GALGOTIAS UNIVERSITY

# Syllabus of

# Electronics and Communication Engineering(B.Tech)

Name of School: **School of Electrical, Electronic and Communication Engineering**

Department: **Electronic and Communication Engineering**

Year: **2018-22**

## Curriculum Structure of B.Tech in Electronics and Communication Engineering, 2018-22

| Semester 1 | | | | | | |
|---|---|---|---|---|---|---|
| **Sl. No.** | **Course Code** | **Course Title** | **L** | **T** | **P** | **C** |
| 1 | BTEE1001 | Introduction to Electrical Engineering | 0 | 0 | 2 | 1 |
| 2 | BCSE1002 | Computer Programming and Problem Solving | 0 | 0 | 4 | 2 |
| 3 | MATH1005 | Multivariable Calculus | 3 | 0 | 0 | 3 |
| 4 | MATH1007 | Exploration with CAS-I | 0 | 0 | 2 | 1 |
| 5 | SLBT1011 | English Proficiency and Aptitude Building-1 | 0 | 0 | 4 | 2 |
| 6 | BTME1003 | Product Manufacturing | 0 | 0 | 2 | 1 |
| 7 | PSSO1001 | Psychology and Sociology | 2 | 0 | 0 | 2 |
| 8 | ENVS1001 | Environmental Science | 3 | 0 | 0 | 3 |
| 9 | BEEE1002 | Basic Electrical and Electronics Engineering | 3 | 0 | 0 | 3 |
| 10 | BEEE1003 | Basic Electrical and Electronics Engineering Lab | 0 | 0 | 2 | 1 |
| 11 | JAPA1001 | Japanese-I | | | | |
| | FREN1001 | French-I | | | | |
| | GERN1001 | German-I | 0 | 0 | 2 | 1 |
| | | TOTAL | | | | 22 |

## Semester 2

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | BCSE1003 | Aplication Oriented Programming using Python | 0 | 0 | 4 | 2 |
| 2 | SLBT1012 | English Proficiency and Aptitude Building-2 | 0 | 0 | 4 | 2 |
| 3 | MATH1006 | Linear Algebra and Differential Equations | 3 | 0 | 0 | 3 |
| 4 | MATH1008 | Exploration with CAS-II | 0 | 0 | 2 | 1 |
| 5 | PHYS1001 | Engineering Physics | 3 | 0 | 0 | 3 |
| 6 | PHYS1002 | Engineering Physics Lab | 0 | 0 | 2 | 1 |
| 7 | BTME1002 | Product Design using Graphics | 0 | 0 | 4 | 2 |
| 8 | CHEM1001 | Engineering Chemistry | 3 | 0 | 0 | 3 |
| 9 | CHEM1002 | Engineering Chemistry Lab | 0 | 0 | 2 | 1 |
| 10 | UHVE1001 | Universal Human Values and Ethics | 0 | 0 | 4 | 2 |
| | JAPA1002 | Japanese-II | | | | |
| | FREN1002 | French-II | | | | |
| 11 | GERN1002 | German-II | 0 | 0 | 2 | 1 |
| | | TOTAL | | | | 21 |

## Semester 3

| Sl. No. | Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | BECE2015 | Electronic Devices and Circuits | 3 | 0 | 0 | 3 |
| 2 | MATH2002 | Numerical Methods | 3 | 0 | 0 | 3 |
| 3 | BECE2001 | ECE project based Learning-I | 0 | 0 | 2 | 1 |
| 4 | BECE2018 | Electronics Design and PCB Lab | 0 | 0 | 2 | 1 |
| 5 | BTEE2002 | Network Analysis and Synthesis | 3 | 0 | 0 | 3 |
| 6 | BECE2016 | Signals and Systems | 3 | 0 | 0 | 3 |
| 7 | BECE2010 | Digital Electronics | 3 | 0 | 0 | 3 |
| 8 | BECE2011 | Digital Electronics Lab | 0 | 0 | 2 | 1 |
| **9** | SLBT2021 | English Proficiency and Aptitude Building - 2 | 0 | 0 | 4 | 2 |
| 10 | BECE9001 | Objected Oriented Programming (Added) | 0 | 0 | 2 | 1 |
| | | | | | | |
| | | **TOTAL** | | | | |

**Semester 4**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | MATH2004 | Probability and Stochastic Processes | 3 | 0 | 0 | 3 |
| 2 | BECE9003 | DATA STRUCTURE | 0 | 0 | 2 | 1 |
| 3 | BECE2008 | Integrated Circuits | 3 | 0 | 0 | 3 |
| 4 | BECE2009 | Integrated Circuits Lab | 0 | 0 | 2 | 1 |
| 5 | BEEE3002 | Control System | 3 | 0 | 0 | 3 |
| 6 | BECE2012 | Electromagnetic Field Theory | 3 | 0 | 0 | 3 |
| 7 | BECE2004 | Analog Communication | 3 | 0 | 0 | 3 |
| 8 | BEEE9001 | DISRUPTIVE TECHNOLOGY | 3 | 0 | 0 | 3 |
| 9 | SLBT2002 | English Proficiency and Aptitude Building - 3 | 0 | 0 | 4 | 2 |
| 10 | BECE2020 | Digital Signal Processing | 3 | 0 | 0 | 3 |
| 11 | BCSE9006 | AI ANDML USING PYTHON | 0 | 0 | 2 | 1 |
| 12 | BECE4501 | INTRODUCTION TO IOT AND ITS APPLICATIONS | 3 | 0 | 0 | 3 |
| | | **TOTAL** | | | | |

**Semester 5**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | UE3 | Humanities Course (from basket) | 3 | 0 | 0 | 3 |
| 2 | | Program Elective-I (from basket) - 1 | 3 | 0 | 0 | 3 |
| 3 | BECE3020 | Digital Communication | 3 | 0 | 0 | 3 |
| 4 | BECE3021 | Digital Communication Lab | 0 | 0 | 2 | 1 |
| 5 | BECE3017 | Microprocessors and Its Applications | 3 | 0 | 0 | 3 |
| 6 | BECE3018 | Microprocessors Lab | 0 | 0 | 2 | 1 |
| 7 | BECE3006 | Microwave Engineering | 3 | 0 | 0 | 3 |
| 8 | BECE3007 | Microwave Engineering Lab | 0 | 0 | 2 | 1 |
| 9 | BECE3008 | ECE Project Based Learning-III | 0 | 0 | 2 | 1 |
| 10 | SLBT3001 | English Proficiency and Aptitude Building - 4 | 0 | 0 | 4 | 2 |
| 11 | ****** | Database Management System (Added) | 0 | 0 | 2 | 1 |
| | | **TOTAL** | | | | 22 |

**Semester 6**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | SLBT3002 | Campus to Corporate | 0 | 0 | 4 | 2 |
| 2 | | Program Elective (from basket) - 2 | 3 | 0 | 0 | 3 |
| 3 | | Program Elective (from basket) - 3 | 3 | 0 | 0 | 3 |
| 4 | BECE3011 | ECE Project Based Learning-IV | 0 | 0 | 2 | 1 |
| 5 | BECE3012 | Wireless and Mobile Communication | 3 | 0 | 0 | 3 |
| 6 | BECE3013 | VLSI Design | 3 | 0 | 0 | 3 |
| 7 | BECE3014 | VLSI Design Lab | 0 | 0 | 2 | 1 |
| 8 | BECE3015 | Antenna and Wave Propagation | 3 | 0 | 0 | 3 |
| 9 | BECE3019 | Embedded Systems | 3 | 0 | 0 | 3 |
| | | **TOTAL** | | | | 22 |

**Semester 7**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | BECE9998 | Capstone Design - I | 0 | 0 | 6 | 3 |
| 2 | BECE4002 | ECE Seminar | 0 | 0 | 2 | 1 |
| | BECE4003 | Embedded System Lab | 0 | 0 | 2 | 1 |
| 3 | | Program Elective (from basket) - 4 | 3 | 0 | 0 | 3 |
| 4 | | Program Elective (from basket) - 5 | 3 | 0 | 0 | 3 |
| 5 | UE1 | Management Course (from basket) | 3 | 0 | 0 | 3 |
| 6 | UC23 | Management Course (from basket) | 3 | 0 | 0 | 3 |
| | | **TOTAL** | | | | 17 |

**Semester 8**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | BECE9999 | Capstone Design - II | 0 | 0 | 18 | 9 |
| | | | | | | |
| | | **TOTAL** | | | | 9 |

| Course Code | BEEE1002 | Course Name | Basic Electrical and Electronics Engineering |
|---|---|---|---|

**Course Objectives**

1. To develop solid foundation for further study of electrical and electronics courses
2. To develop the analytical skills for solving the electrical and electronics circuits
3. To learn the utility of basic electronics devices and circuits
4. To understand the basic principles of electrical machines

**Prerequisites:** Basic Number System, Basic Electronics, Mathematics

**Course Outcomes**

| | |
|---|---|
| CO1 | Summarize the basic network theorems and laws, Boolean algebra, BJT characteristics, principle of different types of electrical machines |
| CO2 | Solve and analyze transient and steady state of AC and DC network, phasors, representation and conversion of data, Synthesis of logic circuits, BJT and diode biasing, wave shaping circuits and operation of the machines |
| CO3 | Apply the AC and DC theorems and laws in networks circuits, Boolean algebra, BJT characteristics, operation of the machines |
| CO4 | Demonstrate AC and DC network circuits using network theorems and laws, Boolean logic circuits, BJT biasing and its characteristics, connections and testing of the machines |
| CO5 | Understand transformer and motor basic characteristic and working |

**Text Book :**


1. D. P. Kothari and I. J. Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill, 20016.

1. V. Mittle and Arvind Mittle, "Basic Electrical Engineering", McGraw Hill, 2005.

2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 9th Edition, Pearson Education, 2007.

3. A. P. Malvino and Donald Leach, "Digital Principles and Applications", 6th Edition, Tata McGraw Hill, 2006.


**Reference Books**


1. D. C. Kulshreshtha,"Basic Electrical Engineering", Tata McGraw Hill, 2009.
2. J. Edminister and M. Nahvi , "Electric Circuits", 3rd Edition, Tata McGraw-Hill, New Delhi, 2002.
3. Jacob Millman, Christos C. Halkias, Satyabrata Jit, "Electronics Devices and Circuits", 3rd Edition, Tata McGraw Hill, 2008

## Syllabus

### Unit I: Elementary Circuit Analysis

Ohm's law, KCL, KVL, node voltage analysis, mesh current, circuits with independent sources, Thevenin's & Norton's equivalent, maximum power transfer and superposition theorem.

### Unit II: Analysis of DC and AC Circuits

RL and RC transients in circuits with DC source, RMS values, the use of phasors for constant frequency sinusoidal sources, steady state AC analysis of a series circuit, parallel circuits, AC power calculations.

### Unit III: Digital Systems

Basic logic circuit concepts, Basic Gates and Universal Gates, representation of numerical data in binary form – Binary to decimal, Octal, Hexadecimal, Boolean algebra, combinational logic circuits- Half adder, full adder, synthesis of logic circuits, minimization of logic circuits.

### Unit IV: Semiconductor Devices

Basic diode concepts, ideal diode model, rectifier and wave-shaping circuits, zener diode voltage regulator concepts, bipolar junction transistors, current and voltage relationship, common emitter characteristics.

### Unit V: Electro-mechanics

Transformers-Ideal and real transformers, Construction, Principle of operation of transformer, E.M.F Equation, Phasor diagram of transformer, Losses, efficiency. D.C Machines-Construction, principles of rotating DC machines, Types of Excitations-separately excited and self excited (shunt, series and compound) DC machines. Three phase induction motors-Construction, Principle of operation, synchronous speed, slip, and frequency of rotor emf. Synchronous Machines-construction, principle of operation of synchronous motor and applications.

| Course Code | BECE2016 | Course Name | Signals and Systems |
|---|---|---|---|

**Course Objectives**

This subject is about the mathematical representation of signals and systems. The most important representations we introduce involve the *frequency domain* – a different way of looking at signals and systems, and a complement to the time-domain viewpoint. Indeed engineers and scientists often think of signals in terms of frequency content, and systems in terms of their effect on the frequency content of the input signal. Some of the associated mathematical concepts and manipulations involved are challenging, but the mathematics leads to a new way of looking at the world.

**Prerequisites:** Engineering Mathematics

**Course Outcomes**

| | |
|---|---|
| CO1 | Understand about various types of signals, classify them, analyze them, and perform various operations on them. |
| CO2 | Understand about various types of systems, classify them, analyze them and understand their response behaviour |
| CO3 | Appreciate use of transforms in analysis of signals and system. |
| CO4 | Carry simulation on signals and systems for observing effects of applying various properties and operations. |
| CO5 | Create strong foundation of communication and signal processing to be studied in the subsequent semester |

**Text Book:**

1. P. Ramakrishna Rao, `Signal and Systems' 2008 Ed., Tata McGraw Hill, New Delhi, ISBN 1259083349, 9781259083341

**Reference Books**

Signals and Systems by Oppenheim & Wilsky

**Syllabus**

**Unit I: Introduction to Signals**

Definition, types of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/ random, one dimensional/ multidimensional; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their inter-relationships),exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables)

**Unit II: Laplace-Transform (LT) and Z-transform (ZT)**

One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC), One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping

**Unit III: Fourier Transforms (FT):**

Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT, Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT.

**Unit IV :Introduction to Systems**

Classification, linearity, time-invariance and causality, impulse response, characterization of linear time-invariant (LTI) systems, unit sample response, convolution summation, step response of discrete time systems, stability, convolution integral, co-relations, signal energy and energy spectral density, signal power and power spectral density, properties of power spectral density.

**Unit V: Time and frequency domain analysis of systems**

Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter.

| Course Code | BECE2002 | Course Name | Network Analysis and Synthesis |
|---|---|---|---|

**Course Objectives**

1. To learn the concepts of network analysis in electrical and electronics engineering.
2. To learn linear circuit analysis, graph theory and network theorems.
3. Analyze two port networks using Z, Y, ABCD and h parameters

**Course Outcomes**

| | |
|---|---|
| CO1 | Analyze an electric network using graph theory |
| CO2 | Solve the electric networks using different network theorems e.g. Thevenin's theorem, superposition theorem and maximum power transfer theorem etc |
| CO3 | Synthesize an electric network using driving point and transfer functions |
| CO4 | Analyze LTI systems using two ports networks |
| CO5 | Design active and passive filter circuits |

**Text Books**

1. M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India
2. A C.L Wadhwa, "Network Analysis and Synthesis" New Age International Publishers, 2007,
3. D.RoyChoudhary, "Networks and Systems" Wiley Eastern Ltd.

**Reference Books**

1. M.E. Van Valkenburg, "An Introduction to Modern Network Synthesis",Wiley Eastern Ltd.
2. A.Chakrabarti, "Circuit Theory" DhanpatRai& Co

**Unit I: Graph Theory**

Loop and Nodal methods of analysis, Graph of a Network, definitions, tree, co tree , link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix Duality.

**Unit II: Network Theorems (Applications to ac networks)**

Super-position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's theorem.

**Unit III: Network Functions and Transient analysis**

Transform Impedances Network functions of one port and two port networks, concept of poles and zeros, properties of driving point and transfer functions, time response and stability from pole zero plot, transient analysis of ac & dc systems.

**Unit IV : Two Port Networks**

Characterization of LTI two port networks ZY, ABCD and h parameters, reciprocity and symmetry. Inter-relationships between the parameters, inter-connections of two port networks, T & Π Representation.

**Unit V: Network Synthesis & Filters**

Positive real function; definition and properties; properties of LC, RC and RL driving point functions, synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms. Image parameters and characteristics impedance, passive and active filter fundamentals, low pass, high pass, (constant K type) filters, and introduction to active filters.

| Course Code | BECE2004 | Course Name | Analog Communication |
|---|---|---|---|

**Course Objectives**

1. Concepts of communication engineering.
2. Different analog modulation techniques used.
3. Effects of noise and interference.
4. Systematic comparison of various modulation techniques.

**Prerequisites:** Principle of Basic Electric Circuit

**Course Outcomes**

| | |
|---|---|
| CO1 | Understand the basics of communication system and analog modulation techniques |
| CO2 | Apply the basic knowledge of signals and systems and understand the concept of Frequency modulation. |
| CO3 | Apply the basic knowledge of electronic circuits and understand the effect of Noise in communication system and noise performance of AM system |
| CO4 | Interpret the effect of noise performance of FM system |
| CO5 | Realize TDM and Pulse Modulation techniques |

**Text Book:**


1. Simon Haykin, “Communication Systems”, 4th edition, John Wiley & Sons, 2006, ISBN 812650904X, 9788126509041.
2. J. Proakis & M. Salehi, “Communication system engineering”, 2nd edition, Prentice Hall, 2002, ISBN 0130617938, 9780130617934
3. Simon Haykin, “Digital Communication”, 3rd Edition, John Wiley and Sons, 2008, ISBN 8126513667, 9788126513666.
4. Bernard Sklar, "Digital Communication”, Pearson Education India 2009, ISBN 8131720926, 9788131720929


**Syllabus**

**Unit I: Basics of Communication Theory**

Need and Importance of Communication, Elements of Communication System, Generalized block diagram of communication system, Types of communication systems- Simplex and Duplex systems, Analog and digital systems, Applications of Electronic Communications, Electromagnetic Spectrum used in communication and various frequency bands, Concept of bandwidth. Noise in communication and types of noise (External and Internal), Noise voltage, Signal-to-noise ratio, Noise Figure, Noise temperature.

**Unit II: Amplitude Modulation**

Concept of modulation and demodulation, baseband and pass band signals. Amplitude Modulation (AM)-generation & demodulation, Modified forms of AM- Double sideband suppressed carrier (DSBSC), single sideband suppressed carrier (SSBSC) and Vestigial sideband (VSB) modulation, Mixers, Frequency Division Multiplexing.

**Unit III: Angle Modulation**

Phase modulation (PM) and Frequency modulation (FM), narrow and wideband FM, Generation & demodulation, phase locked loop (PLL), homodyne and heterodyne receivers, elements of TV broadcast and reception.

**Unit IV : Noise in CW modulation**

Receiver model, signal to noise ratio (SNR), noise figure, noise temperature, noise in DSB-SC, SSB, AM & FM receivers, pre-emphasis and de-emphasis.

**Unit V: Pulse Modulation**

Sampling Process, Basics of Pulse modulation, Types of Pulse Modulation – PAM, PWM and PPM.

| Course Code | BECE2010 | Course Name | Digital Electronics |
|---|---|---|---|

**Course Objectives**

1. Understanding the numbering systems and their transformations used in computerized system
2. Simplification of logic expressions and realize to design combinational and sequential digital circuits
3. Analyzing the operation and design constraints of CMOS and TTL circuit for logic fabrication.
4. To gain an in-depth understanding of VHDL and to realize different circuits using it both sequential and combinational
5. To learn the concept of memories and how they are designed using VHDL

**Prerequisites:** Number system

**Course Outcomes**

| | |
|---|---|
| CO1 | Smooth understanding on digital circuits with inputs/outputs |
| CO2 | Understand the logic circuits, minimize and design the circuits through K-map reduction |
| CO3 | Design a combinational logic circuits like: adder, substractor, multiplexer and demultiplexers |
| CO4 | Design digital register with using different types of flip flops |
| CO5 | Design a circuit of combinational/sequential VHDL platform |

**TEXT BOOKS**

1. Mano, Morris. "Digital logic." *Computer Design. Englewood Cliffs Prentice-Hall* (1979).
2. Kumar, A. Anand. *Fundamentals Of Digital Circuits 2Nd Ed*. PHI Learning Pvt. Ltd., 2009.
3. Taub, Herbert, and Donald L. Schilling. *Digital integrated electronics*. New York: McGraw-Hill, 1977.
4. Stephen Brown and Zvonko Vranesic," Fundamentals of Digital Logic with VHDL Design" , Mc-Graw-Hill (2nd edition).*ISBN*-10: 0077211642

**REFERENCE BOOKS**

1. Floyd, Thomas L. *Digital Fundamentals, 10/e*. Pearson Education India, 1986.
2. Malvino, Albert Paul, and Donald P. Leach. *Digital principles and applications*. McGraw-Hill, Inc., 1986.
3. Jain, Rajendra Prasad. *Modern Digital Electronics 3e*. Tata McGraw-Hill Education, 2003.

**Syllabus**

**Unit I: Number System & Boolean Algebra**

Review of number system; types and conversion, codes. Boolean algebra: De-Morgan's theorem, switching functions, Prime Implicants and Essential Prime Implicants definition and simplification using K-maps upto 5 variables & Quine McCluskey method.

**Unit II: Combinational Circuits**

Introduction to Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR and their combinations. Design of adder, subtractors, comparators, code converters, encoders, decoders, multiplexers and de-multiplexers, Function realization using gates & multiplexers.

**Unit III: Synchronous Sequential Ciruits**

Introduction to Latches and Flip flops - SR, D, JK and T. Design of synchronous sequential circuits – Counters, shift registers. Finite State Machine Design, Mealy, Moore Machines, Analysis of synchronous sequential circuits;, state diagram; state reduction; state assignment with examples.

**Unit IV: Introduction VHDL**

INTRODUCTION to Hardware Description Languages (HDL) and HDL based design, VHDL- Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, VHDL model for a counter.

**Unit V: VHDL Synthesis and Models**

Attributes, Transport and Inertial delays, Operator overloading, Multivalued logic and signal resolution, IEEE-1164 standard logic, Generics, Generate statements, Synthesis of VHDL code, Synthesis examples, Files and TEXTIO.

| Course Code | BECE2008 | Course Name | Integrated Circuits |
|---|---|---|---|

**Course Objectives**

- To introduce the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To introduce the theory and applications of analog multipliers and PLL
- To learn the theory of ADC and DAC
- To introduce the concepts of waveform generation and introduce some special function ICs

**Course Outcomes**

| | |
|---|---|
| CO1 | Illustrate the AC, DC characteristics and compensation techniques of Operational Amplifier |
| CO2 | Realize the applications of Operational Amplifiers |
| CO3 | Clarify and Analyze the working of Analog Multipliers and PLL |
| CO4 | Classify and realize the working principle of various converter circuits using Op-Amps |
| CO5 | Demonstrate the function of various signal generators and Waveform Shaping Circuits |

**Text Books:**

1. Sergio Franco, " Design with operational amplifiers and analog integrated circuits ", McGraw Hill, 2002, ISBN 0070530440, 9780070530447
2. Ramakant A. Gayakwad, " OP - AMP and Linear IC's ", 4th Edition, Prentice Hall, 2000, ISBN 0132808684, 9780132808682

**Reference Books:**

1. Botkar K.R., " Integrated Circuits ", Khanna Publishers, 1996.
2. Taub and Schilling, " Digital Integrated Electronics ", Tata McGraw-Hill Education, 2004, ISBN 0070265089, 9780070265080
3. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001, ISBN 0074622455, 9780074622452Syllabus

**Syllabus**

Unit-1

Analysis of difference amplifiers, Monolithic IC operational amplifiers, specifications, frequency response of op-amp,, slew rate and methods of improving slew rate, Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers.

Unit-2

Differentiator, Integrator, Voltage to Current convertor, Low pass, high pass, band pass filters, comparator, Multi-vibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear function generator, Sine wave Oscillators.

Unit-3

Analysis of four quadrant and variable trans-conductance multipliers, Voltage controlled Oscillator, Closed loop analysis of PLL, Frequency synthesizers, Compander ICs.

Unit-4

Analog switches, High speed sample and hold circuits and sample and hold IC's, Types of D/A converter- Current driven DAC, Switches for DAC, A/D converter, Flash, Single slope, Dual slope, Successive approximation, Voltage to Time and Voltage to frequency converters.

Unit-5

Wave shaping circuits, Multivibrator- Monostable & Bistable, Schmitt Trigger circuits, IC 555 Timer, Application of IC 555, Switched capacitor filter, Frequency to Voltage converters.

| Course Code | BEEE3002 | Course Name | Control Systems |
|---|---|---|---|

## Course Objectives

Study of Open loop & closed control; servomechanism, Transfer functions, Block diagram algebra, Signal flow graph, time response of first and second order systems, time response specifications, dynamics of linear systems, and frequency domain analysis and design techniques. Constructional and working concept of ac servomotor, synchronous and stepper motor, their characteristics, performance. The Routh-Hurwitz, root-locus, Bode, and Nyquist techniques. Design and compensation of feedback control systems. Diagonalization, Controllability and observability and their testing.

**Prerequisites:** Engineering Mathematics

## Course Outcomes

| | |
|---|---|
| CO1 | Summarize different control system and solve transfer function, block diagram and signal flow diagram reduction of control system. |
| CO2 | Design and solve control system engineering problems in time response of first and second order systems.Analyze concept of ac servomotor, synchronous and stepper motor and and understand Stability and Algebraic Criteria concept of stability and necessary conditions |
| CO3 | Applying concept of ac servomotor, synchronous and stepper motor and understand Stability and Algebraic Criteria concept of stability and necessary conditions |
| CO4 | Demonstrate & analyse frequency response analysis for stability by polar and inverse polar plots, Bode plots, Nyquist stability criterion, gain margin and phase margin |
| CO5 | Realize the design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain, diagonalization, Controllability and observability and their testing |

## Text and Reference Books


1. Nagrath&Gopal, “Control System Engineering”, 4th Edition, New age International.
2. 2. K. Ogata, “Modern Control Engineering”, Prentice Hall of India.
3. 3. B.C. Kuo & FaridGolnaraghi, “Automatic Control System” Wiley IndiaLtd, 2008.
4. N.C. Jagan, “Control Systems”, B.S. Publications,2007. K. Ogata, “Modern Control Engineering”, Prentice Hall of India.
5. D.RoyChoudhary, “Modern Control Engineering”, Prentice Hall of India.


## Syllabus

### UNIT I

Open loop & closed control system, servomechanism, Physical examples. Transfer functions, Block diagram algebra, and Signal flow graph, Mason’s gain formula Reduction of parameter variation and effects of disturbance by using negative feedback.

**UNIT II**

Standard test signals, time response of first and second order systems, time response specifications, steady state errors and error constants. Design specifications of second order systems: Derivative error, derivative output, integral error and PID compensations, design considerations for higher order systems, performance indices.

**UNIT III**

Routh-Hurwitz criteria and limitations, root locus concepts, construction of root locus. Constructional and working of ac servomotor, synchronous and stepper motor.

**UNIT IV**

Frequency response, correlation between time and frequency responses, polar and inverse polar plots, Bode plots Stability in Frequency Domain: Nyquist stability criterion, assessment of relative stability: gain margin and phase margin, constant M&N circles.

**UNIT V**

The design problem and preliminary considerations lead, lag and lead-lag networks, design of closed loop systems using compensation techniques in time domain and frequency domain**.** Review of state variable technique: Review of state variable technique, conversion of state variable model to transfer function model and vice-versa, diagonalization, Controllability and observability and their testing.

| Course Code | BECE2012 | Course Name | Electromagnetic Field Theory |
|---|---|---|---|

**Course Objectives**

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts

**Course Outcomes**

| | |
|---|---|
| CO1 | Apply coordinate systems and transformation techniques to solve problems on Electromagnetic Field Theory |
| CO2 | Apply the concept of static electric field and solve problems on boundary value problems. |
| CO3 | Analyze the concept of static magnetic field and solve problems using Biot - Savart's Law, Ampere's circuit law, Maxwell's equation. |
| CO4 | Understands magnetic forces, magnetic dipole and magnetic boundary conditions. |
| CO5 | Understands the time-varying Electromagnetic Field and derivation of Maxwell's equations. |

**Reference Books**


1. Principles of Electromagnetics N. O. Sadiku, Oxford University Press Inc
2. Engineering Electromagnetics W H Hayt, J A Buck, McGraw Hill Education
3. Electromagnetic Waves, R.K. Shevgaonkar, Tata McGraw Hill India, 2005
4. Electromagnetics with Applications, Kraus and Fleish, Edition McGraw Hill International Editions, Fifth Edition, 1999Syllabus


**Syllabus**

**UNIT I STATIC ELECTRIC FIELDS**

Introduction to Co-ordinate System – Rectangular –Cylindrical and Spherical Co- ordinate System – Introduction to line, Surface and Volume Integrals – Definition of Curl, Divergence and Gradient – Meaning of Stokes theorem and Divergence theorem Coulomb's Law in Vector Form – Definition of Electric Field Intensity – Principle of Superposition – Electric Field due to discrete charges – Electric field due to continuous charge distribution – Electric Field due to charges distributed uniformly on an infinite and finite line – Electric Field on the axis of a uniformly charged circular disc – Electric Field due to an infinite uniformly charged sheet.Electric Scalar Potential – Relationship between potential and electric field

– Potential due to infinite uniformly charged line – Potential due to electrical dipole – Electric Flux Density – Gauss Law – Proof of Gauss Law – Applications

**UNIT II: STATIC MAGNETIC FIELDS**

The Biot-Savart Law in vector form – Magnetic Field intensity due to a finite and infinite wire carrying a current I –Magnetic field intensity on the axis of a circular and rectangular loop carrying a current I – Ampere's circuital law and simple applications. Magnetic flux density The Lorentz force equation for a moving charge and applications, Force on a wire carrying a current I placed in a magnetic field – Torque on a loop carrying a current I – Magnetic moment – Magnetic Vector Potential.

**UNIT III: ELECTRIC AND MAGNETIC FIELDS IN MATERIALS**

Poisson's and Laplace's equation – Electric Polarization-Nature of dielectric materials- Definition of Capacitance – Capacitance of various geometries using Laplace's equation– Electrostatic energy and energy density – Boundary conditions for electric fields – Electric current – Current density – point form of ohm's law – continuity equation for current.Definition of Inductance – Inductance of loops and solenoids – Definition of mutual inductance – simple examples. Energy density in magnetic fields – Nature of magnetic materials – magnetization and permeability – magnetic boundary conditions.

**UNT IV: TIME VARYING ELECTRIC AND MAGNETIC FIELDS**

Faraday's law – Maxwell's Second Equation in integral form from Faraday's Law – Equation expressed in point form.Displacement current – Ampere's circuital law in integral form – Modified form of Ampere's circuital law as Maxwell's first equation in integral form – Equation expressed in point form. Maxwell's four equations in integral form and differential form.Poynting Vector and the flow of power – Power flow in a co-axial cable – Instantaneous Average and Complex Poynting Vector.

**UNIT V: ELECTRO MAGNETIC WAVES**

Derivation of Wave Equation – Uniform Plane Waves – Maxwell's equation in Phasor form – Wave equation in Phasor form – Plane waves in free space and in a homogenous material.Wave equation for a conducting medium – Plane waves in lossy dielectrics –Propagation in good conductors – Skin effect. Linear, Elliptical and circular polarization – Reflection of Plane Wave from a conductor – normal incidence – Reflection of Plane Waves by a perfect dielectric – normal and oblique incidence. Dependence on Polarization, Brewster angle.

| Course Code | BECE3020 | Course Name | Digital Communication |
|---|---|---|---|

**Course Objectives**

1. Difference between analog and digital communication systems, and compare their respective advantages and disadvantages.
2. Performance limitation, detection and estimation in digital communication system.
3. Waveform coding techniques and the design and use of A/D convertors or D/A convertors.
4. Role of Digital Modulation and Demodulation techniques in different application.
5. Use of spreading of signals and multiple access schemes

**Course Outcomes**

| | |
|---|---|
| CO1 | Define Sampling theorem and explain the various aspects of sampling theorem viz. Aliasing, signal distortion. Explain quadrature sampling of band pass signals |
| CO2 | Identify and explain the techniques used for waveform coding viz. Pulse Amplitude Modulation (PAM) and Pulse Code Modulation. (PCM). |
| CO3 | Identify various types of error introduced in the processes viz. sampling, quantizing, and Describe Inter Symbol Interference(ISI), adaptive equalization techniques |
| CO4 | Describe different digital modulation schemes, and compare advantages/ Disadvantages of each as applied to baseband signal. |
| CO5 | Identify the presence of error bits signal, and calculate unknown phase of noise in the received signal. Describe spread spectrum and pseudo noise sequence |

**Text Books**

1. Simon Haykin, "Digital Communications", Wiley student edition- 1988, ISBN 978-81-265-0824-2

2. Bernard Sklar, "Digital Communication", 2nd Edition, Pearson Education,edition- 2006, ISBN-10: 0130847887.

**Reference Books**

1. John.G. Proakis, "Fundamentals of Communication Systems", Pearson Education, 2006, ISBN 978-81-317-05735

2. Amitabha Bhattacharya, "Digital Communications", Tata McGraw Hill, 2006, ISBN: 978-0-07-059117-2.

3. Herbert Taub& Donald L Schilling – Principles of Communication Systems (3rd Edition) – Tata McGraw Hill, 2008, ISBN 0070648115.

4. Michael. B. Purrsley, "Introduction to Digital Communication", Pearson Education, 2006, ISBN 978-0-07-2957 I6-7,4th edition.

**Syllabus**

**Course Content**

**Unit- I: Communication System & Information Theory**

Introduction to Digital Communication; Basic building blocks of digital communication, GSOP, Mutual information, Information and Channel Capacity, Entropy, Shano- Fano and Huffman's Coding, Overview of Sampling, Quantization – Uniform and Non-uniform (A-law & μ-law). Classification of line codes, characteristics and power spectra of line codes.

**Unit – II: Baseband Transmission**

Baseband data Transmission Systems: Baseband and Bandpass transmission through AWGN channel, Coherent and noncoherent receiver structures, Error Probability, Pulse Shaping, M-ary Signaling Schemes, Matched Filter, Correlation receiver, Equalization, ISI, Eye Pattern analysis.

**Unit – III: Waveform Coding Techniques**

Pulse-Code modulation (PCM), Quantization Noise and Signal-to-noise Ratio, Differential-PCM, Delta Modulation and Adaptive delta-Modulation

**Unit – IV: Modulation Schemes**

Digital Modulation Schemes, ASK, PSK, DPSK, FSK, QPSK, QAM and MSK systems, Probability of Error in Digital Modulation Schemes, Continuous Phase Carrier Modulation, Differential modulation schemes, receiver structure and error performance, Performance comparison of modulation schemes.

**Unit – V**: **Spread Spectrum & Multiple Access Techniques**

Introduction – Generation of PN Sequences – Properties of PN Sequences – Direct Sequence Spread Spectrum – Frequency Hopped Spectrum. Introduction to Multiple Access– TDM/TDMA – FDM/FDMA – CDMA – SDMA - OFDM/OFDMA.

| | | | |
|---|---|---|---|
| Course Code | **BECE3006** | Course Name | Microwave Engineering |

**Course Objectives**

1. Concept of scattering parameters used to characterize devices and system behavior.
2. The high frequency behavior of circuit and network elements as well as the analysis and the design of active and passive microwave devices.

**Prerequisites:** Electromagnetic field theory

**Course Outcomes**

| | |
|---|---|
| CO1 | Illustrate the basic concepts of microwave transmission lines. |
| CO2 | Identify and use microwave guides and components. |
| CO3 | Apply the conceptual knowledge of microwave solid state technology and traveling wave tube techniques |
| CO4 | Distinguish between microwave solid state and technology and traveling wave tube techniques |
| CO5 | Demonstrate and evaluate the microwave measurement techniques. |

**Text Book**

1.D.M.Pozar, “Microwave engineering”, John Wiley, 3/e, 2005
2. Samuel Y.Liao, “Microwave Devices and Circuits”, 3/e, PHI, New Delhi,1987.

**Reference Books**

1. Rober.E.Collin, “Foundations of Microwave Engineering”, John Wiley, 3/e, 2001
2. Annapurna Dasand S,.K.Das, “Microwave Engineering”, Tata Mc Graw-Hill, New Delhi, 2000
3. R.Chatterjee, “Microwave Engineering”, Affiliated East west Press PVT Ltd, 2001
4. O.P.Gandhi, “Microwave Engineering”, Pergamon Press, NY, 1983

**Syllabus**

**Unit – I: Introduction**

Microwave frequency, Applications of Microwave, microwave transmission line, Introduction to Micro strip Transmission line (TL), Coupled TL, Strip TL, Coupled Strip Line, Coplanar TL.

**Unit – II: Microwave waveguides and components**

Rectangular Wave Guide: Field Components, TE, TM Modes, Dominant (TE10) mode, Power Transmission, Power losses, Excitation of modes, Circular Waveguides:
TE, TM modes, Microwave cavities (Resonators), Scattering matrix- The transmission matrix, Passive microwave devices: Microwave Hybrid Circuits, E Plane Tee, H plane Tee and Magic Tee , Terminations, Attenuators, Phase Shifters, Directional Couplers: Two Hole directional couplers, S Matrix of a Directional coupler, Hybrid Couplers, Isolators, Circulators.

**Unit – III: Microwave Semiconductor Devices**

Operation, characteristics and application of BJTs and FETs, Principles and characterstics: -tunnel diodes, Varactor diodes, PIN diode, Schottky diodes, Transferred Electron Devices : Gunn diode(Gunn Effect, RWH theory, two valley model theory, modes of operation), Avalanche Transit time devices: IMPATT and TRAPATT devices.

**Unit – IV: Microwave linear-beam tubes (O TYPE) and microwave crossed-field tubes (M TYPE)**

Klystrons, Reentrant Cavities, Velocity-Modulation Process, Bunching Process, Output Power and Beam Loading, Multicavity Klystron Amplifiers, Beam-Current Density, Output Current Output Power of Two-Cavity Klystron, Reflex Klystrons, Velocity Modulation, Power Output and Efficiency, Helix Traveling-Wave Tubes (TWTs), Slow-Wave structures, Amplification Process, Convection Current, Axial Electric Field, Wave Modes, Gain Consideration, Microwave Crossed-Field Tubes , Magnetron Oscillators, Cylindrical Magnetron, Coaxial Magnetron, Tunable Magnetron , Backward wave Oscillators

**Unit – V: Microwave Measurements**

Introduction, Microwave Measurements devices: Slotted line carriage, Tunable detectors, VSWR Meter, microwave power measurements techniques, frequency measurement, wavelength measurements, Impedance and Refection coefficient measurements, VSWR, Insertion and attenuation measurements: Power ratio method, RF substitution method, VSWR measurements (Low and High)

| Course Code | **BECE2020** | Course Name | **Digital Signal Processing** |
|---|---|---|---|

**Course Objectives**

1. Introduce to discrete time signal processing and characterization of random signals, filter design techniques, and imperfections caused by finite word length.
2. Learn how design FIR and IIR filters.
3. Learn the theory of digital signal processing and digital filter design, including hands-on experience with important techniques involving digital filter design and digital simulation experiments
4. Introduce the fundamental principles and techniques of digital signal processing for understanding and designing new digital signal processing systems and for continued learning.

**Prerequisites:** Signals and System, Engineering Mathematics

**Course Outcomes**

| | |
|---|---|
| CO1 | Apply Digital Signal Processing fundamentals. |
| CO2 | Acquire the knowledge of representation of discrete-time signals in the frequency domain,using z-transform and discrete Fourier transform |
| CO3 | Learn the basic forms of FIR and IIR filters. |
| CO4 | Design filters with desired frequency responses |
| CO5 | Understand the concept of linear prediction and spectrum estimation. |

**TEXT BOOKS**

1. Proakis J. G. and Manolakis D. G., "Digital Signal Processing: Principles, Algorithms And Applications", Pearson Education, 3rd Ed., 2003

2. Babu Ramesh P., "Digital Signal Processing", SciTech Publication, 41FL Ed., 2008.

**REFERENCE BOOKS**

1. Mitra Sanjit K., "Digital Signal Processing: A Computer Based Approach", 3rd Ed., Tata McGraw-Hill, 2008.

2. Oppenhein A. V. and Shafer R. W., "Discrete-Time Signal Processing", PHI, 2nd Ed., 2000.

3. Shaliwahan S., Vallavaraj A. and Gnanapriya C., "Digital Signal Processing", Tata McGraw-Hill, 2nd Ed., 200

**Syllabus**

**UNIT I SIGNALS AND SYSTEMS**

Basic elements of DSP, concepts of frequency in Analog and Digital Signals, sampling theorem, Discrete–time signals, systems, Analysis of discrete time LTI systems, Z transform, Convolution, Correlation.

**UNIT II FREQUENCY TRANSFORMATIONS**

Introduction to DFT, Properties of DFT, Circular, Convolution , Filtering methods based on DFT, FFT Algorithms, Decimation–in–time Algorithms, Decimation–in–frequency Algorithms, Use of FFT in Linear Filtering, DCT, Use and Application of DCT.

**UNIT III IIR FILTER DESIGN**

Structures of IIR, Analog filter design, Analog Low Pass Butterworth Filter, Analog Low Pass Chebyshev Filter, Comparison Between Butterworth Filter And Chebyshev Filter, Frequency Transformation In Analog Domain, Design Of High Pass, Bandpass And Bandstop Filters, Design Of IIR Filters From Analog Filters, Approximation Of Derivatives, Design Of IIR Filter Using Impulse Invariance Technique, Design Of IIR Filter Using Bilinear Transformation, Frequency Transformation In Digital Domain.

**UNIT IV FIR FILTER DESIGN**

Structures of FIR, Linear phase FIR filter, Frequency Response Of Linear Phase FIR Filters, Location Of The Zeros Of Linear Phase FIR Filters, The Fourier Series Method Of Designing FIR Filters, Design Of FIR Filter Using Windows, Digital Differentiator, Hilbert Transformers, Frequency Sampling Method Of Designing FIR Filters, Optimum Equi-ripple Approximation Of FIR Filters.

**UNIT V INTRODUCTION TO DSP PROCESSORS**

Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs Multiple access memory, multiport memory, VLSI Architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS 320C5X-Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Registrar, Index Registrar, Auxiliary Register Compare Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, Some flags in the status registers, On- chip registers, On-chip peripherals