IV Semester B.TECH. (Electrical Engineering)

SIGNAL AND SYSTEMS

Total Credit- 04 **Subject Code**:- BTCHEE401T

Teaching Scheme Examination Scheme Theory-03 Hours/Week Th (U)= 70 Th(I)=30

Tutorial/ Activity -01 Hous/Week Duration of University Exam:-3 Hours Course

Objectives Students will be able to –

• Understand the various methods of analysis for continuous time and discrete time systems in time domain and frequency domain

• Apply various transformation analysis to electrical signals

Course Outcomes: After studying the course, the students will be able to

CO1. Understanding the basics of signal space theory

CO2. Understanding the concepts of state space representation C

O3. Understand convolution sum of two signals

CO4. Apply Fourier and Laplace transforms, understand the duality Apply DFT, DTFT and ztransform
CO5. Understand the concept of sampling and reconstruction

UNIT I: Introduction to Signals and Systems (06 Hrs)

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additively and homogeneity, shiftinvariance, causality, stability, realizability. Examples.

UNIT II: Behavior of continuous and discrete-time LTI systems (08 Hrs)

Impulse response and step response, convolution, input-output behavior with a periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. Statespace Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

UNIT III Convolution (04 Hrs)

Convolution Sum, Convolution Integral and Their Evaluation, Time Domain Representation and Analysis of LTI Systems Based on Convolution and Differential Equations.

UNIT IV Time and Frequency Domain Transformations (17 Hrs)

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and study of system behavior, The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

UNIT V: Sampling and Reconstruction (07 Hrs)

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction, ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory, filtering, feedback control systems.

Text Books:

1. Oppenheim A.V., Willsky A.S. and Young I.T., “Signals and Systems”, Second Edition, 1997, Prentice Hall.

2. Simon Haykin and Barry Van Veen, “Signals and Systems”, Second Edition, Wiley International.

Reference Books:

1. R.F. Ziemer, W.H Tranter and J.D.R.Fannin, “Signals and Systems - Continuous and Discrete”, Forth Edition Prentice Hall.

2. M. J. Roberts, “Signals and Systems”, 2003, Tata McGraw-Hil

IV Semester B.TECH (Electrical Engineering)

DIGITAL ELECTRONICS

Total Credit- 04 **Subject Code**:- BTCHEE402T

Teaching Scheme Examination Scheme Theory-03 Hours/Week Th (U)= 70 Th(I)=30

Tutorial/ Activity -01 Hous/Week Duration of University Exam:-3 Hours Practical- 02 Hours/week

Course Objectives Students will be able to –

- To provide basic knowledge and applications of logic gates and logic families.
- To provide basic understanding of Analog to digital and digital to analog converters.

Course Outcomes: After studying the course, the students will be able to demonstrate the ability to
CO1. Understand number system, logic gates and logic families.

CO2. Design and implement combinational digital circuits.

CO3. Design and implement sequential logic circuits

. CO4. Understand the process of Analog to Digital conversion and Digital to Analog conversion.

CO5. Understand memories and PLDs to implement given logic.

UNIT I: Fundamentals of Digital Systems and Logic Families (07 Hrs)

Number systems-binary, signed binary, binary arithmetic, one's and two's complements arithmetic, octal and hexadecimal number system , codes, error detecting and correcting codes, Digital Signals, basic digital circuits, NAND and NOR operations, Exclusive – OR and Exclusive NOR operations, Boolean algebra, Examples of IC gates, Digital logic families, TTL and Schottkty TTL and CMOS logic, interfacing CMOS and TTL, Tri-State logic.

UNIT II: Combinational Digital Circuits (07 Hrs)

Standard representation for logic functions, K-map representation (up to 4 variables), and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, use in combinational logic design, Adders, Subtractors, BCD arithmetic, carry, Arithmetic logic unit (ALU), popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices.

UNIT III: Sequential circuits and systems (07 Hrs)

A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K flip flop, T and D types flip-flops, excitation table of flip flop, conversion of flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT IV: A/D and D/A Converters (07 Hrs):

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit. Analog to digital converters: quantization and encoding, parallel comparator, A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs

UNIT V: Semiconductor memories (08 Hrs).

Memory organization and operation, expanding memory size, classification and characteristics of memories, Types of Memory commonly used memory chips. Programmable Logic Devices: ROM as Programmable logic devices (PLD), Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA)

Text Books /References:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

3. H.Taub, "Digital Integrated Electronics" McGraw Hill

4. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

5. Herbert Taub, Donald LSchilling "Digital Integrated Electronics", McGraw Hill, 1977

6. Thomas C Bartee, "Digital Computer Fundamentals",McGraw Hill,1985.

IV Semester B.TECH. (Electrical Engineering)

DIGITAL ELECTRONICS

Total Credit- 01 **Subject Code**:- BTCHEE402P

Teaching Scheme Examination Scheme Practical- 02 Hours/week Pr (U)= 25Pr(I)=25

Experiments based on the above syllabus with at least one experiment from each unit. IV Semester B.E. (Electrical Engineering

IV Semester B.TECH. (Electrical Engineering)

ELECTRICAL MACHINES-I

Total Credit- 04 **Subject Code**:- BTCHEE403T

Teaching Scheme Examination Scheme Theory-03 Hours/Week Th (U)= 70 Th(I)=30

Tutorial/ Activity -01 Hous/Week Duration of University Exam:-3 Hours Practical- 02 Hours/week

Course Objectives Students will be able to –

• The Basic Principle of Transfer of Electrical Power Operation and Construction of Single Phase and Three Phase Transformer with Phasor diagram and Connection.

• The Construction, Principle and Applications of D.C.Machines

. • The Construction, Principle and Applications of Three Phase Induction Motor.

• The Construction, Principle and Applications of Three Phase Synchronous Machines.

• The Construction, Principle and Applications of Single Phase Machines and Special Machines.

Course Outcomes: After Completing the Course, Students Will Be Able to –

CO1. Determine Equivalent Circuit parameter, Efficiency and Regulation of Single Phase Transformer and to Explain the Phasor groups of Three Phase Transformer.

CO2. Analyze different characteristics of D. C. Motor and Speed Control of D.C. Motor.

CO3. Explain different types of Three Phase Induction Motor and Analyze the characteristics at different Value of Slip.

CO4. Know Voltage Regulation of Three Phase Synchronous Generator and Behavior of Synchronous Motor with Different Excitations

CO5. Understand Single Phase Machines and Special Machines.

Unit-I Single Phase Transformer (12-Hrs)

Revision of Single Phase Transformer, Phasor Diagram Under Different Load Conditions, Losses, Equivalent Circuit, Open Circuit and Short Circuit Test, Voltage Regulation, Efficiency, Condition of Maximum Efficiency, All Day Efficiency, Polarity Test. Single phase AutoTransformer, Working, Merits and Demerits. Applications. Three Phase Transformer: -Principle and Operation, Connection and Phasor Groups, Polarity Test, Open Circuit and Short Circuit Test, Conditions of Parallel Operation.

Unit II D.C. Machines (08-Hrs)

Basic Principle and Operation of D.C. Motor and D.C. Generator, Emf Equation and Torque equation, Types of D.C. Machines, Characteristics and Speed Control of D.C. Shunt and D.C. Series Motor, Losses and Efficiency of D.C. Motor. Necessity of Starter and Constructional Details of Three Point Starter. Armature Reaction in D. C. Machines. Applications.

Unit III Three Phase Induction Motor (08-Hrs)

Construction Details, Types, Principle, Production of Torque, Torque Equation and Condition of Maximum and Starting Torque, Losses and Efficiency, Torque-Slip Characteristics, Behavior for Different values of Slip. No Load Test and Blocked Rotor Test. Starting methods of Three Phase Induction Motor. Applications.

Unit IV Synchronous Machines (08-Hrs)

Three Phase Synchronous Generator : -Introduction, Constructional features of Salient Pole and Cylindrical Pole Rotor Machines, Introduction to Armature Winding and Field Winding, Winding Factors and EMF Equation, Armature Reaction, Phasor Diagram Under Load Condition, Regulation and Synchronous Impedance Method to Find Voltage Regulation. Three Phase Synchronous Motor: - Construction and Principle, Starting of Synchronous Motor, Motor on Load, Effect of Changing Field Excitation at Constant Load, V and Inverted-V Curves. Applications.

Unit V Single Phase Machines (07-Hrs)

Single Phase Induction Motor :- Principle and Operation, Double Field Revolving Theory. Principle and Working of Shaded Pole Induction Motor , Split Phase Induction Motor and Capacitor Start Capacitor Run Motor. Applications. Principle, Working And Applications Of Special Machines:- Universal Motor, Hysteresis Motor, Brushless D. C. Motor, A.C. Series Motor.

TEXT BOOKS:-

1. I. J. Nagrath , D.P. Kothari, “Elecrtcal Machines,”, Tata McGraw- Hill Publishing Company Ltd.

2. P.S.Bhimbra,”Electrical Machinery”, Khanna Publishers.

3. P.K. Mukherjee, S. Chakrabvorty, “ Electrical Machines”, Dhanpat Rai Publications.

4. P.S. Bhimbra , “Generalized Theory in Electrical Machines”, Khanna Publishers.

5. D C Kulshreshtha, “Basic Electrical Engineering,” The McGraw Hill Higher Education Private Limited, New Delhi.

6. S.G.Tarnekar, P.P. Kharbanda, S.B.Bodkhe, S.D. Naik , “ Laboratory Courses in Electrical Engineering,” S. Chand & Company Ltd., New Delhi.

7. Use of ICT Tools.

REFERENCE BOOKS :-

1. M.G.Say, " Performance and Design of A.C. Machines," CBS Publishers and Distributors Pvt. Ltd.

2. A.F. Fitzgerlad, Charles Kingdey, Jr. Stephan D. Umans, "Electrical Machinery", Fifth Edition in SI Units, McGraw Hill Book Company.

3. D.P. Kothari, B.S.Umre, "Laboratory Manual for Electrical Machines," Second Edition , I.K. International Publishing House Pvt.Ltd., New Delhi.

IV Semester B.TECH. (Electrical Engineering)

ELECTRICAL MACHINES-I

Total Credit- 01 **Subject Code**:- BTCHEE403P

Teaching Scheme Examination Scheme Practical- 02 Hours/week Pr (U)= 25 Pr (I)=25

10 EXPERIMENTS BASED ON ABOVE SYLLABUS.

IV Semester B.TECH. (Electrical Engineering)

POWER SYSTEM

Total Credit- 03 **Subject Code**:- BTCHEE404T

Teaching Scheme Examination Scheme: Theory-03 Hours/Week Th (U)= 70 Th(I)=30

Tutorial/ Activity -0 Duration of University Exam:-3 Hours

Course Objectives Students will develop the ability

• To model and represent the power system components, understand and calculate the transmission line parameter, evaluate its performance, understand the method of load flowanalysis and the concept of voltage stability.

Course Outcomes: After Completing the Course, Students Will Be Able to –

CO1. Understand the basic structure of powersystem , smart grid and microgrid.

CO2. Model and represent the power systemcomponents in its per unit value.

CO3. Learn the parameters of transmission linesand cables.

CO4. Evaluate the performance of transmissionlines.

CO5. Acquaint with the method of load flowanalysis and the concept of voltage stability.

UNIT- I: Evolution of Structure of Power Systems (08Hrs)

Structure of power systems, brief exposure to generation, transmission and distribution aspects, Present-Day Scenario, Introduction to Smart Grids and Micro-grids, their components, Standardization of transmission voltages, Overhead and Underground transmission system, EHVAC verses HVDC transmission, HVDC Components, distribution connection scheme (radial, ring main and interconnected), Feeders and distributors, Substation and its equipments.

UNIT- II: Per Unit Representation (06Hrs)

Representation of power system elements, models and parameters of generator, transformer and transmission lines and load, voltage and frequency dependence of loads, single line impedance diagram, advantages of per unit representation.

UNIT-III: Overhead Transmission Lines and Cables (10Hrs)

Components of overhead lines, choice of conductors, Skin effect, Proximity effect, Corona, Transposition of conductors, Bundled conductor, Types of insulators , string efficiency, Method to improve string efficiency, Derivation for Inductance of a single phase line, concept of self GMD and mutual GMD, Derivation for Capacitance of a single phase line, Insulated Cables, Dielectric stress in single core cables, Grading of cables, XLPE cables.

UNIT-IV: Performance of Transmission line (08Hrs)

Classification of transmission line (short, medium (nominal T and nominal Π) and long), Characteristics (voltage regulation and efficiency) of transmission lines, determination of generalised (A,B,C,D) constants for transmission line, Ferranti effect, Surge Impedance Loading, Series and Shunt Compensation of transmission lines (using capacitors only) .

UNIT-V: Load Flow Studies (08Hrs)

Introduction to load flow studies, Classification of buses , Formation of bus admittance matrix, Static load flow equations, Gauss Seidel and Newton-Raphson method for solution (Numerical is not expected), Introduction of frequency and voltage as system state indicators, Concept of Voltage Stability, P-V and V-Q curves, Methods to improve voltage stability.

Text Book

1. I. J. Nagrath, D. P. Kothari, Power System Engineering, Tata McGraw-Hill publications, 2008

2. Ashfaq Husain, Electrical Power System, CBS Publication, 5th Edition

3. C. L. Wadhwa, Electrical Power Systems, New Age International Publiser, 6th Edition

4. V. K. Mehta and Rohit Mehta, Principles of Power System, S. Chand Publication, 2008

Reference Books:

1. W.D. Stevenson, Elements of power system analysis, McGraw-Hill publications, 3rd Edition

2. O. I. Elgerd, Electric Energy Systems Theory: An Introduction, McGraw-Hill publications, 2ndEdition

3. Hadi Saadat, Power System Analysis , TMH , 2002

4. James A Momoh, Smart Grid : Fundamentals of Design and Analysis, Wiley 2012 5. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, “Smart Grid: Technology and Applications”,Wiley 2012

IV Semester B.TECH. (Electrical Engineering)

ELECTROMAGNETIC FIELDS

Total Credit- 04 **Subject Code**:- BTCHEE405T

Teaching Scheme Examination Scheme Theory-03 Hours/Week Th (U)= 70 Th(I)=30

Tutorial/ Activity – 01 Hours/week Duration of University Exam:-3 Hours

Course Objectives Students will be able to –

• Introduce the concepts of different coordinate systems, Maxwell`s equations, static electric and magnetic fields and methods of solving for the quantities associated with these fields, time varying fields and displacement current.

Course outcomes At the end of this course students will demonstrate the ability to

CO1. Recognize and apply the knowledge of different co-ordinate systems.

CO2. Evaluate the physical quantities of electromagnetic fields in different media and apply Gauss law.

CO3. Describe static electric fields boundary conditions, nature of dielectric materials and evaluate potential fields.

CO4. Explain steady magnetic fields, their behavior in different media, associated laws and inductance.

CO5. Understand Maxwell's equations in different forms and different media.

Unit I: Review of Vector Analysis: (08 Hrs)

Review of Scalars and vectors, Vector Algebra, Rectangular Co-ordinate System, Cylindrical Co-ordinate System, Spherical Co-ordinate System and transformation of Cartesian to Cylindrical, Cartesian to Spherical and vice versa.

Unit II: Coulomb's law, Electrical field intensity and electric flux density, Gauss's law, Divergence: (08 Hrs)

Coulombs Law, Electric field intensity, field due to continuous volume charge distribution, field of point charge, field of line charge, field of sheet charge, Electric Flux density, Gauss's law and Applications of Gauss's law, the divergence theorem.

Unit III: Potential of charge system , Conductors, Dielectric, Capacitance and poison's and Laplace Equations: (07 Hrs)

Definition of potential difference and potential, the potential field of a point charge, the potential field of a system of charges, potential gradient. Metallic conductors, conductor properties, the nature of dielectric materials, boundary conditions for perfect dielectric materials, Capacitance of parallel plate capacitor, capacitance of two wire line, Poisons and Laplace Equation.

Unit IV: The steady Magnetic Field and Magnetic forces: (08 Hrs)

Biot Savart's law, Ampere's Circuital law, Stoke's theorem, magnetic flux density, scalar and vector magnetic potentials. Force on moving charge, force between differential current elements, nature of magnetic material, Magnetization and permeability, Inductance and mutual inductance.

Unit V: Boundary conditions, Maxwell's equation and wave propagation: (08 Hrs)

Magnetic boundary conditions, Faraday's law, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Wave propagation, Poynting vector, skin effect.

Text books:

1. W.H. Hayt , "Engineering Electromagnetics" ,TMH Publication 2006

Reference books:

1. N.N.Rao Electromagnetic Engg. V Edition ,Prentice Hall. 2005

2. Fawwaz T.Ulaby Applied Electromagnetics, Prentice Hall. 1999

3. Krauss Electromagnetic Engg. IV Edition,Tata Mc Graw Hill. 2003

4. Shevgaonkar Electromagnetic Waves,Tata Mc Graw Hill 2002 5. Matthew, N. O. Sadiku Elements of Electromagnetics, Oxford University publication, 6th edition, 2014.

IV Semester B.TECH. (Electrical Engineering)

SIMULATION & PROGRAMMING TECHNIQUES

Total Credit- 03 **Subject Code**:- BTCHEE406T

Teaching Scheme Examination Scheme Theory-03 Hours/Week Th (U)= 70 Th(I)=30

Tutorial/ Activity –0 Duration of University Exam:-3 Hours Practical:-02 Hours/ week

Course Objectives Students will be able to –

• The concept of programming and topics using C & C++ language and apply it in the field of engineering and technology. Similarly student will know about the MATLAB, various matrix operation and use of graphic tools for representation.

Course outcomes At the end of this course students will be able to

CO1. Learn the basics of C programming and apply the knowledge for developing small programs including Function. C

O2. Apply the knowledge of C language for developing simple programs using variables, arrays, structures etc. for applications like searching and sorting, use of pointers & File handling functions.

CO3. Understand the basics of C++

CO4. Study the basic of MATLAB and apply fundamental knowledge for analysis of basic engineering problems.

CO5. Apply knowledge of MATLAB, Toolboxes and Simulink to solve matrix equations, plot graphs, build and analyze simple electrical circuits.

Unit-I: (08 Hrs)

Structure of C program, Data types, Variables, Input/output statements, Storage class, operators, Program control statements, Concept of function & Recursion

Unit-II: (08 Hrs)

Introduction to Arrays, Programs with Arrays, Searching (Linear & Binary), Sorting (Bubble & Selection), Introduction to Structures, Simple programs using structures, Introduction to Pointers, File Handling

Unit III: Introduction to C++ concepts (06 Hrs)

Unit-IV: (08 Hrs)

Introduction to MATLAB Programming, Import/export data, Program and run simple scripts (Mfiles), Use graphics tools to display data, Conditional Statements (If-else, if-else-if), and Iterative statements (while, for loop)

Unit -V: (10 Hrs)

Matrix operation (Transpose, Determinant, Inverse), Plotting of graphs (Basic plot, generating waveforms) using MATLAB Programming. Programming using MATLAB functions, Introduction to Toolbox (SimPower system, Control System) and Simulink

Text Book

1. Kakade & Deshpande, A text book on Programming languages C& C++ ,DREAMTECH PRESS 2nd . Ed.

2. E. Balgurusami, Programming in ANSI- C, TATA MCGRAW-HILL Publishing Company Ltd.

3. Y. Kanetka, Let us C, 8 th BPB PUBLICATIONS

4. Jaydeep Chakravorty Introduction to MATLAB Programming, Toolbox & Simulink, Universities Press

5. Stephen Chapman, MATLAB Programming for Engineers, 4th Edition, CENGAGE Learning

Reference Book

1. B.W. Kernighan and D.M. Ritchie, C Programming languages, 2 nd EDITION PEARSON EDUCATION
2. Stormy Attaway, METLAB-A Practical introduction to programming problem Solving, Elsevier

3. Duane Hansselman Bruce Littlefield, Mastering METLAB, Pearson

IV Semester B.TECH. (Electrical Engineering)

SIMULATION & PROGRAMMING TECHNIQUES

Total Credit- 01 **Subject Code**:- BTCHEE406T

Teaching Scheme Examination Scheme Practical:-02 Hours/ week Pr (U)= 25 Pr(I)=25

10 EXPERIMENTS BASED ON ABOVE SYLLABUS