measure of uncertainty, Entropy, its properties, discrete memoryless channels, Mutual information, its properties, BSC, BEC. Channel capacity, Shanon’s theorem on coding for memoryless noisy channels. Separable binary codes, Shanon–Fano encoding, Noiseless coding, Theorem of decodability, Average length of encoded message, Shanon’s binary encoding,

**Unit 3:**Fundamental theorem of discrete noiseless coding, Huffman’s minimum redundancy codes.Linear block codes: Introduction to error control coding, Types of codes, Maximum Likelihood decoding, Types of errors and error control strategies,

**Unit 4:**Galois fields, Linear block codes, Error detecting and correcting capabilities of a block code, Hamming code, cyclic code, B.C.H. codes.Convolutional codes and ARQ: Transfer function of a convolutional code, Syndrom decoding, Majority logic decodable codes,

**Unit 5:**Viterbi decoding, distance properties of binary convolutional codes, Burst error correcting convolutional codes, general description of basic ARQ strategies, Hybrid ARQ schemes.

CO1: Design the channel performance using Information theory.

CO2: Comprehend various error control code properties

CO3: Apply linear block codes for error detection and correction

CO4: Apply convolution codes for performance analysis & cyclic codes for error detection and correction.

CO5: Design BCH & RS codes for Channel performance improvement against burst errors.

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | L |  | H |  | L |  |  | M |  |  | L |  |  | H | L |
| CO2 |  | M |  | H | M | L |  |  |  | H |  | L | L |  | M |
| CO3 | L |  |  | H |  | M | L |  | M |  | L |  | L |  |  |
| CO4 |  | H | L |  | H |  |  |  |  | L |  |  | H |  | M |
| CO5 | H | M |  |  |  |  | H |  |  |  | L | L |  | M |  |

**Textbooks:**

1. Papoulis, A. Probability, Random Variables and Stochastic Processes, MGH.

2. Gray, R.M. Davission, L.D,Introduction to Statistical Signal Processing- Web Edition 1999.

**Reference books:**

1. F. M. Reza, Information Theory, McGraw Hill.

2. Das, Mullick and Chatterjee, Digital Communication, Wiley Eastern Ltd.

3. Shu Lin and J. Costello, Error Control Coding, Prentice Hall.

4. B. R. Bhat, Modern Probability Theory, New Age International Ltd.

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 3-1-0**

**Computer Organization and Architecture (BEE029A)**

**Course Objective:**

*To give a robust understanding of various software and hardware techniques required to boost the performance of single as well as multi-core processors. This course also aims at discussing future micro-architectures in processor design.*

**Unit 1:**Introduction to basic computer architecture, register transfer, bus and memorytransfers, arithmetic, logic and shift micro operations.

**Unit 2:**Instruction codes, computer registers, computer instructions, timing and control,instruction cycle, memory reference instructions, I/O interrupt, complete computerdescription, design of basic computer, design of accumulator logic.

**Unit 3:**Micro programmed control, control memory, address sequencing, micro program example, and design of control unit. Central Processing Unit: Introduction, general registerorganization, stack organization, instruction formats, addressing modes, data transfer and manipulation, program control, RISC.

**Unit 4:**Pipeline and Vector Processing: Parallel processing, pipelining, arithmeticpipeline, instruction pipeline, RISC pipeline, vector processing, array processors.Input-output Organisation: Peripheral devices, input-output interface,asynchronous data transfer, modes of transfer, priority interrupt, DMA, IOP serialcommunication.

**Unit 5:**Memory Organisation: Memory hierarchy, main memory, auxiliary memory,associative memory, cache memory, virtual memory, memory management, hardwaremultiprocessor architectures and their characteristics, interconnection structures, interprocessor arbitration, inter-processor communication and synchronization, cache coherence.

1. Master the binary and hexadecimal number systems including computer arithmetic,

2. Be familiar with the history and development of modern computers,

3. Be familiar with the Von Neumann architecture,

4. Be familiar with the functional units of the processor such as the register file and   arithmetic‐logical unit,

5. Be familiar with the basics of systems topics: single‐cycle (MIPS), multi‐cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures.

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  | M |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  | L |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  | L | L |  |  | M |

H = Highly Related; M = Medium L = Low

**Textbook:**

1. Morris Mano, “Computer System Architecture”, PHI.

**Reference Books:**

1. J.F. Heys, “Computer Organization and Architecture”, TMH.

2. Hwang K. and F.A. Briggs, “Computer Architecture and Parallel Processing”, TMH.

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester V**

**Contact Hours (L-T-P): 3-1-0**

**Power Electronics (BEE030A)**

**Course Objectives:**

*The objectives of this subject are to enable students to:*

*acquire an*

*be aware of the electromagnetic interference problems associated with power electronic systems;*

*use commercial software for the rigorous circuit analysis of real power electronic systems; analysis and design circuits to meet specific specifications; and fabricate basic power electronic circuits such as a chopper.*

**Unit 1:Semiconductor Power Devices -** Basic characteristics & working of Power Diodes, DIAC, SCR, TRIAC, Power Transistor, MOSFETs, IGBT and GTO.

**Unit 2:Rectifiers & Inverters -** Working principles of single and three phase bridge rectifiers, Voltage and current source inverters.

**Unit 3:Power Supplies-** Principle of operation of choppers. Step up, Step down and reversible choppers. High frequency electronic ballast, Switch Mode Power Supply: Fly back converter, forward/buck converter, Boost converter and buck-boost converter. Uninterruptible Power Supply.

**Unit 4:Motor Control-** Introduction to speed control of DC motors using phase controlled converters and choppers, Basic idea of speed control of three phase induction motors using voltage and frequency control methods.

**Unit 5:Stepper Motors-** Variable reluctance, Permanent magnet and hybrid stepper motors. Induction and dielectric heating control.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understanding of the nature of power semiconductor devices and their control and use in switch-mod. |
| CO2- Ability to understand the arrangement and topology of the circuits in which switch-mode devices are used; |
| CO3-Appreciate the use of power electronic circuits in high-power applications such as motor drives. |
| CO4-Ability to use commercial software for the rigorous circuit analysis of real power electronic systems. |
| CO5-Ability to use commercial software for the rigorous circuit analysis of real power electronic systems; analysis and design circuits to meet specific specifications; and fabricate basic power electronic circuits such as a chopper. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | L |  | H |  | L |  |  | M |  |  | L |  |  | H | L |
| CO2 |  | M |  | H | M | L |  |  |  | H |  | L | L |  | M |
| CO3 | L |  |  | H |  | M | L |  | M |  | L |  | L |  |  |
| CO4 |  | H | L |  | H |  |  |  |  | L |  |  | H |  | M |
| CO5 | H | M |  |  |  |  | H |  |  |  | L | L |  | M |  |

H = Highly Related; M = Medium L = Low

**Text Book:**

1. Power Electronics by P. S. Bimbhra: Khanna Publication.

**Reference Books:**

1. Power Electronics Principles & Applications, Joseph Vithayathil, TMH

2. Power Electronics, Ravish Singh, TMH

3. Industrial Electronics And Control, Ttti, TMH

4. Power Electronics: Converters Applications., Mohan, Robbins, Wiley

5. Power Electronics, Moorthi, Oxford

6. Elements Of Power Electronics, Krein, Oxford

7. Power Electronics, R.S.Murthy, Pearson

8. Power Electronics: Circuits, Devices And Applications, Muhammad.H.Rashid, Pearson

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**Faculty of Engineering & Technology Hours: 24**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 2-0-0**

**Fuzzy & Computational Mathematics(BAS008A)**

**Course Objective:**

Mostofthemathematicsandapplicationsarebasedon“hard‟conceptsfromsettheory.However inrecenttimes,theideaof*fuzzy mathematics*hastakenroots. Someofthe advancesinthearena havefound applicationsinreal-life problemsrelatedtodesignandfunctioningof systems.The courseintroducesthestudentstothese developmentsandfamiliarizesthemwithconceptual underpinning and makesthem awareof someinteresting applications.

*Module1:*

Classical sets vs Fuzzy Sets – Need for fuzzy sets – Definition and Mathematical representations – Level Sets – Fuzzy functions -  Zadeh’s Extension Principle

*Module2:*

Operations on [0,1] – Fuzzy negation, triangular norms, t-conorms, fuzzy implications, Aggregation Operations, Fuzzy Functional Equations

*Module 3:*Fuzzy Binary and n-ary relations – composition of fuzzy relations – Fuzzy equivalence relations – Fuzzy compatibility relations – Fuzzy relational equations

*Module4:*

Fuzzy Measures – Evidence Theory – necessity and belief measures – probability measures vs possibility measures.

*Module5:*

Finite Difference Method, Finite Element Method.

**Course Outcomes**

**At the end of this course, students will be able to:**

CO1: Explain the Zadeh’s Extension Principle and Fuzzy functions.

CO2: Understand Fuzzy Functional Equations and Fuzzy operations.

CO3: Better utilization of Fuzzy tools and Fuzzy relational equations.

CO4: Defineprobability measures and possibility measures.

CO5: Calculate FDM and FEM.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  | H |  |  |  |  | M | M |  |  |  | M | M |  |  |
| CO2 | H |  |  | H |  |  |  |  |  |  | M | M | H |  |  |
| CO3 |  |  | H |  |  | M |  |  | M |  |  |  |  | H | M |
| CO4 |  |  |  | M | H |  |  | L |  |  | M | L |  |  | M |
| CO5 |  |  | L |  |  |  | L |  | M |  |  | H | M |  |  |

H = Highly Related; M = Medium; L=Low

***Recommended Books:***

1. *M. Ganesh : Introduction to Fuzzy Sets and Fuzzy Logic, PHI, 2001.*

*2. G.J. Klir and B.Yuan: Fuzzy sets and Fuzzy Logic–Theory and Applications, PHI, ‘97.*

*3. T.J.Ross : Fuzzy Logic with Engineering Applications, McGraw-Hill, 1995.*

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**Faculty of Engineering & Technology Hours: 36**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-0-0**

**Digital Signal Processing(BEE033A)**

**Course Objectives:**

1. *To Introduce Discrete time signals and systems, FIR and IIR filters. Methods for computing FFT. Characterization & classification of signals.*
2. *To study Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.*
3. *To study DFT properties, computation of the DFT of real sequences. Sampling,Filter Design, Sample-and Hold circuits, A/D & D/A converter*

**Unit 1:**Introduction to signals and systems Discrete time signals and systems, Z-transforms, structures for digital filters, design procedures for FIR and IIR filters. Frequency transformations: linear phase design; DFT. Methods for computing FFT. Noise analysis of digital filters, power spectrum estimation. Signals and signal Processing: characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signal Processing applications.

**Unit2:**Time Domain Representation of Signals & Systems- Discrete Time Signals,Operations on Sequences, the sampling process, Discrete-Time systems, Time-Domain characterization of LTI Discrete-Time systems, state-space representation of LTI Discrete-Time systems, random signals.

**Unit 3:**Transform-Domain Representation of Signals-The Discrete-Time FourierTransform, Discrete Fourier Transform, DFT properties, computation of the DFT of real sequences, Linear Convolution using the DFT. Z-transforms, Inverse Z-transform, properties of z-transform, transform domain representations of random signals. Transform-Domain Representation of LTI Systems: the frequency response, the transfer function, types of transfer function, minimum-phase and maximum-Phase transfer functions, complementary transfer functions, Discrete-Time processing of random signals.

**Unit 4:**Digital Processing of Continuous-Time Signals - sampling of Continuous Signals,Analog Filter Design, Anti-aliasing Filter Design, Sample-and Hold circuits, A/D & D/A converter, Reconstruction Filter Design.

**Unit 5:**Digital Filter Structure and Design- Block Diagram representation, Signal FlowGraph Representation, Equivalent Structures, bone FIR Digital Filter Structures, IIR Filter Structures, State-space structure, all pass filters, tunable IIR Digital filters. cascaded Lattice realization of IIR and FIR filters, Parallel all pass realization of IIR transfer function, Digital Sine-Cosine generator. Digital Filter Design: Impulse invariance method of IIR filter design,Bilinear Transform method of IIR Filter Design, Design of Digital IIR notch filters, FIR filter Design based on truncated fonner sens, FIR filter design based on Frequency Sampling approach.

***Course Outcome (CO):***

At the end of this course students will have:

CO1-Recognize the fundamentals of fixed and floating point architectures of various DSPs.

CO2- Learn the architecture details  and instruction sets of fixed and floating point DSP

CO3- Infer about the control instructions, interrupts, and pipeline operations.

CO4-Analyze and learn to implement the signal processing algorithms in DSPs

CO5- Learn the DSP programming tools and use them for applications & design and implement signal processing modules in DSPs

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

1. Proakis J.G., and Manolakis, Introduction to DSP, PHI, 2007
2. Sanjit K. Mitra, “Applications DSP a Computer based approach”, TMH, 2006

**Reference Books:**

1. Allan Y. Oppenhein & Ronald W. Schater , "Applications DSP”,.
2. C.Sydney Burrus (Eds), DSP and Digital Filter Design

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

**VLSI Design (BEE034A)**

**Course Objectives:**

1. *To introduce Basics of MOS transistors and its types.*
2. *To study MOSFET circuits, their power analysis and noise margin.*
3. *To study Memory latches and registers using MOS and Layout designing rules, and introduction to VHDL coding.*

**Unit 1:** Basic MOS transistors, Enhancement Mode transistor action, Depletion Mode transistor action, NMOS and CMOS fabrication. Ids versus Vds relationship, Aspects of threshold voltage, Transistor Transconductance gm.Inverter, nMOS inverter, Pull up to Pulldown ratio for a NMOS Inverter and CMOS Inverter (Bn/Bp), MOS transistor circuit Model, Noise Margin.

**Unit 2:**Combinational MOS Logic Circuit: NAND, NOR gate, Compound Gates, 2 input CMOS Multiplexer, Transmission Gate, Gate delays, CMOS-Gate Transistor sizing, Power dissipation.

**Unit 3:** Sequential MOS Logic Circuits:Behavior of Bistable Elements,SR Latch, clocked Latch and flip flop circuits, CMOS D latch andedge triggered flip flop, Basic Principles of Pass Transistor Circuits.

**Unit 4:** MOS Layers Stick/Layout Diagrams; Layout DesignRules, Issues of Scaling, Scaling factor for device parameters.Layout issues for inverter, Layout for NAND and NOR Gates, Complex Logic gates Layout, Layout optimization for performance.

**Unit 5:** Verilog and other design tools. VHDL Code for simple Logic gates, flip-flops, shift registers.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understand MOSFET and their fabrication. |
| CO2- Ability to understand any combinational circuit analysis using MOSFET. |
| CO3-Ability to understand & analyse sequential MOS circuits |
| CO4-Ability to draw layout of any circuit. |
| CO5-Ability to understand hardware description language. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | L |  | L | H | M | L |  |  |  | H |  | L | L |  | M |
| CO3 | L | M |  | H |  |  | L |  |  |  | L |  |  |  | H |
| CO4 |  |  | L |  | H |  | H |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | H |  |  |  |  |  |  | M |  |

H = Highly Related; M = Medium L = Low

**Text Books:**

1. CMOS Digital Integrated Circuits Analysis , Sung-Mo (Steve) Kang, TMH

**Reference Book**:

1. Essentials Of VLSI Circuits And Systems, Kamran Eshraghian, Eshraghian, PHI

2. Introduction To VLSI Circuits And Systems, John P. Uyemura, John Wiley & Sons

3. Modern VLSI Design, Wayne Wolf, Pearson

4. Principles Of Cmos VLSI Design, Neil H.E.Weste, Pearson

5. VLSI Design, Shanthi, A. Kavitha, A., New Age International

6. VLSI Design And Technology, Bose, D.N., New Age International

7.Digital Systems Design Using VHDL, [Charles H. Roth](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Charles+H.+Roth%22), PWS Publishing Company, 01-Jan-1998

8.Verilog HDL: A Guide to Digital Design and Synthesis, 2nd ed. (English) 2nd Edition, [Samir Palnitkar](http://www.flipkart.com/author/samir-palnitkar), Pearson Education

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**Faculty of Engineering & Technology Hours:36**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-0-0**

**Control System(BEE035A)**

**Course Objectives:**

1. *Introduction to control problem, Transfer functionmodels of mechanical, Closed-loop systems. transfer function.*
2. *To understand Basic characteristics of feedback control systems and measure the stability of a system for any given input.*
3. *To acquaint with different Frequency-response analysis methods,Polar plots, Bode’s plot, stability in frequency domain, Nyquist plots.*
4. *To develop robust understanding of compensation techniques.*

**Unit 1:**Introduction to control problem, Essence of Feedback control theory, feedforward- feedback control structure, Multivariable control systems, Transfer functionmodels of mechanical and electrical systems,Dynamic response of system model, Block diagram algebra and signal flow graph analysis, Feedback and non-feedback control systems, Reduction of parameter variations by Use of feedback, Control over System Dynamics by use of feedback, Control of Effects of Disturbance signals by use of feedback, Linearizing Effect of feedback, Regenerative feedback.

**Unit 2:**Introduction to Time response analysis, Standard test signals, Time response of first order systems, Time response of second order systems, Steady state errors, and error constants, Effect of adding a zero to a system, Design specifications of Second order systems, Design considerations of Higher order systems, Performance Indices, Approximation of Higher Order systems by lower order systems.

**Unit 3:**Concept of Stability, necessary conditions for stability, Hurwitz Stability criterion, routh stability criterion, relative stability analysis, Introduction to root locus technique, Construction of root loci, root contours, systems with transportation lags, sensitivity of roots of the characteristic equation.

**Unit 4:**Frequency-response analysis- Correlation between time & frequency response,Polar plots, Bode’s plots, All-pass and Minimum phase systems,experimental determination of transfer functions, Comparison between Log-magnitude and Phase plots, Stability in frequency domain, Nyquist plots. Nyquist stability criterion. Assessment of relative stability using Nyquist criterion, closed loop frequency response, sensitivity analysis in frequency domain.

**Unit 5:**Introduction to Design problem, Preliminary considerations of Classical design, Realization of basic compensators, Cascade Compensation in time-domain,Cascade Compensation in frequency-domain, tuning of PID controllers, Feedback Compensation, State variable Analysis- Concepts of state, state variable, state model, state modelsfor linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understand the concept of control system and *Transfer function.* |
| CO2- Ability to understand the physical *models of mechanical and electrical system* |
| CO3- *Basic knowledge of characteristics of feedback control systems and measure the stability of a system for any given input.* |
| CO4-Ability to *acquaint with different time and Frequency-response analysis methods,Polar plots, Bode plot, stability in frequency domain.* |
| CO5-Ability to understand *compensation techniques.* |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books**

1. Nagrath & Gopal, “Control Systems Engineering”, New Age International, New Delhi

**References**

1.Kuo, B.C., “Automatic Control System”, Prentice Hall, sixth edition, 1993.

1. Joseph Distefano III, Sanjoy Mandal, “Control Systems”, Tata McGraw-Hill, Third edition.
2. Gopal. M., “Control Systems: Principles and Design”, Tata McGraw-Hill, 1997.
3. Nise, N., “Control Systems Engineering”, Wiley, sixth edition, 2014.
4. Ogata, K., “Modern Control Engineering”, Prentice Hall, second edition, 1991.

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**Faculty of Engineering & Technology Hours:24**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 0-0-2**

**Digital Signal Processing Lab(BEE036A)**

**List of Experiments**

1. **Modeling and simulation using MATLAB/ SCILAB**

1.TO write a MATLAB/SCILAB program to compute linear convolution and de-convolution of two given sequences.

2. TO write a MATLAB/SCILAB program to compute circular convolution of two given sequences.

**3.** Write a program to compute M Point DFT of following M Point sequence.



Assume N=16 and M=32.

**4.** Write a program to compute M point IDFT of following M Point sequence



Assume M=32 and N=16

**5.**Realizing a given block diagram having multiplier, adder/subtractor and system (Discrete/Continuous) with given Impulse response. Calculating output for given input.

**6.**To simulate the transmitter and receiver for BPSK

**7.**To design and simulate FIR digital filter (LP/HP).

**8.**To design and simulate IIR digital filter (LP/HP).

**9.** Design a FIR lowpass filter with given specification and verify the magnitude ,phase,impulse response using FDA toolbox.

Order=100

Window =Rectangular window

Cut off Frequency in radian/sec=0.4

**10.**Design a IIR lowpass Butterworth filter with following specification and verify magnitude, phase,impulse response using FDA tool

Order Minimum

Pass Band attenuation in dB: .36

Stop Band attenuation in dB: 36

Pass Band freq in Hz: 1500

Stop Band freq in Hz: 2000

Sampling freq in Hz: 6000

1. **DSP Lab using TMS320C6XXX DSP Kits**

**11.**To study the architecture of TMS320C6XXX DSP kits using Bloom with DSP

**12.**To generate wave forms (SINE, COSINE, SQUARE & TRIANGULAR).

**13.**Verification of Sampling Theorem.

**14.**Verification of linear/circular convolution.

**15.**To design FIR and IIR digital filter ( LP/HP).

CO1: Able to understand of signal in time domain with continuous and discrete format.

CO2: Able to understand transforms of signal from time to frequency domain and analyze them

On to the basis of their spectrums.

CO3: Able to design & analyze of the filters on the basis of their responses

CO4: Able to design filters and checking responses with their mathematical expression.

CO5: Able to analyze various transforms and also see their computational part with the

Application of FFT algorithms under various Radix bases

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | |  |  |  |  |  | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | H |  | L |  |  |  | L |  |
| CO2 | M | L |  | L |  | L | L |  | L |  | L | L | L | M |  |
| CO3 |  |  | L |  | H |  |  | L |  | H |  |  | H |  |  |
| CO4 | H |  | L |  | L |  |  | H |  | L |  |  |  | L |  |
| CO5 | M | L | H |  |  | L | L |  | L |  | L | L | L | M |  |

H = Highly Related; M = Medium L = Low

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**Faculty of Engineering & Technology Hours:24**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 0-0-2**

**VLSI Design Lab(BEE037A)**

**List of Experiments:**

1. Write a VHDL code to simulate and synthesis the following gates
   1. Basic Gates
   2. Universal Gates
   3. Exclusive Gates
2. Write a VHDL code to simulate and synthesis the following circuits
   1. Half Adder
   2. Fulladder
   3. Half Substractor
   4. Full Substractor
3. Write a VHDL code to find the largest of three number.
4. Write a VHDL code to find the smallest of three number.
5. Write a VHDL code to model MUX 4X1, 8X1 Using

a. With select

b. When

1. Write a VHDL code to model DMUX 1X4, 1X8.
2. Write a VHDL code to generate the Fibonacci series.
3. Write a VHDL code to model a JK Flip Flop (clocked). Using model as a sub program,write VHDL code to model a 8-bit Shift Register.
4. Write VHDL code with “generate” statement to model a 8-bit Shift Register.
5. Using a “block” statement in VHDL, model a 24-bit Shift Register.
6. Using concurrent statements in VHDL, write a code to model a BCD to 7 Segment Encoder.
7. Design a Decade counter with 10 decoded outputs. Write the VHDL for the same and verify the output.
8. Design a retrigger able monostable output pulse for duration of 10 mS. For the input waveform sinewave & write the VHDL code to verify t he output.
9. Design a monostable pulse at the start of the pulse train as in Expt.6 of duration 1 mS. Write a VHDL code for the same.
10. Write a VHDL code to model the Arithmetic, Logical Unit.
11. Design a BCD decoder to accept transmitted data serially, decode the data and if any error, detect it and ask for retransmission.

***Course Outcome (CO):***

At the end of this course students will have:

|  |
| --- |
| CO1-Ability to understand basics of HDL and uses. |
| CO2- Ability to understand basics of VHDL and different type of VHDL coding. |
| * CO3 - Distinguish coding between primitive, data flow, behavioral and structural programming * CO4 - Learn about VHDL and different design levels   CO5-Ability to develop and execute relatively simple VHDL models. |
|  |
|  |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | L |  | L | H | M | L |  |  |  | H |  | L | L |  | M |
| CO3 | L | M |  | H |  |  | L |  |  |  | L |  |  |  | H |
| CO4 |  |  | L |  | H |  | H |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | H |  |  |  |  |  |  | M |  |

H = Highly Related; M = Medium L = Low

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**Faculty of Engineering & Technology Hours:24**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 0-0-2**

**Control System Lab(BEE038A)**

**List of Experiments**

1.      Basics of MATLAB matrices and vectors, matrix and array operations, Saving and loading data, plotting simple graphs, scripts and functions, Script files, Function files, Global Variables, Loops, Branches, Control flow, Advanced data objects, Multidimensional matrices, Structures, Applications in linear algebra curve fitting and interpolation. Numerical integration, Ordinary differential equation. (All contents is to be covered with tutorial sheets).

2.      Simulink:Idea about simulink, problems based on simulink. (All contents is to be covered with tutorial sheets)

3.      (a) To plot step response of a given Transfer Function. Take different values of damping ratio and \_n natural undamped frequency, (b) Plot ramp response.

4.      For a given 2nd order system plot step response and obtain time response specification.

5.      To design 1st order R-C circuits and observe its response with the following inputs and trace the curve.(a)Step (b)Ramp (c)Impulse.

6.      To design 1st order electrical network and study its transient response for step input and following cases.(a)Lag network (b)Lead network (c)Critically damped system.

7. PID CONTROLLER

(a) To observe open loop performance of building block and calibration of PID Controls.

(b) To study P, PI and PID controller with type 0 system with delay.

(c) To study P, PI and PID controller with type 1 system.

8. LEAD LAG COMPENSATOR

(a) To study the open loop response on compensator.

(b) Close loop transient response.

9. Introduction to MATLAB (Control System Toolbox)

a. Different Toolboxes in MATLAB, Introduction to Control Systems Toolbox.

b. Determine transpose, inverse values of given matrix.

10. Plot the pole-zero configuration in s-plane for the given transfer function.

11. Determine the transfer function for given closed loop system in block diagram representation.

12. Plot unit step response of given transfer function and find peak overshoot, peak time.

13. Plot unit step response and to find rise time and delay time.

14. Plot locus of given transfer function, locate closed loop poles for different values of k.

15. Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discussstability.

***Course Outcome (CO):***

At the end of this course students will have the

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| --- |
| CO1. Knowledge of Basics of simulink.  CO2. Ability to make the Difference between Open loop and closed loop system.  CO3 Ability to Implement and realization of First order and second order systems.  CO4Calibration of PID control system.  CO5 stability of closed and open loop system. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

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| **Antennas and Wave Propagation (BEE039A)** |  |
|  |  |

**Course Objective:**

*Antenna Theory is central for all radio systems, and this course will enable the students to understand different radio antennas and their usage. The student will understand the applications of the electromagnetic waves in free space. The students will be able to apply the fundamentals to design different types of antennas.*

**Unit 1:**Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-andfar-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

**Unit 2:**Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linearelements near conductors, dipoles for mobile communication, small circular loop Aperture and Reflector Antennas- Huygens' principle, radiation from rectangularand circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

**Unit 3:**Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequencyindependent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feedingmethods, methods of analysis, design of rectangular and circular patch antennas.

**Unit 4:**Antenna Arrays- Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

**Unit 5:**Basic Concepts of Smart Antennas- Concept and benefits of smart antennas, Fixedweight beam forming basics, Adaptive beam forming. Different modes of Radio Wave propagation used in current practice.

***Course Outcome (CO):***

At the end of this course students will have the

|  |
| --- |
| CO1. Able to understand fundamentals of Antenna system and terminologies.  CO2. Able to understand antennas arrays , their classifications and radiation field intencity  CO3. Able to design and measurement of different types of antennas at different frequencies  CO4. Able to understand meachanism of radio wave propogation with their associated factors  CO5. Able to understand meachanism of radio wave propogation with their associated factors |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books**

1. J.D. Kraus, Antennas, McGraw Hill, 1988.

**Reference Books:**

1. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
2. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
3. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw Hill, 1984.
4. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House,1980.

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

**Optimization Techniques (BEE040A)**

**Course Objective:**

*To learn fundamental principles of Multi objective Optimization (MOP) and survey different Multi objective Optimization algorithms. The linear, non linear and dynamic programming is covered in detail and various design issues are discussed.*

**Unit 1:** Introduction -Historical development, engineeringapplications of optimization, Formulation of design problems for a mathematical programming problem, Classification of optimization problems.

**Unit 2:** Linear Programming-Simplex methods, Revised simplex method, Duality in linear programming, Post optimality analysis.

**Unit 3:** Applications Of Linear Programming-Transportation and Assignment problems.

**Unit 4:** Nonlinear Programming - Unconstrained optimization techniques, Direct search methods, Descent methods, Constrained optimization, Direct and Indirect methods.

**Unit 5:** Dynamic Programming-Introduction, multi-decision processes, computational procedures.

***Course Outcome (CO):***

At the end of this course students will have the

|  |
| --- |
| CO1. Able to formulate the real world problem into mathematical form.  CO2. Able to apply simplex methods in solving linear programming problem and To understand the effect of change in parameters of LPP after the attainment of optimal solution  CO3. Able to optimize tansportation problem and assignment problem.  CO4. Able to obtain the optimum values of non-linear programming problems.  CO5. Able to reduce multi-stage dynamic programming problem into a single variable problem and to solve it. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text books:**

1. Gillet B.E: Introduction to Operation Research, Computer Oriented Algorithmic approach - Tata McGraw Hill Publishing Co. Ltd. New Delhi.

**Reference books:**

1. P.K. Gupta & D.S. Hira, “Operations Research”, S.Chand & Co.

2. J.K. Sharma, “Operations Research: Theory and Applications”, Mac Millan.

3. S.D. Sharma, “Operations Research”, Kedar Nath Ram Nath, Meerut (UP).

4. S.S. Rao “Optimization Theory and Application”, Wesley Eastern.

5. Tata Handy, A “Operations Research - An Introduction”, Fifth Edition, Prentice Hall of India Pvt. Ltd., New Delhi.

6. Taha H.A. “Operations Research an Introduction” McMillan Publication

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

**Embedded System (BEE041A)**

**Course Objective:**

1. *To teach students about embedded system Design and implementation.*
2. *To teach AVR architecture and programming.*

**Unit 1:** Introduction to Embedded System: An Embedded System, Embedded system Vs General computing systems, Classification of embedded systems, Major application areas of embedded systems, Purpose of embedded systems, Processor, Processor selection for an    Embedded systems, Characteristics of Embedded system, Quality attributes of Embedded systems. Memory devices, memory selection for an embedded system, RISC Vs CISC Processor, Harvard Vs Von Neumann Processors/Controllers architecture, Big Endian Vs Little Endian Processors/Controllers.

**Unit 2:** sensors and actuators, I/O subsystem: LED, 7 segment LED Display, Opto-coupler, Stepper Motor, Relay, keyboard, PPI chip.

Communication interface: onboard communication interfaces-I2C, SPI, UART, 1-wire interface, Parallel interface. External communication interfaces: RS232C, USB, IEEE 1394, Infrared, Bluetooth, Wi-Fi, ZigBee and GPRS.

**Unit 3:** AVR Microcontroller architecture- registers and memory in AVR. Assembly language programming of AVR- Addressing modes, instruction sets, Assembler directive, Advanced programming- time delay, I/O port programming, I/O bit manipulation programming.

**Unit 4:**AVR timer and counter programming, AVR interrupt programming, AVR interfacing- Serial Ports, LCD, Keyboard, ADC, DAC, sensors, stepper motor,PWM control, DC Motor Speed Control. Watchdog timer,Real Time Clock.

**Unit 5:** HARDWARE SOFTWARE CO-DESIGN: issues in hardware software co-design, Computational models in embedded design-data flow graph/diagram model, Control data flow graph/diagram, State Machine model, Sequential program model, Concurrent/ Communicating process model, Object oriented model. Introduction to unified modelling language.

Embedded Network Devices: CAN, LIN, Fail Safe SBC, Safe by wire.

To acquire knowledge about microcontrollers embedded processors and their applications.

• Foster ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.

• Foster ability to write the programs for microcontroller.

• Foster ability to understand the role of embedded systems in industry.

• Foster ability to understand the design concept of embedded systems.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

1. Shibu K V, “Introduction to Embedded Systems”, MacGraw Hill Education
2. M.A. Mazidi, S. Naimi and S. Naimi, “The AVR Microcontroller and Embedded Systems using assembly and C”, Prentice Hall

**References: -**

1. Raj Kamal, “Embedded systems - architecture, programming and design” , Tata McGraw Hill, 2007.
2. Daniel Pack, Mitchell Thornton, Steven F. Barrett , “Atmel AVR microcontroller primer: programming and interfacing**”,** Morgan & Claypool Publishers
3. Dhananjay Gadre, “Programming and Customizing the AVR Microcontroller”**,** McGraw-Hill Companies
4. Mitchell Thornton **, Steven Barrett “Embedded Systems Design with the Atmel AVR Microcontroller”,** Morgan & Claypool Publishers.
5. Frank Vahid, Tony D. Givargis , “[Embedded System Design: A Unified Hardware Software Introduction](http://webbooksmanager.com/Embedded-System-Design-A-Unified-Hardware-Software-Introduction/p257837/)”, Wiley publications.

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

**Programming in JAVA (BEE 081A)**

Objective

* Cover issues related to the definition, creation and usage of classes, objects and methods.
* Discuss the principles of inheritance and polymorphism and demonstrate though problem analysis assignments how they relate to the design of methods, abstract classes and interfaces.
* Provide the foundation of good programming skills by discussing keys issues to the design of object-oriented software, including programming design patterns, automatic documentation techniques and programming testing.
* Cover the basics of creating APIs as well as allow students to explore the Java Abstract Programming Interface (API) and Java Collection Framework through programming assignments.
* Discuss basic principles and tools of collaborating programming (versioning systems, code review) and study their usage through group programming projects.

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| **UNIT 1** | **Java Fundamentals:** Features of Java ,OOPs concepts , Java virtual machine , Reflection byte codes ,Byte code interpretation , Data types, variable, arrays, expressions, operators, and control structures , Objects and classes |
| **UNIT 2** | **Java Classes:** Abstract classes ,Static classes ,Inner classes ,Packages,Wrapper classes Interfaces ,This ,Super ,Access control |
| **UNIT 3** | **Exception handling:** Exception as objects ,Exception hierarchy ,Try catch finally ,Throw, throws |
| **UNIT 4** | **IO package:** Input streams ,Output streams ,Object serialization ,De serialization ,Sample programs on IO files ,Filter and pipe streams |
| **UNIT 5** | **Multi threading:** Thread Life cycle ,Multi threading advantages and issues ,Simple thread program ,Thread synchronization .GUI: Introduction to AWT programming, Layout and component managers ,Event handling ,Applet class ,Applet life-cycle ,Passing parameters embedding in HTML ,Swing components – JApplet, JButton, JFrame, etc. Sample swing programs |

CO 1: Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.

CO 2: Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.

CO 3: Understand the principles of inheritance, packages and interfaces.

CO 4 :Identify classes, objects, members of a class and relationships among them needed for a specific problem

CO 5 : Demonstrate the concepts of polymorphism and inheritance

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**References:**

**1.** Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies

2. Java Programming John P. Flynt Thomson 2nd

3. Java Programming Language Ken Arnold Pearson

4. The complete reference JAVA2, Herbert schildt. TMH

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

**Radar and Satellite Communication(BEE042A)**

**Course Objectives:**

*Satellite communication is most popular mode of transmission and reception of information at very long distance points. TV , Radio, Voice Channels, Mobile Communication, GPS , Weather forecasting , all are sub parts of this subjects.We study ,how to decide the location and operating bandwidth of satellite, what factors decide life, performance, cost of satellite link.*

**Unit 1:** Radar Block diagram, Frequencies and Applications. Radar range Equation. Continuous Wave (CW) & FM radar.

**Unit 2:** Delay line Cancellers, Blind velocity Pulse Doppler Radar. Tracking radar sequential lobbing, Conical scan and Mono-pulse radar, Types of display, Radar receivers, Noise figure. Introduction.

**Unit 3:** Orbital mechanics and launching, Earth station and satellite sub systems, Satellite link, Design and Analysis.

**Unit 4:** Multiple accesses for satellite links: FDMA, TDMA, CDMA & DAMA. Propagation effects.

**Unit 5:** Network architecture, Access control protocol & Link Analysis.

***Course Outcome (CO):***

At the end of this course students will have the

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| CO1. Able to understand the fandamentals and working or RADAR, Moving target indicator (MTI), Types of RADAR Displays and RADAR Receivers.  CO2. Able to understand the Radar direction finder & range system. LORAN system, DME, TACAN, Aircraft landing systems.  CO3. Able To understand the Principles of Monochrome and colour T.V. system (PAL, SECAM, NTSC). Composite video signal T.V Cameras: Image orthicon, plumbicon, vidicon. CCD camera tubes, LCD and Plasma displays.  CO4. Able to understand the Vestigial side band transmission, Encoding picture information, Chrominance modulation, Compatibility of colour and monochrome T.V. systems. Students will be able To understand the T.V. transmitters, TV transmission & reception antennas.  CO5. Able to understand the working of T.V. receiver, R.F. Tuner, I.F. amplifier, Video detector, video amplifier, AGC, Synch. Separation, Sync. Students will be able To understand the theory HDTV, DBSTV and 3D-TV. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

Fundamentals Of Satellite Communications ,K.N. Raja Rao, ,Phi

Wireless Broadband Networks,David T. Wong, Peng-Yong Kong,John Wiley & Sons

**Reference Books:**

1. Radar Principles, By Peyton Z. Peebles, Oxford

2. Radar HandOBOOK, By Merrill I. Skolnik, Oxford

5. Satellite Communications ,Timothy Pratt, Charles Bostian And, John Wiley & Sons.

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**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

**Web Designing Techniques (BEE082A)**

**Objective:**

At the end of the course, the student should be able to:

* To gain the skills and project-based experience needed for entry into web design and development careers.
* Touse a variety of strategies and tools to create websites.
* To develop awareness and appreciation of the myriad ways that people access the web and will be able to create standards-based websites that are accessible and usable by a full spectrum of users.

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| **UNIT 1** | Computer network, uses of computer networks, network hardware, network protocol, Reference models: The OSI reference model, the TCP/IP Reference model, a comparison of the OSI and TCP/IP reference models. Introduction of Ethernet, Hub, Client Server Architecture, Switch, modem. |
| **UNIT 2** | **The World Wide Web (WWW): HTML History**, Hypertext and Hypertext Markup Language.**HTML Documents**: Tags, Elements of an HTML Document: Text Elements, Tag Elements, Structural elements of HTML documents, Header tags, Body tags, Paragraphs, Title.  **List:** Numbered list, Non-Numbered lists, Definition lists |
| **UNIT 3** | **Formatting HTML Documents:** Logical styles (source code, text enhancements, variables), Physical Styles (Bold, Italic, underlined, crossed),  **Managing images in html**: Image format (quality, size, type), Importing images (scanners), Tags used to insert images.**Frames** Tables in HTML documents: Tags used in table definition, Tags used for border thickness,  Tags used for cell spacing, Tags used for table size, Dividing table with lines, Dividing lines with cells, Cell types: Titles cells, Data cells |
| **UNIT 4** | **Hypertext and Link in HTML Documents** URL/FTP/HTTP,Types of links: Internal Links, External Link, Link Tags, Links with images and buttons, Links that send email messages Special effects in HTML documents. |
| **UNIT 5** | **Web Designing with PHP (Introduction):Orientation and First Steps:** PHP's Place in the Web World, Basic Rules of PHP Programs, Application of PHP on the internet. Advantages of PHP. |

CO 1: Apply the tools and techniques for effective Web site planning and analysis (CIT i)

CO2 :Create static Web pages using HTML 5 (CIT a)

CO3 :Create pages using CSS for formatting and layout (CIT a)

CO4 :Construct dynamic Web pages using HTML 5 and JavaScript (CIT a)

CO5 :Use Web authoring tools such as Dreamweaver (CIT i)

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

**Digital Hardware Design (BEE044A)**

**Course Objective:**

*The objective of the course is to introduce the basic concepts of asynchronous and synchronous state machines and their implementation, hazards faced in today’s world.*

**Unit 1:**Memory element: Latch, R-S, J-K, D –flip flops, Master Slave arrangement, edge triggered flip flops, shift registers, asynchronous and synchronous counters.

**Unit 2:**Analysis and Design of Synchronous Sequential Finite state machines: ASM charts, synchronous analysis process, design approaches, state reduction, design of next state decoder and output decoder, design of counters and decoders, code sequence detectors, sequential code generators.

**Unit 3:**Linked state mechanics: Introduction to system controller design: System controller state specification (MDS diagram) timing and frequency considerations, synchronizing system, state assignments, implementation using ROM, PAL, PLA multiplexers.

**Unit 4:**Analysis and design of Asynchronous Sequential finite state machines: Need for asynchronous circuits, analysis, cycles and races, Hazards, Map entered variable approaches to asynchronous design.

CO 1. Students can apply logic fundamentals using hardware description languages.

CO 2. Students understand the difference between procedural programming and hardware description languages.

CO 3. Students can write synthesizable verilog code describing basic logic elements a. Combinatorial logic. b. Sequential logic

CO 4. Students can code state machines in a hardware description language.

CO 5. Students can analyze and develop basic logic pipelined machines.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text book:**

1. William J. Fletcher- An Engineering approach to Digital Design – PHI 1993.

**Reference books:**

2. F.P.Frosser and D.E. Winkel – The Art of Digital Design.

3. D.H. Green – Modern Logic Design.

4. Morant M.J. Integrated Circuit Design and Technology, champion and Hall, 1990.

5. Wakerly – Digital Design: Principles and Practices, PHI 1994.

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VI**

**Contact Hours (L-T-P): 3-1-0**

**Operating Systems (BEE083A)**

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| **UNIT 1** | Introduction-OS Concepts – Evolution of OS, OS Structures- Kernel, Shell, General Structure of MSDOS, Windows 2000, Linux. Introduction- UNIX and ANSI Standards: The ANSI C Standard, the ANSI/ISO C++ Standards, Difference between ANSI C and C++, the POSIX Standards. |
| **UNIT 2** | Process Management-Process & Threads – Process States - Process Control Block – Process Scheduling – Operations on Processes, Threads, CPU Scheduler – Preemptive and Non- Preemptive; Dispatcher, Scheduling Criteria, Scheduling Algorithms – Process Management in UNIX |
| **UNIT 3** | UNIX Processes: The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, get limit, set limit Functions, UNIX Kernel Support for Processes. Process Control |
| **UNIT 4** | Process Synchronization & Inter process Communication-Concurrent Processes, Co-operating Processes, Precedence Graph, Hierarchy of Processes, Critical Section Problem – Two process solution, Synchronization Hardware, Semaphores – Deadlock- detection, handling, prevention, avoidance, recovery, Starvation, Critical Regions, Monitors, Inter process communication |
| **UNIT 5** | Memory Management-Objectives and functions, Simple Resident Monitor Program (No design), Overlays – Swapping; Schemes – Paging – Simple, Multi-level Paging; Internal and External Fragmentation; Virtual Memory Concept, Demand Paging – Page Interrupt Fault, Page Replacement Algorithms; Segmentation – Simple, Multi-level, Segmentation with Paging, Memory Management in UNIX. |

***Course Outcome (CO):***

At the end of this course students will have the

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| CO1. To understand the structure and functions of OS  CO2. To learn about Processes, Threads and Scheduling algorithms  CO3. To understand the principles of concurrency and Deadlocks  CO4. To learn various memory management schemes  CO5. To study I/O management and File systems |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 |  |  | L |  | L |  |  | M |  |  | L |  |  | H |  |
| CO2 | M |  | H | L | M | L |  |  |  | H |  | L | M | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

***Text Books:***

1. Operating Systems Concepts – Silberschatz, Galvin, Wiley Publications (2008)

2. Modern Operating Systems - Andrew S. Tanenbaum, Pearson Education Asia / PHI (2005)

***Reference Books:***

1. Operating Systems – William Stallings, Pearson Education Asia (2002)
2. UNIX System Programming Using C++, by Terrence Chan: Prentice Hall India, 1999.
3. Advanced Programming in UNIX Environment, by W. Richard Stevens: 2nd Ed, Pearson Education, 2005

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 2-1-0**

**Linear Algebra (BAS009A)**

**Unit 1:**Vector spaces, linear dependence, basis; Representation of linear transformationswith respect to a basis.Inner product spaces, Hilbert spaces, linear functions; Riesz representation theoremand adjoints.

**Unit 2:**Orthogonal projections, products of projections, orthogonal direct sums; Unitaryand orthogonal transformations, complete orthonormal sets and Parseval's identity; Closed subspaces and the projection theorem for Hilbert spaces.

**Unit 3:**Polynomials: The algebra of polynomials, matrix polynomials, annihilatingpolynomials and invariant subspaces, Jordan forms.

**Unit 4:**Applications: Complementary orthogonal spaces in networks, properties of graphsand their relation to vector space properties of their matrix representations; Solution of state equations in linear system theory; Relation between the rational and Jordan forms.

**Unit 5:**Numerical linear algebra: Direct and iterative methods of solutions of linearequations; Matrices, norms, complete metric spaces and complete normal linear spaces (Banach spaces); Least squares problems (constrained and unconstrained); Eigenvalue problem.

**Course Outcomes**

CO1:-Understanding the basic theory of vector space.

CO2:-Understanding the basics concepts of linear transformations.

CO3:-Understanding the different data structures like Inverted Indices used in Information retrieval systems

CO4:-Understanding the basic concept of Innerproductspaces.

CO5:-Developing the ability tosolve the system of linear equations.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H | M | L | L | L |  |  |  |  |  |  | L | L |  | L |
| CO2 | H | M | L | L |  | L |  |  |  |  |  | L | L |  |  |
| CO3 | H | M | L | L |  |  |  |  |  |  |  | L |  |  |  |
| CO4 | H | M | L | L |  |  |  |  |  |  |  | L |  |  |  |
| CO5 | H | M | L | L | L |  | L |  | L | L | L | L | L | M | L |

H = Highly Related; M = Medium L = Low

**Textbooks:**

1. K. Hoffman and R. Kunze, Linear Algebra, Prentice-Hall (India), (1986).

**Referencebooks:**

1. G.H. Golub and C.F. Van Loan, Matrix Computations, North Oxford Academic, 1983.
2. G. Bachman and L. Narici, Functional Analysis, Academic Press, 1966.
3. E.Kreyszig, Introductory functional analysis with applications John Wiley, 1978.

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**Faculty of Engineering & Technology Hours:36**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 3-0-0**

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| **Communication Networks** | **(BEE049A**) |
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**Course Objective:**

*To acquire a foundational understanding of communication network technologies. Networking concepts will be illustrated using the TCP/IP and ATM networks.*

**Unit 1:** Overview of networking principles and of analytical networking. Outline of thecourse. Networking practice. A brief overview of networking technologies and the development of a functional view.

Analysis of packet multiplexed stream traffic; Introduction to DeterministicNetwork Calculus and packet scheduling algorithms and their analysis.

**Unit 2:**Stochastic analysis of packet multiplexed stream traffic. Overview of queueingmodels, Little's theorem, Brumelle's theorem, M/G/1 queue formulae, development of equivalent bandwidth of a stream source.

**Unit 3:**Circuit multiplexing. Blocking probability calculations and the Kaufman Robertsrecursion. Application to a simple analysis of cellular network. Stochastic analysis of packet multiplexing of elastic sources. Window flow/congestion control algorithms, detailed description of TCP and a detailed analysis of the TCP protocol.

**Unit 4:**Introduction to multiple access channels. Description and analysis of the Aloha,Ethernet, and CSMA/CA protocols. Brief overview of ad hoc networks and issues in sensor networks.

**U****nit 5:**Packet Switching and Architecture of routers and packet switches. Queueingissues in packets switches, input and output queueing, virtual-output-queueing, maximum and maximal matching algorithms, stable matching algorithm

***Course Outcome (CO):***

At the end of this course students will have:

C0-1: The students will able to understand the evolution of different generation of Mobile.

CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.

CO3- The student will be able to analyze and design different accessing techniques.

C0-4:The student will be able to analyze and design different standard of communication system.

CO-5- The student can work in advanced research wireless and mobile cellular programs.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |
|  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  |
| CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M |
| CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H |
| CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  |
| CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text books:**

1. Data Communication and Networking , Behroun A. Forouzan, DeAnza College, 4th edition TMH 2007.

2.R G Gallager and D Bertsekas, Data Networks, Prentice Hall of India, 1992.

**Reference books:**

1.J F Hayes, Modelling and Analysis of Computer Communication Networks, Plenum Publishers, NY,1984. 3.W Stallings, Data and Computer Communications, Prentice Hall of India, 1997.

2.R Rom and M Sidi, Multiple Access Protocols, Springer Verlag, 1990.

3.M DePrycker, ATM-solutions for Broadband ISDN, Prentice Hall of USA, 1995.

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**Faculty of Engineering & Technology Hours: 36**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 3-0-0**

**Fiber Optic Communication(BEE050A)**

**Course Objectives:**

1. *To be able analyze the performance of both digital and analog optical fibre.*
2. *To calculate the system bandwidth, noise, probability of error and maximum usable bit rate of a digital fiber system.*
3. *To be able to calculate the system link loss, distortion and dynamic range of an RF photonic link.*

**Unit 1:**OPTICAL FIBERS: **-** Basic optical laws and definitions, Principles of light propagation in fibers, Ray theory, Optical fiber modes and configurations, Step index and graded index fibers. Monomode and multimode fibers, Fiber materials, fiber fabrication, Fiber optic cables. Attenuation, signal distortion in optical fibers, Dispersionintra modal & inter modal, Dispersion shifted and flattened fiber.

**Unit 2:**OPTICAL SOURCES: **-** LED’s- Structure, Materials, Characteristics, Modulation, Power & efficiency, Laser Diodes - Basic concept, Hetro Structure, properties and modulation.

**Unit 3:**OPTICAL DETECTORS: **-** PIN and Avalanche photo diodes, photo detector noise, detector response time, Avalanche multiplication noise. Photo diode materials. Fundamental of Optical Receiver Operation.

**Unit 4:**OPTICAL FIBER COMMUNICATION SYSTEMS:-Source to fiber coupling, fiber to fiber joints, fiber splicing, fiber connectors. Principal components. Link design calculation, Applications, Wavelength division multiplexing.

**Unit 5:**OPTICAL FIBER MEASUREMENTS:Measurements of Fiber attenuation, Dispersion, refractive index profile, Numerical aperture & diameter.

**Course Outcome (CO):**

By the end of this course, students will be able to::

**CO1**- Ability to understand Optical Fiber and light propagation.

**CO2**- Ability to understand Optical Sources.

**CO3**-Ability to understand Optical detectors with calculation of bandwidth, noise.

**CO4**- Ability to understand coupling and multiplexing in optical fiber communication.

**CO5**- Ability to understand calculation of attenuation, dispersion, numerical aperture.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  | L |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  | M |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text book**:

1. Optical Fiber Communication: Principles And Practice:John M Senior, Pearson

**Reference books**:

1. Opto Electronics And Fibre Optics Communication, Sarkar, D.C,

2. Optical Fiber Communication: Principles And Systems, Selvarajan, A, TMH

3. Optical Communication System, Johan Gowar, PHI

4. Introduction To Optical Fiber Communications Systems, William B. Jones, Oxford

5. Optical WDM Networks - Principles and Practice, Biswanath Mukherjee, Oxford

6. Optical Fiber Communications, Keiser, Gerd, TMH

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 2-1-0**

**Mobile Communication(BEE051A)**

**Course Objective:**

*To familiarize students with various technologies traversed in the complete evolution path from 2G to 4G and beyond. Also providing sound understanding to the students about the various technologies from mathematical perspective.*

**Unit 1:**Cellular concepts- Cell structure, frequency reuse, cell splitting, channelassignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

**Unit 2:**Signal propagation**-**Propagation mechanism- reflection, refraction, diffraction andscattering, large scale signal propagation and lognormal shadowing. Fading channels Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

**Unit 3:**Capacity of flat and frequency selective channels. Antennas- Antennas for mobileterminal- monopole antennas, PIFA, base station antennas and arrays.Multiple access schemes**-**FDMA, TDMA, CDMA and SDMA. Modulationschemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

**Unit 4:**Receiver structure- Diversity receivers- selection and MRC receivers, RAKEreceiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Alamouti scheme.MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff.

**Unit 5:**Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

***Course Outcome (CO):***

At the end of this course students will have:

C0-1: The students will able to understand the evolution of different generation of Mobile.

CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.

CO3- The student will be able to analyze and design different accessing techniques.

C0-4:The student will be able to analyze and design different standard of communication system.

CO-5- The student can work in advanced research wireless and mobile cellular programs.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |
|  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  |
| CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M |
| CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H |
| CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  |
| CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text book:**

1.WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.

**Reference Books:**

1.Raymond Steele, Mobile Radio Communications, IEEE Press, New York, 1992.

2.AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995. 3.VK Garg &JE Wilkes, Wireless & Personal Communication Systems, Prentice Hall, 1996.

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**Faculty of Engineering & Technology**

**B.Tech. Electronics and communications Engineering Semester VII Hours: 24**

**Contact Hours (L-T-P): 0-0-2**

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| **Communication Network Lab(BEE052A)**  1. To design and simulate CDMA transmitter and receiver with BPSK modulation scheme and measuring the BER in AWGN and Rayleigh channel on SIMULINK.  2. To design and simulate CDMA transmitter and receiver with QPSK modulation scheme and measuring the BER in AWGN and Rayleigh channel on MATLAB SIMULINK.  3. To design and simulate CDMA transmitter and receiver with QAM modulation scheme and measuring the BER in AWGN and Rayleigh channel on MATLAB SIMULINK.  4. To analyze and reduce the effect of co-channel interference in a wireless communication system on MATLAB SIMULINK.  5. To design and simulate the transmitter and receiver of IEEE 802.15 standard on MATLAB SIMULINK.  6. To design and simulate the transmitter and receiver of GSM system using GMSK modulation scheme and analyze the performance in terms of SNR and BER as well as throughput.  7. To design and simulate the CDMA transmitter and receiver with a specific modulation scheme and measuring the BER in AWGN and Rayleigh channel for different coding schemes on MATLAB SIMULINK.  8. To analyze the ADSL by observing the effect of varying SNR on the received signal constellation.    9. To analyze the effect of a specific modulation scheme on the bit rate of OFDM system using MATLAB.  10. To implement MIMO OFDM using MATLAB.  11. To analyze the effect of adaptive modulation and coding on the bit rate of OFDM system using MATLAB.  12. To study various spectrum sensing techniques in wireless communication.  13. To implement OFDMA scheme using MATLAB.  14. To analyze the performance of OFDMA transmission scheme in flat fading as well frequency selective fading.  15. To analyze the performance of OFDMA transmission scheme in fast fading channel. |
| ***Course Outcome (CO):***  At the end of this course students will have:  C0-1: The students will able to understand the evolution of different generation of Mobile.  CO-2: The student will have the ability to understand the characteristics of communication for different channels and environment.  CO3- The student will be able to analyze and design different accessing techniques.  C0-4:The student will be able to analyze and design different standard of communication system.  CO-5- The student can work in advanced research wireless and mobile cellular programs.  **MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | | |  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 | | CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  | | CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M | | CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H | | CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  | | CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |   H = Highly Related; M = Medium L = Low |

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 3-1-0**

**Adaptive Signal Processing(BEE054A)**

1. *This course focuses on problems algorithms and solutions for processing signals in an manner that is responsive to a changing environment Adaptive signal processing systems are developed which take advantage of the statistical properties of the received signals.*
2. *The course analyzes the performance of adaptive filters and considers the application of the theory to a variety of practical problems such as interference and echo cancellation signal and system identification and channel equalization.*
3. *The class is designed as an advanced statistical signal processing course in which students will build a strong foundation in approaching problems in such diverse areas as acoustic sonarradar geophysical biomedical and communications signal processing Understanding of the theoretical foundations of adaptive signal processing theory will be achieved through a combination of theoretical and computer based homework assignments Detail.*

**Unit 1:**General concept of adaptive filtering and estimation, applications and motivation. Review of probability, random variables and stationary random processes;Correlation structures, properties of correlation matrices.

**Unit 2:**Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued signals.

**Unit 3:**The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment.Variants of the LMS algorithm : the sign LMS family, normalized LMSalgorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

**Unit 4:**Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces ,Vector space of random variables, correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

**Unit 5:**Introduction to recursive least squares (RLS), vector space formulation of RLSestimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topic: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

CO1- Understand the basics of digital signal processing and digital filter design and its realizations

CO2- Classify the various adaptive systems and its applications

CO3-Analyze the basic adaptive signal processing methods, especially linear adaptive filters

CO4-Apply important structures of adaptive filters and algorithms

CO5-Design and integrate an adaptive filter in communication systems etc

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |
|  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  |
| CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M |
| CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H |
| CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  |
| CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Books:**

|  |  |  |
| --- | --- | --- |
| . | 1. S. Haykin, Adaptive filter theory, Prentice Hall, 1986. |  |
|  | 1. B. Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall,1984. |  |
|  |  |  |

**Reference Books:**

1. Aurelio Uncini, Fundamentals of Adaptive Signal Processing, Springer, 2015
2. [Dimitris G. Manolakis](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Dimitris+G.+Manolakis%22), [Vinay K. Ingle](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Vinay+K.+Ingle%22), [Stephen M. Kogon](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Stephen+M.+Kogon%22), Statistical and adaptive signal processing, McGraw-Hill, 2000
3. [Lee D. Davisson](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Lee+D.+Davisson%22&source=gbs_metadata_r&cad=5), [Giuseppe Longo](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Giuseppe+Longo%22&source=gbs_metadata_r&cad=5),Adaptive signal processing, Springer-Verlag, 1991

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 3-1-0**

**Speech and Audio Processing(BEE055A)**

**Course Objectives:**

1. *This course will give students a foundation in current audio and recognition technologies.*
2. *One objective is to build up a familiarity with the perceptually-salient aspects of the audio signal, and how they can be extracted and manipulated through signal processing.*
3. *Objective is to obtain a thorough understanding of the statistical pattern recognition technology at the core of contemporary speech and audio recognition systems.*
4. *The course aims to deepen each student's familiarity with the practical application of signal processing in general, through the study of specific instances, and through the experience of the term project.*

**Unit 1:**Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

**Unit 2:**Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

**Unit 3:**Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

**Unit 4:**Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

**Unit 5:**Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero-state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

**Course Outcomes:**

CO1. **Analyze and design algorithms for extracting parameters from the speech signal.**

**CO2.** To provide a broad treatment of the fundamentals in audio and speech processing.

CO3. To give an overview of applications (recognition, synthesis, coding) and to inform about practical aspects of speech algorithms implementation.

CO4. To describe basic algorithms of speech analysis common to many applications.

CO5. To provide students with the knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |
|  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  |
| CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M |
| CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H |
| CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  |
| CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text/Reference Books:**

1. “Digital Speech” by A.M.Kondoz, Second Edition (Wiley Students‟ Edition), 2004.
2. “Speech Coding Algorithms: Foundation and Evolution of Standardized Coders”, W.C. Chu, Wiley Inter science, 2003.

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**Faculty of Engineering & Technology Hours:48**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 3-1-0**

**ASIC & FPGA(BEE056A)**

**Course Objectives:**

*To introduce students to the process of designing application specific hardware implementations of algorithms for ASICs and FPGAs. Students will work with commercial computer aided design tools to synthesize designs described in hardware description languages. Topics covered will include differences between hardware description languages for synthesis and simulation, behavioral synthesis, gate-level design, register transfer level design, design methodologies, finite state machines, design reuse and intellectual property cores, and optimization.*

**Unit 1:**Introduction to ASICs, CMOS Logic And ASIC Library Design :Types of ASICs,Design flow **,**CMOS transistors, CMOS Design rules, Combinational Logic Cell, Sequential logic cell , Data path logic cell,I/O cells, Transistors as Resistors, Transistor ParasiticCapacitance, Logical effort, Library cell design, Library architecture, Gate-Array Design.

**Unit 2:**Programmable ASICs, Logic Cells And I/O Cells:Anti fuse, static RAM, EPROM and EEPROM technology, PREP benchmarks, Actel ACT, Xilinx LCA, Altera FLEX, Altera MAX DC & AC inputs and outputs, Clock & Power inputs, Xilinx I/O blocks.

**Unit 3:**Programmable ASIC Interconnect, Design Software And Low Level Design Entry :Actel ACT, Xilinx LCA, Xilinx EPLD, Altera MAX 5000 and7000, Altera MAX 9000, Altera FLEX , Design systems, Logic Synthesis, Half gate ASIC,Schematic entry, Low level design language, PLA tools,EDIF, CFI design representation.

**Unit 4:**Logic Synthesis, Simulation And Testing :Verilog and logic synthesis, VHDL and logic synthesis, types of simulation, boundary scan test, fault simulation, automatic test pattern generation, Introduction to JTAG.

**Unit 5:**ASIC Construction, Floor Planning, Placement & Routing:System partition, FPGA partitioning, partitioning methods, floor planning, placement, physical design flow, global routing, detailed routing, special routing, circuit extraction, DRC.

.  
**CO 1:**Continue discussion synthesis subset. Review finite state machines.

CO 2Introduce ASIC design methodologies and synthesis tools, VHDL simulation and verification  
**CO 3:**Discuss standard libraries. Introduce optimizations  
**CO 4**Introduce FPGA Synthesis tools and Intellectual Property Cores  
**CO 5 :**Topics TBA, related to main project.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |
|  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  |
| CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M |
| CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H |
| CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  |
| CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text Book:**

1. M.J.S .Smith, "Application Specific Integrated Circuits ", Addison -Wesley LongmanInc.,1997

**Reference Books:**

1. Andrew Brown, "VLSI Circuits and Systems in Silicon", McGraw Hill, 1991

2.S. Y. Kung, H. J. White House, T. Kailath, "VLSI and Modern Signal Processing ",Prentice Hall, 1985.

3. S.D. Brown, R.J. Francis, J. Rox, Z.G. Vranesic, “Field Programmable Gate Arrays”, Kluwer Academic Publishers, 1992.

4. Mohammed Ismail and Terri Fiez, "Analog VLSI Signal and Information Processing", McGraw Hill, 1994.

5. Jose E. France, Yannis Tsividis, "Design of Analog & Digital VLSI Circuits for Telecommunication and SignalProcessing", Prentice Hall, 1994

JECRC UNIVERSITY

**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 3-1-0**

**Micro Electro Mechanical Systems(BEE057A)**

**Course Objectives:**

*1. In this course you will learn about microelectromechanical systems (MEMS). You will learn about elasticity and the static and dynamic behavior of beams and membranes.*

*2. The Laplace transformation is introduced and used to translate both mechanical and other systems to electrical components ("lumped elements"), which are then analyzed by use of the tools available for systems of electrical components. Transducers (sensors and actuators) are treated with focus on electrostatic, electromagnetic and piezo-resistive/electric transducers.*

*3. It is central here that you learn to calculate the electrical and mechanical response of simple MEMS-transducers. Related simple electronic circuits are introduced and noise (electrical and in other domains) is introduced. Applications in e.g. accelerometers, microfabricated microphones and pressure sensors are illustrated via examples and problems as well as company visits.*

*4. The final part of the course is a desktop project, where you will work in groups on an open MEMS-related problem defined by a research group at DTU Nanotech or a company.*

**Unit 1:** Introduction to MEMS:MEMS and Microsystems, Miniaturization, Typical products, Micro Sensors,Micro actuation, MEMS with micro actuators, Microaccelorometers and Micro fluidics, MEMS materials, Micro Fabrication.

**Unit 2:** Mechanics for MEMS Design:Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations,torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics, material, physical vapor deposition (PVD),chemical mechanical polishing (CMP).

**Unit 3:** Electro static design:Electrostatics: basic theory, electro static instability, Surface tension, gap and finger pull up, Electro static actuators, Comb generators, gap closers, rotary motors, inch worms, Electromagnetic actuators, bistable actuators.

**Unit 4:** Circuit and system issues:Electronic interfaces, Feed back systems, Noise, Circuit and system issues, Case studies –Capacitive accelerometer, Peizo electric pressure sensor, Thermal sensors, radiation sensors, mechanical sensors, bio-chemical sensors Modeling of MEMS systems, CAD for MEMS.

**Unit 5:** Introduction to Optical And RF MEMS:Optical MEMS, system design basics – Gaussian optics, matrix operations, Resolution, Case studies, MEMS scanners and retinal scanning, display, Digital Micro mirror devices, RF Mems – design basics, case study – Capacitive RF MEMS switch, Performance issues.

**Course Outcomes:**

CO1. Be familiar with the important concepts applicable to MEMS, their fabrication.

CO2. . Be fluent with the design, analysis and testing of MEMS.

CO3. Apply the MEMS for different applications.

CO4. To know various fabrication and machining process of MEMS.

CO5. To know about the polymer and optical MEMS.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |
|  | PO1 | PO2 | PO3 | PO4 | P05 | PO6 | PO7 | PO8 | PO9 | P010 | P011 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  |  | M |  |  | M | M | H | M |  | H |  |
| CO2 | H |  | H | M |  | H | M |  |  | H | M |  | M | H | M |
| CO3 | H | M |  |  |  |  |  | H | H |  |  |  |  |  | H |
| CO4 |  |  | M |  |  | H |  |  |  |  | M | H | H |  |  |
| CO5 | M | M |  |  |  |  |  |  | L |  |  | H |  |  | M |

H = Highly Related; M = Medium L = Low

**Text books:**

1. Stephen Santeria, “Microsystems Design “, Kluwer publishers, 2000.

2. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

**Reference books:**

1. Mohamed Gad-el-Hak, editor, “ The MEMS Handbook”, CRC press Baco Raton, 2000

2. Nadim Maluf, “ An introduction to Micro electro mechanical system design”, Artech House, 2000.

3. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim,micro sensors mems and smart

devices, John Wiley & son LTD,2002

4. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

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| JECRC UNIVERSITY  **Faculty of Engineering & Technology Hours: 48**  **B.Tech in Electronics and Communication Engineering Semester VII**  **Contact Hours (L-T-P): 3-1-0**    **Broad Band Communication(BEE058A)**  **Course Objectives:**   1. *study-unit aims to familiarize students with current and future broadband This systems be they interface systems in the PAN, interconnection schemes in Data centers or networked systems in the Local, Metropolitan and Wide Area Network.* 2. *udents will familiarize with various broadband systems and their components, and shall familiarize with the critical design parameters of each of the covered broadband system.*  |  | | --- | |  |   **Unit 1:** X.25, Frame relay, X.25 v/s Frame relaying, Frame mode protocol architecture, Frame relay and Frame switching, Frame mode call control, Call control protocol, DLCI, Bearer capability, Link layer core parameters, LAPF. ISDN – Integration of Transmission and Switching, Analog and Digital switching, Principles of ISDN.  **Unit 2:** User interface, Architecture, ISDN standards, I-series recommendations.ISDN interface and Functions – Transmission structure, User network interface, ISDN protocol architecture, ISDN connections, Addressing, Interworking, B-ISDN architecture and standards**.**  **Unit 3:** B-ISDN Services and protocols – Conversational, Messaging, Retrieval, Distribution, Business and Residential requirements. User plane, Control plane, Physical layer, Line coding, Transmission structure, Signal Hierarchy, System Hierarchy.  **Unit 4:** ATM – Overview, Virtual channels, Virtual paths, VP and VC switching, ATM cells, Header format, Generic flow control, Header error control, Transmission of ATM cells, Adaptation layer, AAL services and protocols, ATM service categories, ATM Traffic related Attributes QOS.  **Unit 5:** ATM switching – ATM switching building blocks, ATM cell processing in a switch, Matrix type switch, Input, Output buffering, Central buffering, Performance aspects of buffering switching networks.  ***Course Outcome (CO):***  At the end of this course students will have:  CO1-Ability to understand basic broadband Communication concepts.  CO2- Ability to understand concept of ISDN standards, interface, function, architecture and addressing.  CO3-Ability to understand different high speed networks supporting B-ISDN.  CO4-Ability to understand Broadband Network architecture, data transmission Broadband network design  CO5-Ability to understand the concept ATM switching and processing.  **MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | | |  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | | CO1 | H |  | H | L |  |  |  | M |  |  | L |  |  | L |  | | CO2 | L |  | L | M |  | L |  |  |  | H |  | L | L | H | L | | CO3 | H | M |  |  | L |  | L |  |  |  | L |  |  |  | M | | CO4 | L |  | L | H | H |  |  |  |  |  |  |  | H |  |  | | CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |   H = Highly Related; M = Medium L = Low  **Text books:**   1. ISDN and Broadband ISDN with Frame Relay and ATM, William Satllings –PHI   **Reference books:**   1. Broadband Communications, Balajikumar, Mac-Graw Hill 2. Broadband Bible - Wiley India Publication   JECRC UNIVERSITY  **Faculty of Engineering & Technology Hours:48**  **B.Tech in Electronics and Communication Engineering Semester VII**  **Contact Hours (L-T-P): 3-1-0**  **Image and Video Processing(BEE059A)** |  |
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**Course Objectives:**

1. *To introduce students to both the fundamentals and emerging techniques in image and video processing.*
2. *Concepts and applications in image and video processing; introduction to multidimensional signal processing: sampling, Fourier transform, filtering, interpolation, and decimation; human visual perception; scanning and display of images and video; image enhancement, restoration and segmentation; digital image and video compression; image analysis.*

**Unit 1:**Digital Image Fundamentals-Elements of visual perception, image sensing andacquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures.

**Unit 2:**Image Enhancements and Filtering-Gray level transformations, histogramequalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

**Unit 3:**Color Image Processing-Color models–RGB, YUV, HSI; Color transformations– formulation, colr complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.mage Segmentation- Detection of discontinuities, edge linking and boundarydetection, thresholding – global and adaptive, region-based segmentation.

**Unit 4:**Wavelets and Multi-resolution image processing- Uncertainty principles of FourierTransform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Subband filter banks, wavelet packets.Image Compression-Redundancy–inter-pixel and psycho-visual; Losslesscompression – predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

**Unit 5:**Fundamentals of Video Coding- Inter-frame redundancy, motion estimationtechniques – full-search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks andblocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X. Video Segmentation- Temporal segmentation–shot boundary detection, hard-cutsand soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.

***Course Outcome (CO):***

At the end of this course students will have:

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| --- |
| CO1-Ability to understand Digital Image Fundamentals |
| CO2- Ability to understand Gray Images, Enhancements and Filtering for Images and DCT. |
| CO3-Ability to understand & Color Image Processing. |
| CO4-Ability to understand Wavelets and Multi-resolution image processing MRA. |
| CO5-Ability to understand Fundamentals of Video Coding. |

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  |  |  | H |  |  | H |  | H |  | H |  | L |  |
| CO2 |  | H | H | M | L | M |  |  | M |  |  |  | L | H | L |
| CO3 | H | M |  |  |  |  | M | M | H | M | M |  |  |  | H |
| CO4 |  |  | L |  | M |  |  |  |  |  |  | L | H |  |  |
| CO5 | H | H |  |  |  | H | M |  | L |  |  | H |  |  | L |

H = Highly Related; M = Medium L = Low

**Textbook:**

1. “Digital Image Processing”, by R.C.Gonzalez and R.E. Woods, Second Edition, Pearson Education.

**Reference books**

1. “Fundamentals of Digital Image Processing”, by Anil Kumar Jain. Prentice Hall of India.
2. “Video Processing” by Murat Tekalp.

JECRC University

**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 3-1-0**

**Artificial Neural Networks(BEE060A)**

**Course Objective:**

1. *The objective of the course is to study basics of biological Neural Network and artificial Neural Network.*
2. *The students will learn about the applications of ANN and different pattern recognition tasks using ANN.*

**Unit I :** Fundamentals: Introduction & Motivation, Biological Neural Networks and simple models, The Artificial Neuron Model; Hopfield Nets; Energy Functions and Optimization; Neural Network Learning Rules:Hebbian Learning Rule, Perceptron Learning Rule, Delta Learning Rule Widrow-Hoff Rule, Correlation Learning Rule, Winner –Take-All Learning rule, Out Star Learning Rule, summary of Learning rules.

**Unit II :** Single layer perceptron classifiers: Classification model, features and decision regions, discriminant functions, linear machine and minimum distance classification, nonparametric training concept training and classification using the discrete perceptron: algorithm and example, single layer continuous perceptron network for linearly separable classifications, multicategory

**Unit III :**Multilayer feed forward networks: Linearly nonseparable pattern classification delta learning rule for multiperceptron layer. Generalized Delta Learning rule. Feed forward Recall and Error Back Propagation Training; Examples of Error Back-Propagation. Training errors: Learning Factors; Initial weights, Cumulative Weight Adjustment versus Incremental Updating, steepness of activation function, learning constant, momentum method, network architecture Versus Data Representation, Necessary number of Hidden Neurons. application of Back propagation Networks in pattern recognition & Image processing, Madaunes: Architecture & Algorithms.

**Unit IV:**Single Layer Feedback Network: Basic concepts of dynamical systems, mathematical foundation of discrete-time hop field networks, mathematical foundation of Gradient-Type Hopfield networks, transient response of continuous time networks. example solution of optimization problems: summing networks with digital outputs, minimization of the traveling salesman tour length, solving simultaneous linear equations.

**Unit V :**Associative Memories I: Basic concepts, linear associator basic concepts of recurrent auto associative memory, retrieval algorithm, storage algorithm, storage algorithms performance considerations, performance concepts of recurrent auto associative memory, energy function reduction capacity of recurrent auto associative memory, memory convergence versus corruption, fixed point concept, modified memory convergence towards fixed points, advantages and limitations.

***Course Outcome (CO):***

At the end of this course students will have:

CO1-Ability to understand the fundamental and types of neural network models and various learning algorithms.

CO2- Ability to understand the layered models, their classification, algorithms and their application.

CO3-Ability to understand the feed forward and back propagation networks, their architecture and algorithms, application in speech recognition and image processing.

CO4-Ability to understand the cocept of single layer feedback networks and application in solving various optimization problems

CO5-Ability to understand the concept associative memories and their various algorithms.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L | M |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  | L |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text books:**

1. Introduction to Artificial Neural Systems, J.M.Zurada: Jaico Publishers

**Reference books:**

1. Artificial Neural Networks, Dr. B. Yagananarayana, PHI, New Delhi.

1. Elements of Artificial Neural Networks, Kishan Mehrotra, Chelkuri K. Mohan, Sanjay Ranka: Penram International
2. Introduction Neural Networks Using MATLAB 6.0 - by S.N. Shivanandam, S. Sumati, S. N. Deepa,1/e, TMH, New Delhi.
3. Fundamental of Neural Networks – By Laurene Faus

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| JECRC UNIVERSITY  **Faculty of Engineering & Technology Hours:48**  **B.Tech in Electronics and Communication Engineering Semester VII**  **Contact Hours (L-T-P): 3-1-0**  **Mixed Signal Design(BEE061A)** |  |
|  |  |

**Course Objective:**

*The objective of the course is make students learn to design core mixed-signal IC blocks: comparators and data converters, filters and their usage. The course will also take into account frequency synthesizers and usage to various tools for the complete IC design process.*

**Unit 1:**Analog and discrete-time signal processing, introduction to sampling theory;Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

**Unit 2:**Switched-capacitor filters, Non-idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

**Unit 3:**Basics of data converters; Successive approximation ADCs, Dual slope ADCs,Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

**Unit 4:**Mixed-signal layout, Interconnects and data transmission; Voltage-mode signalingand data transmission; Current-mode signaling and data transmission.

**Unit 5:**Introduction to frequency synthesizers and synchronization; Basics of PLL,Analog PLLs; Digital PLLs; DLLs.

***Course Outcome (CO):***

At the end of this course students will have:

CO1-Design noise–shaping data converters given a set of requirements such as bandwidth, clock speed, and signal–to–noise ratio.

CO2- Design, simulate, and implement the digital interpolation and decimation filters used in noise–shaping data converters.

CO3-Design, simulate, and implement the analog filters used for anti–aliasing and reconstruction in a data conversion system.

CO4-Discuss the limitations of op–amps and comparators used in noise–shaping data converters

CO5-Simulate noise–shaping data converting circuits and systems and the filtering used.

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 | L |  | L |  | H |  |  |  | L |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  | L |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text books:**

1. Behzad, Razavi: Design of Analog CMOS Integrated Circuits, MGH, 2001.
2. R. Jacob Baker: CMOS: Mixed Signal Circuit design, 2nd Edition, Wiley

**Reference books:**

1. Allen Holberg: CMOS Analog Integrated Circuit Design, Oxford University Press, 2002.
2. P. R. Gray, Hurst, Lewis and R. G. Meyer. Analysis and Design of Analog Integrated Circuits. John Wiley, 4th Ed. 2001.
3. A. B. Grebene, Bipolar and MOS analog integrated circuits design. John Wiley, 1984.

JECRC University

**Faculty of Engineering & Technology Hours: 48**

**B.Tech in Electronics and Communication Engineering Semester VII**

**Contact Hours (L-T-P): 3-1-0**

**DSP Processors and Applications(BEE062A)**

**Course Objective:**

*The main aim of the course is to make students learn the concepts and usage of DSP. The student would learn architecture of a Real time Signal Processing Platform; different errors introduced during A-D and D-A converter stage, Digital Signal Processor Architecture, ADSP family, FIR/IIR filtering andfixed point and Floating point implementations.*

**Unit 1:**Introduction: Architecture overview, Fixed and Floating point digital signal processors. TMS320C54X Architecture and Assembly language instructions :

Introduction, Bus structure, CALU, ARAU, index register, ARCR, BMAR, Block repeat registers, Parallel Logic Unit (PLU), Memory mapped registers, Program controller, On chip memory & peripherals, Addressing modes & instructions.

**Unit 2:**ADSP family **:**Analog 21061 series sharc block diagram, Interrupt Hardware, memory quantization,central arithmetic logic unit, system control , memory addressing modes, instruction set,Software applications – Process initialization , interrupts etc.

**Unit 3:**An overview of TMS320C6X DSPs **:** Introduction, TMS320C6X architecture, functional units, Fetch & Execute packets, pipelining, registers,addressing modes, instruction set, assembly directives, timers, interrupts, Memory considerations, code improvement, constraints.

**Unit 4:** DSP Application I: FIR/IIR filtering; Fixed point and Floating point implementation using TMS320C54XFast Fourier Transform ; Fixed point and Floating point implementation using TMS320C54X.

**Unit 5:**DSP Applications II: FIR/IIR filtering, Adaptive filtering, FFT Analysis, SpectralAnalysis etc. Implementation using TMS320C62X / TMS320C67x.

***Course Outcome (CO):***

At the end of this course students will have:

CO1-Recognize the fundamentals of fixed and floating point architectures of various DSPs.

CO2- Learn the architecture details  and instruction sets of fixed and floating point DSP

CO3- Infer about the control instructions, interrupts, and pipeline operations.

CO4-Analyze and learn to implement the signal processing algorithms in DSPs

CO5- Learn the DSP programming tools and use them for applications & design and implement signal processing modules in DSPs

**MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

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| ***Course Outcome*** | Program Outcome | | | | | | | | | | | | Program Specific Outcome | | |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | H |  | H |  | L |  |  | M |  |  | L |  |  | L |  |
| CO2 | L |  | L | L | M | L |  |  |  | H |  | L | L | H | L |
| CO3 | H | M |  |  |  |  | L |  |  |  | L |  |  |  | M |
| CO4 |  |  | L |  | H |  |  |  |  |  |  |  | H |  |  |
| CO5 | H | M |  |  |  |  | L |  |  |  |  |  |  |  | M |

H = Highly Related; M = Medium L = Low

**Text books:**

1. Programming with DSP processors – Texas Instruments.
2. Digital Signal Processors Architectures, Implementations & Applications – Sen Kuo, Woon-Seng S. Gen . Pearson Publicatios.

**Reference books:**

1. Digital Signal Processors – Venkataramani / Bhaskar.
2. Digital Signal Processing and applications with C6713 and C6416 DSK by Rulph Chassaing. A JOHN WILEY & SONS, INC., PUBLICATION
3. DSP Processor fundamentals Architectures and Features by Phil Lapsley, Jeff Bier, Amit Shoham. Wiley India