RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

B.E. ELECTRONICS / ELECTRONICS & TELECOMMUNICATION / ELECTRONICS & COMMUNICATION ENGINEERING

B.E. THIRD SEMESTER

Mathematics III

Subject Code: BEETC-301T/BEEN-301T/BEEC-301T Credits: 03
Teaching scheme- Lectures (including activity based learning): 3 Hours/ Week
Examination Scheme T (U) : 70 Marks , T (I) : 30 Marks
Duration of University Exam. : 03 Hours

Course Objectives:

The objective of this course is to provide students with understanding of

1. A primary objective is to introduce and develop advanced mathematical skills of students that are imperative for effective understanding of engineering subjects.
2. The topics covered will equip them with the techniques to understand advanced level Mathematics and its applications that would enrich logical thinking power.

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to:

1. Apply Laplace Transform to solve ordinary differential equations, Integral equations and Integro-differential Equations.
2. Apply Fourier series in the analysis of periodic functions in terms sine and cosine encountered in engineering problems and Fourier Transform to solve integral equations.
3. Learn the concept of differentiating, integrating and expanding of analytic functions in complex numbers and their applications such as evaluation of integrals of complex functions.
4. Solve partial differential equations of first order, higher order with constant coefficients and of second order using method of separation of variables.
5. Analyze real world scenarios to recognize when matrices are appropriate, formulate problems about the scenarios, creatively model these scenarios in order to solve the problems using multiple approaches.
6. Understand the impact of scientific and engineering solutions in a global and societal context.
7. Create the groundwork for post-graduate courses, specialized study, and research in mathematics.

UNIT - I: LAPLACE TRANSFORM (14 Marks)

Definition, Properties (Statement only), Evaluation of integrals by Laplace transform, Inverse Laplace transform using partial fraction method and properties of Laplace transform, Convolution theorem (Statement only), Laplace transform of periodic

functions (Statement only), Unit step function and unit impulse function (Statement only), Applications of Laplace transform to solve ordinary differential equations, Integral equations &Integro-differential equations

UNIT – II FOURIER SERIES & FOURIER TRANSFORM (14 Marks)

Fourier Series: Periodic functions and their Fourier expansions, Even and odd functions, Change of interval, Half range expansions. Fourier Transform: Definition and Properties (excluding FFT), Fourier integral theorem, Applications of Fourier transform to solve integral equations.

Unit III: FUNCTIONS OF COMPLEX VARIABLES (14 Marks)

Analytic function, Cauchy-Riemann conditions, Harmonic function (Excluding orthogonal system), Milne-Thomson method, Cauchy integral theorem & integral formula (Statement only), Taylor's & Laurent's series (Statement only), Zeros and singularities of analytic function, Residue theorem (Statement only).

Unit IV: PARTIAL DIFFERENTIAL EQUATIONS (8 Hrs)

Partial differential equations of first order first degree i.e. Lagrange's form, Linear homogeneous equations of higher order with constant coefficients, Method of separations of variables, Simple applications of Laplace transform to solve partial differential equations (One dimensional only).

Unit V: MATRICES (6 Hrs)

Linear dependence of vectors, Eigen values and Eigen vectors, Reduction to diagonal form, Singular value decomposition, Sylvester's theorem (Statement only), Largesteigen value and corresponding eigen vector by iteration method.

Text/Reference Books:

1. Advanced Engineering Mathematics (Wiley), Erwin Kreyzig.
2. Higher Engineering Mathematics (Khanna Publishers), B. S. Grewal.
3. Advanced Engineering Mathematics (S. Chand), H. K. Dass.
4. Applied Mathematics for Engineers and Physicists, L. A. Pipes and L. R. Harville.
5. Advanced Mathematics for Engineers, Chandrika Prasad.
6. A text book of Engineering Mathematics (Laxmi Publication), N. P. Bali & M. Goyal

B.E. THIRD SEMESTER

COMPONENTS FOR ELECTRONIC CIRCUIT DESIGN

Subject Code: BEETC-302T/BEEN-302T/BEEC-302T Credits: 03
Teaching scheme- Lectures (including activity based learning): 3 Hours/ Week
Examination Scheme T (U) : 70 Marks , T (I) : 30 Marks
Duration of University Exam. : 03 Hours

Course Objectives:

The objective of this course is to provide students with understanding of

8. To learn the principle of Semiconductor Diodes.
9. To understand the working of different types of Diodes.
10. To study the working of Transistors.
11. To understand the internal structure of MOSFET, JFET and IC Fabrication.

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to:

CO1: Understand the principles of semiconductor physics

CO2: Understand the principles of semiconductor diode.

CO3:Understand and analyze the mathematical model of transistors.

CO4:Understand and analyze the mathematical model of unipolar transistors.

CO5:Understand the process of Integrated Circuit Fabrication.

UNIT - I: INTRODUCTION TO SEMICONDUCTOR PHYSICS (14 Marks)

Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams, Energy bands in metals, insulators, intrinsic and extrinsic semiconductor, Carrier transport: diffusion current, drift current, mobility and resistivity, Generation and recombination of carriers, Poisson and continuity equation

UNIT- II: P-N JUNCTION DIODE (14Marks)

P-N Junction, Biasing of diodes, Avalanche &Zener breakdown, I-V characteristics, Transition and Diffusion Capacitance, small signal switching models, Applications of Diode as a Rectifier, Switch, Clipper and Clamper, Zener diode, Zener diode as a voltage regulator, Varactor Diode, LED, Photodiode.

UNIT- III: Bipolar Junction Transistors (14 Marks)

Construction and Types of BJT, Biasing of BJT, BJT Configurations, I-V characteristics,Stability Factors, Compensation Techniques of BJT, Thermal Runaway, Ebers-Moll Model,Transistor as an Amplifier.

UNIT- IV: Unipolar Transistors (14Marks)

Construction & working of UJT, JFET, JFET parameters, C-V characteristics, Biasing of JFET, Low frequency model of JFET and its analysis. MOSFET (E-type & D-type), I-V characteristics, MOS capacitor and small signal models of MOS transistor.

UNIT- V: Fabrication of IC(14Marks)

Integrated circuit fabrication process: Oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process. sheet resistance, design of resistors.

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1. All Experiments are from Virtual Labs.
2. At least 1 experiment activity should be conducted from every unit.
3. Some additional simulation-based activities feasible to be executed in classrooms can be added by the course teachers.
4. At least 10 activities to be conducted in every course in classroom.
5. Course faculty is permitted to use any other open source or licensed platform in classroom.
6. Course faculty can add any other activity as per the feasibility in classroom-based teaching learning process.

Suggested List

1. Familiarization with Resistor
2. Familiarization with Capacitor
3. Familiarization with Inductor
4. Ohm's Law
5. VI Characteristics of a Diode
6. Half Wave Rectification
7. Full Wave Rectification
8. Capacitative Rectification
9. Zener Diode-Voltage Regulator
10. BJT Common Emitter Characteristics
11. BJT Common Base Characteristics
12. Studies on BJT CE Amplifier
13. RC Frequency Response
14. RC Differentiator and Integrator
15. Black Box
16. I-V Characteristics and Fabrication of p-n junction Diode
17. I-V Characteristics of LED Diode

18. Rectifier Circuits
19. Wave Shaping Circuits using Diodes
20. BJT characteristics
21. BJT biasing and amplifier response
22. RC circuits
23. Wien Bridge Oscillator
24. Monostable and Astablemultivibrators using IC 555
25. Design and Simulate Analog to Digital Converter and Digital to Analog Converter
26. Implementation of monostable and astable oscillator using IC 555
27. Characterize the temperature sensor (RTD)
28. Simulate the performance of a bio-sensor
29. Measurement of level in a tank using capacitive type level probe
30. Characterize the LVDT
31. Design an orifice plate for a typical application
32. Simulate the performance of a chemical sensor
33. Characterize the strain gauge sensor
34. Characterize the temperature sensor (Thermocouple)
35. Grounding Practices

Web links::

1. http://vlabs.iitkgp.ernet.in/be/index.html
2. https://ee-iitb.vlabs.ac.in/
3. https://slcoep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical%20Engineering

Text Books:

1. J. Millman and Halkias : ”Electronic devices and circuits” , TMH Publications
2. Boylestad&Nashelsky : ”Electronic Devices & Circuit Theory” , PHI publications.
3. Salivahanan, Suresh Kumar, Vallavaraj: ”Electronic devices and circuits”, TMHPublications.
4. G. Streetman, and S. K. Banerjee, ”Solid State Electronic Devices,” 7th edition, Pearson,2014.
5. D. Neamen , D. Biswas, ”Semiconductor Physics and Devices,” McGraw- Hill Education.

Reference Books:

1. S. M. Sze and K. N. Kwok, ”Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2006.
2. C.T. Sah, ”Fundamentals of solid state electronics,” World Scientific Publishing Co. Inc, 1991.
3. Y. Tsividis and M. Colin, ”Operation and Modeling of the MOS Transistor,” Oxford Univ.Press, 2011.

B.E. THIRD SEMESTER

COMPONENTS FOR ELECTRONIC CIRCUIT DESIGNLAB

Subject Code: BEETC-302P/BEEN-302P/BEEC-302P Credits: 01
Teaching Scheme Practicals: 2 Hours/ Week
Examination Scheme: P (U) :25 Marks , P (I) : 25 Marks

Course Objectives:

To study basic concepts, DC circuits, AC circuits, semiconductors, Semiconductor devices, Power supply, Bipolar and Field effect transistor amplifiers, Frequency response of amplifier.

Course Outcomes:

After completion of the practical:

1. The students will get the basic concepts of different semiconductor components.
2. They will be able to understand the use of semiconductor devices in different electronic circuits.
3. They will be able to calculate different performance parameters of transistors.
4. They will be able to plot and study the characteristics of semiconductor devices.

Instructions:

1. Minimum 9 Practical including one mini project needs to be conducted(In the list given below, wherever a,b,c categories listed can be offered to different groups in the samebatch of praticals.
2. All practicals must be performed on breadboard.
3. One mini project using transistor, MOSFET and general components to be executed on general purpose PCB
4. Minimum 10 viva and tinkering questions to be asked at the end of every experiment. Viva questions should be related futuristic variation in the experiments carried out.
5. Minimum 1 practical to be conducted from every unit.

List of Experiments:

1. Familiarization with the Electronic Instruments like function generator, CRO, DC power supply, use of multimeter as voltmeter, ammeter, Ohmmeter, continuity meter, different types of transformers and Centre tapped transformer, Dimmer stat, Rheostat, AC voltage tester, concept of earthing. Measurement of voltage and frequency with CRO and DSO. Concept of saving and accessing waveform on DSO.

2. Familiarization with different types of passive electronic components like resistor, inductor, capacitor. And miscellaneous components like winding wire, Ferrite Cores, connectors, general purpose PCB, and Bread board, relays, diodes, etc.
3. To study basic wiring and design a switchboard/extension board for power distribution of 230V AC and electrical safety, fuses and MCBs, ELCB, contactors etc.
4. To study the concept of phase shift on CRO and DSO and measure phase shift in degrees and radians.
5. Design a a) forward bias circuit of a 1n4001 diode with a DC voltage of 5V and which will provide 5mA current with a suitable series resistor. Find unknown resistor and internal forward resistance of diode using this experiment. Measure forward voltage drop across diode, b)Design a reverse bias circuit of a 1n4001 diode with a DC voltage of 5V. Measure the reverse bias current and find reverse resistance of this diode.
6. Design a a) Half-wave rectifier using a capacitor-input filter. Use diode 1N4001 and Electrolytic capacitor of 100uF and at 3 different resistive loads. Measure peak to peak ripple voltage. b) Design a Full-wave rectifier using two diodes and a capacitor-input filter. Use diode 1N4001 and Electrolytic capacitor of 100uF and at 3 different resistive loads. Measure peak to peak ripple voltage, c)Design a Bridge wave rectifier using four diodes and a capacitor-input filter. Use diode 1N4001 and Electrolytic capacitor of 100uF and at 3 different resistive loads. Measure peak to peak ripple voltage. Compare answers with two diode rectifier and half wave rectifier.
7. Design a)Unregulated power supply of 12V DC using bridge wave rectifier. Ripple voltage should be less than 5mVpp. b) Convert this to regulated power supply using 7812 Linear voltage regulators.Measure efficiency against input supply variation. Plot the graph of efficiency verses input supply variation.
8. Design diode 1N4001 as a positive and negative clipper with a peak to peak voltage of 5Vpp and load resistance of 5kOhms. Use suitable frequency. Plot Waveforms.
9. Design a diode in voltage clamping mode with doubling the voltage for input voltage of 5Vpp and frequency of 50Hz.
10. To determine the operating voltages of different colours of LEDs and measure minimum current and forward bias voltages across them.
11. Design an optocoupler based switching circuit to switch a group of 5 LEDs connected in parallel.

12. To design Transistor as a switch using a driving Relay and switch on and off a 230 V AC/10 W LED Bulb using concept and circuit modification of a) a normally open (N/O) switch(inverter) and b) a normally closed(N/C) switch.
13. To design transistor as an audio amplifier using microphone to amplifier different audio frequencies of 20Hz to 20kHz, test it on DSOs and save different pattern of waveforms at different frequencies, Measure its efficiency.
14. To design a) Audio Frequency Oscillator (RC) of 1kHz using transistor by determining values of R and C for a fixed frequency, b)To design Radio Frequency Oscillator of 1MHz (LC) by determining values of L and C for a fixed frequency.
15. To design transistorized AstableMultiviabrator for a frequency of 5kHz and 5Vpp.
16. To design a D.C. Power supply of 9V using Full Wave Rectifier of two diodes 1N4007 and suitable Zener Diode. Calculate efficiency.
17. To design an LED blinking circuit using Transistor BC547 and LDR. Use 12V DC power supply for biasing.
18. a)To measure the unknown values of inductors and capacitors using the Voltage divider and AC voltage of 24 V pp and 50Hz frequency, b)To find the value of unknown capacitor using a series RC circuit and AC voltage of 12Vpp and 50Hz, c)To find the value of unknown inductor using a series RL circuit and AC voltage of 12Vpp and 50Hz.
19. a)To use BJT as driver for amplifying switching pulses to 9Vpp at different switching frequencies of 1kHz to 100kHz,b)To use MOSFET as driver for amplifying switching pulses to 12Vpp at different switching frequencies of 1kHz to 100kHz, c)To use IGBT as driver for amplifying switching pulses to 15Vpp at different switching frequencies of 1kHz to 100kHz.
20. To develop an LED blinking of on and off time of 1second each using a charge and discharge concept of RC circuit.

B.E. THIRD SEMESTER

DIGITAL SYSTEM DESIGN

Subject Code: BEETC-303T/BEEN-303T/BEEC-303T Credits: 04
Teaching Scheme Lectures (including activity based learning): 3 Hours/ Week
Tutorial: 1 Hours / Week
Examination Scheme T (U): 70 Marks, T (I): 30 Marks
Duration of University Exam. : 03 Hours

Course Objectives:

The objective of this course is to provide students with understanding of

1. To study various digital gates and construction of various logic circuits using basic gates.
2. To study combinational circuits.
3. To study Flip flops & its applications.
4. To study fundamentals of microprocessor & to understand the concept of Assembly language programming.
5. To study different interrupt techniques.

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to:

CO1: demonstrate the knowledge of: Logic gates, Boolean algebra including algebraic manipulation/simplification and Application of DeMorgan's Theorem, Karnaugh map reduction method.

CO2. construct basic combinational circuits and verify their functionalities.

CO3. illustrate and apply the knowledge of different flip flops to build sequential digital circuits.

CO4. interpret different logic families and their characteristics.

CO5. demonstrate and apply programming proficiency using the various addressing modes and instructions of the target microprocessor

Course Contents

UNIT – I: FUNDAMENTALS OF DIGITAL CIRCUIT (14 Marks)

Number System, Boolean Algebra, Logic Gates and their truth tables, D Morgan's Laws, k-map representation (SOP & POS forms), Minimization of logical functions for min-terms and maxterms (upto 5 variables), Introduction of logic families based on characteristics -Speed of operation, power dissipation, figure of merit, fan in, fan out.

UNIT- II COMBINATIONAL CIRCUIT (14Marks)

Arithmetic Circuits, Adders and their use as substractor, ALU, Digital Comparator, Parity generators/checkers. Multiplexers and their use in combinational logic designs, multiplexer trees, Demultiplexers, Encoders & Decoders. BCD - to – 7 segment decoder, Code converters.

UNIT- III: SEQUENTIAL LOGIC DESIGN(14 Marks)

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Conversion of flip flops, Registers, Shift registers.

UNIT- IV: APPLICATION OF FLIP-FLOP(14Marks)

Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, lock out.

UNIT - V: 8085 PROGRAMMING &INTERRUPTS (14Marks)

Introduction to Intel's 8085, Architecture-description, Pin description, Addressing Modes. 8085 instruction set, Concept of assembly language programming, Interrupts.

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1. All Experiments are from Virtual Labs.
2. At least 1 experiment activity should be conducted from every unit.
3. Some additional simulation-based activities feasible to be executed in classrooms can be added by the course teachers.
4. At least 10 activities to be conducted in every course in classroom.
5. Course faculty is permitted to use any other open source or licensed platform in classroom.
6. Course faculty can add any other activity as per the feasibility in classroom-based teaching learning process.

Suggested List

1. Analysis of Functions of BCD-TO-7-segment Decoder / Driver and Operation of 7-segment LED Display
2. Characterization of Digital Logic Families
3. Analysis and Synthesis of Boolean Expressions using Basic Logic Gates
4. Analysis and Synthesis of Logic Functions using Multiplexers
5. Analysis and Synthesis of Logic Functions using Decoders
6. Analysis and Synthesis of Boolean Relations using Digital Comparators
7. Analysis and Synthesis of Arithmetic Expressions using Adders / Subtractors

8. Analysis and Synthesis of Sequential Circuits using Basic Flip-Flops
9. Analysis and Synthesis of Multi-bit Sequential Circuits using Shift Registers
10. Design of Arithmetic Logic Unit (ALU)
11. Washing machine control using basic AND and NOT gates
12. Basics of OR gate and its application in industrial control
13. Basics of NOT gate and its application in an eight bit ones complement circuit
14. Basic NOT gate and its application in fuel level indicator
15. Seat belt warning system using basic AND and NOT gates
16. Basics of AND gate and its application in car wiper control
17. Water level control using basic AND and NOT gates
18. Electronic lock using basic logic gates
19. Universal NAND gate and its application in level monitoring in chemical plant
20. Universal NOR gate and its application in automobile alarm system
21. XOR gate and its application in staircase light control
22. Majority circuit using basic logic gates
23. Cockpit warning light control using basic logic gates
24. DIY Build your own combinational logic circuit using generalized simulator
25. Design of multiplexer circuit using gates
26. Multiplexer using Universal logic gates
27. Demultiplexer using basic logic gates
28. Demultiplexer using Universal logic gates
29. Application of Multiplexer
30. Implementation of 8:1 multiplexer using MSI ICs
31. Design of four variable function using MSI ICs
32. Design of Gray to Binary code converter using MSI ICs
33. Design of Binary to Gray code converter using MSI ICs
34. Implementation of binary adder using MSI ICs
35. Design of binary subtractor using MSI ICs
36. Implementation of 4-bit digital comparator using MSI ICs
37. Design of 8 -bit digital comparator using MSI ICs
38. Construction of half and full adder using XOR and NAND gates and verification of its operation
39. To Study and Verify Half and Full Subtractor
40. Realization of logic functions with the help of Universal Gates (NAND, NOR)
41. Construction of a NOR gate latch and verification of its operation
42. Verify the truth table of RS, JK, T and D flip-flops using NAND and NOR gates
43. Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers
44. Implementation and verification of decoder or de-multiplexer and encoder using logic gates
45. Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates
46. Design and verify the 4- Bit Synchronous or Asynchronous Counter using JK Flip Flop
47. Verify Binary to Gray and Gray to Binary conversion using NAND gates only
48. Verify the truth table of one bit and two bit comparator using logic gates
49. To implement Half adder & Full adder by using basic and universal gates
50. To study Parallel Binary Adder
51. To study a BCD to 7 Segment LED display decoder
52. Study of Binary to Grey code converter
53. Implementation of Boolean Functions using MUX

54. To study the J-K FF and conversion of D and T flip flop to JKFF.
55. To study a simple two-bit ripple counter
56. Design a synchronous up/down counter
57. Design and Implementation of Various Arithmetic Circuits
58. Design and Simulate Various Code Converters
59. Design and Simulation of Various Counters and Shift Registers
60. Design and Simulation of Arithmetic Logic Unit
61. Design and Simulation of Decoders, Encoders, Multiplexer and Demultiplexer

Web links:

1. http://vlabs.iitkgp.ernet.in/dec/index.html#
2. http://vlabs.iitb.ac.in/vlabs-dev/labs/digital_application/experimentlist.html
3. http://vlabs.iitb.ac.in/vlabs-dev/labs/dldgates/experimentlist.html
4. http://vlabs.iitb.ac.in/vlabs-dev/labs/dldesignlab/experimentlist.html
5. https://vlab.amrita.edu/?sub=3&brch=81
6. https://de-iitr.vlabs.ac.in/List%20of%20experiments.html

Text Books:

1. Morris Mano : “An approach to digital Design”, Pearson Publications.
2. Ramesh Gaonkar : “ Microprocessor Architecture, Programming and Applications with the 8085”, Penram International Publications.
3. R. P. Jain : “Modern digital electronics” , TMH Publications.

Reference Books

1. WakerlyPearon : “Digital Design: Principles and Practices”, PearonEducationPublications.
2. Mark Bach : “Complete Digital Design”, Tata MCGraw Hill Publications.
3. W. Fletcher : “Engg. Approach to Digital Design”, PHI Publications.

B.E. THIRD SEMESTER

DIGITAL SYSTEM DESIGNLAB

Subject Code: BEETC-303P/BEEN-303P/BEEC-303P Credits: 01
Teaching Scheme Practicals: 2 Hours/ Week
Examination Scheme P (U):25 Marks, P (I):25 Marks

Course Objectives:

The course objectives are:

1. To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.
2. To perform a practical based on microprocessor.

Course Outcomes:

After the completion of practicals, the students will

1. Demonstrate the different Boolean Laws & basics of K-map to realize combinational & sequential circuits.
2. Identify the various digital ICs & understand their operation.
3. Describe the operation & timing constraints for latches, registers, different sequential circuits.
4. Solve basic binary math operations using microprocessor & explain the internal architecture & its operation within the area of manufacturing & performance.
5. Select programming strategies & proper mnemonics & run their program on the training boards.

NOTE:

1. All experiments need to be conducted on breadboard. No readymade kits should be used.Total 9 experiments including one mini project needs to be conducted.
2. Use LEDs, breadboard, and 5V to 12V power supply for all digital experiments
3. Minimum 6 experiments needs to be conducted from hardware list
4. Minimum 2 experiments to be conducted on Microprocessor 8085
5. Minimum one mini project on general purpose PCB/etched PCB to be conducted

List of Experiments:

1. To verify NAND(IC 4011) & NOR(IC 4001) gates as a universal gate.
2. Implementation of the given Boolean function using logic gates in both Sum of products (SOPs) and Product of Sum (POS) forms.
3. Design and implementation of code converters using Logic gates.
4. To design and verify operation of half adder and full adder(IC CD 4008).
5. Implementation of 4-bit parallel adder using CD 4008 IC.
6. Implementation and verification 16:1 multiplexer using 8:1 Mux(CD 4051) and 2:1 Mux
7. Implementation and verification of decoder/de-multiplexer and encoder using logic gates.
8. To explore 4 bit ALU(CD 40181) and verify its function table
9. Verification of state tables of RS, JK, T and D flip-flops using NAND(IC 4011) & NOR(IC 4001) gates.

10. Design and implement the sequential circuits such as registers and sequence generator.
11. Simplification and implementation of a Boolean function using k -map technique
12. Design and implementation of Binary,BCD adders and Subtractor using IC 4008 and gates
13. Design and implementation binary and BCD comparator using of using CD 4063
14. Parity generator and checker using X-OR gate(CD 4070)
15. Design and implementation of ripple and synchronous counters using JK(CD 4027) and D FF(CD 4013) and additional gates
16. Design of counter using ICs like 4029 (ripple) and CD 40192(synchronous)
17. Design and implementations of random sequence counter using JK(CD 4027) and D FF(CD 4013) ICs
18. Study of shift registers CD 54HC194 for different modes.
19. Study of characteristics of typical TTL and CMOS IC's like fan out, noise margin, propagation delay
20. Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
21. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
22. To find the largest and smallest number in an array of data using 8085 instruction set.

MINI PROJECT: -

Design of a 230 V AC on off circuit for a 10W LED bulb using a single pushbutton, 2 push buttons. Automatically this light should be switched off after a duration of 30 second using any digital IC concept. Use any components, relay or resistors.

B.E. THIRD SEMESTER

Network Theory

Subject Code: BEETC-304T/BEEN-304T/BEEC-304T Credits: 03
Teaching Scheme Lectures(including activity based learning): 3 Hours/ Week
Examination SchemeT(U) : 70 Marks , T (I) : 30 Marks
Duration of University Exam. : 03 Hours

Course Objectives:

The objective of this course is to provide students with understanding of

1. Various methods of analysis of electric networks under transient and steady state conditions.
2. Concrete foundation needed to learn future professional courses.

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to:

1. Apply mesh and node voltage method to model and analyze electrical circuits.
2. Apply network theorems for the analysis of networks.
3. Obtain the transient and steady-state response of electrical circuits.
4. Synthesize waveforms and apply Laplace transforms to analyze networks.
5. Evaluate different Network Functions and Analyze two port network behavior

UNIT - I: Sources and Mesh Analysis (14 Marks):
Voltage, Current sources, source transformation and reduction, mesh basis equilibrium approach for complicated network containing independent sources and reactances.
Node Voltage Analysis (5 hours):
Nodal Basis equilibrium equation, matrix for electrical network containing independent sources and reactances. Duality.

UNIT- II: Network Theorems (14 Marks):
Superposition, Thevenin's, Norton's, Maximum Power transfer, Reciprocity, Tellegen's theorem as applied to A. C. & D. C. circuits (problems with dependent sources are also to be dealt)

UNIT- III: Solution of First and Second order Networks (14 Marks):
Solution of first and second order differential equations of different combinations of series and parallel RLC networks, initial and final conditions in network elements, free and forced response, time constants.

UNIT- IV: Electric Circuit Analysis using Laplace Transforms (14 Marks):
Review of Laplace transform, waveform synthesis, Analysis of electrical circuits using Laplace transform for standard inputs, analysis of networks with and without initial conditions using Laplace transforms.

UNIT- V: Two port networks and Network functions (14 Marks):
Two port networks, relationship between two port variables, driving point and transfer functions, properties, concept of complex frequency, Poles and zeros, evaluation of response from pole zero locations.
Two port network parameters: Impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnection of two port networks.

Text Books:

1. Van Valkenburg, “Network Analysis”, Third Edition, 2009, Prentice Hall of India
2. Sudhakar, A, Shyammohan, “Circuits and Networks”, Third Edition, 2006, Tata McGraw-Hill.
3. D. Roy Choudhary, “Networks and Systems”, New Age International Publishers, 2nd Edition, 2012
4. Kelkar and Pandit, “Linear Network Theory”, Pratibha Publications.

Reference Books:

1. MahmoodNahvi, Joseph A Edminister, “Schaum’s outline of Electric Circuits”, 6th Edition, Tata McGraw-Hill, 6th Edition, 2013
2. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.
3. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
4. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.
5. K. Sureshkumar, “Electric Circuits & Network”, Pearson Publication
6. Del Toro, “Electrical circuit”, Prentice Hall

B.E. THIRD SEMESTER

SIGNALS AND SYSTEMS

Subject Code: BEETC-305T/BEEN-305T/BEEC-305T Credits 03
Teaching Scheme Lectures(including activity based learning): 3 Hours/ Week
Examination SchemeT(U) : 70 Marks , T (I) : 30 Marks
Duration of University Exam. : 03 Hours

Course Objectives:

The objective of this course is to provide students with understanding of

1. To introduce the fundamentals, basic characteristics, concept techniques of signals & systems.
2. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
3. Development of the mathematical skills like Fourier series, Fourier transforms, Random theory to solve problems involving convolution, filtering, modulation and sampling.

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to:

CO1: Classify different types of signals and systems

CO2: Illustrate the concept of Linear Time Invariant (LTI) system and its properties.

CO3: Analyze continuous time periodic and aperiodic signals.

CO4: Analyze continuous time systems using Laplace Transform.

CO5: Analyze DT signals and systems in frequency domain using Fourier Transform.

Course Content:

UNIT - I: CLASSIFICATION OF SIGNALS AND SYSTEMS (14 Marks)

Standard signals: Step, Impulse, Ramp, Real & complex exponentials,sinusoidal. Classification of signals: Continuous time(CT) and Discrete Time (DT) signals, Periodic and aperiodic signals, Deterministic and random signals, Energy and power signals.
Sampling: Introduction, Need for perfect reconstruction, Sampling theorem, Nyquist rate of sampling, zero order hold and first order hold.Classification of Systems: Continuous time and Discrete time, Static and dynamic, Linear and nonlinear, Time-variant and Time-invariant, Casual and non-casual, Stable and unstable, Invertible and Inverse system.

UNIT- II: LINEAR TIME-INVARIANT SYSTEMS (14Marks)

Introduction, Continuous-Time LTI systems: The Convolution Integral, Properties of Linear Time Invariant systems, LTI Systems with and without memory, Invertibility of LTI systems,

Causality for LTI systems, Stability for LTI systems, The unit step response of an LTI system, Block diagram representations of first-order systems described by differential equation

UNIT- III: ANALYSIS OF CONTINUOUS TIME PERIODIC AND APERIODIC SIGNALS (14Marks)

Fourier Series: Trigonometric Fourier Series, Exponential Fourier Series, Fourier Transform Properties: Linearity,Time Shifting, Time and frequency scaling, Duality, Multiplication property, Differentiation and Integration, Convolution property.Parseval's relation.

UNIT- IV: Laplace Transform (14Marks)

Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis of LTI systems.

UNIT- V: DISCRETE TIME FOURIER TRANSFORM (DTFT) (14Marks)

Introduction, Representation of aperiodic Signals: The Discrete-Time Fourier Transform, The Fourier Transform of periodic signal, Properties of Discrete-Time Fourier Transform, Frequency response of discrete time LTI systems.

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1. All Experiments are from Virtual Labs.
2. At least 1 experiment activity should be conducted from every unit.
3. Some additional simulation-based activities feasible to be executed in classrooms can be added by the course teachers.
4. At least 10 activities to be conducted in every course in classroom.
5. Course faculty is permitted to use any other open source or licensed platform in classroom.
6. Course faculty can add any other activity as per the feasibility in classroom-based teaching learning process.

Suggested List

1. Exp-1 Signals and their properties

Demonstration of different signals and their properties. There are FIVE sub-experiments within this experiment.

2. Exp-2 System and their property

Demonstration of Salient properties systems. There are THREE sub-experiments within this experiment.

3. Exp-3 Fourier analysis of signals

Analysis of Fourier properties of Signals. There are SIX sub-experiments within this experiment.

4. Exp-4 Sampling and signal reconstruction.

Demonstration of sampling/ reconstruction of signals and spectral analysis using DFT. There are FIVE sub-experiments within this experiment.

5. Exp-5 Analysis of LTI system response.
    - Convolution and correlation of signals.
    - Study of sampling theorem, effect of undersampling
    - Study of properties of Linear time-invariant system.
    - Study of Discrete Fourier Transform (DFT) and its inverse
    - Study of Transform domain properties and its use

Web links:

1. https://vlab.amrita.edu/?sub=3&brch=81
2. http://ssl-iitg.vlabs.ac.in/Signal%20and%20their%20properties%205(theory).html
3. http://vlabs.iitkgp.ernet.in/dsp/index.html#

Text Books:

1. Signals and Systems, A. Anand Kumar, PHI Learning Private Limited.
2. Oppenheim, Wilsky, Nawab, “Signals and Systems”, Person Education Publications
3. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

Reference Books

1. Simon Haykin, Barry Wan Veen : “Signals and Systems”, John Wiley and Sons Publications.
2. K.Lindner, “Signals and Systems”, McGraw Hill International, 1999.
3. B.P. Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, c1998
4. John G. Proakis, Dimitris G. Manolakis,“ Digital Signal Processing”, 4th Edition, Pearson Prentice Hall, c 200

B.E. THIRD SEMESTER

MEASUREMENTS AND INSTRUMENTATION

Subject Code: BEETC-306T/BEEN-306T/BEEC-306T Credits 03
Teaching Scheme Lectures (including activity based learning): 3 Hours/ Week
Examination Scheme T (U): 70 Marks , T (I): 30 Marks
Duration of University Exam. : 03 Hours

Course Objectives:

The objective of this course is to provide students with understanding of

1. Necessary foundation of electronic measurement techniques and its use for voltage, current, power, energy, frequency & time measurement.
2. Working principle and use of moving coil instruments for measurements of voltage, current, power, energy etc.
3. Understanding application of bridges in resistance, capacitance and Inductance measurement and their use in real life industrial applications.
4. Knowledge of working principle of various instruments like CRO, DSO, LCR, and Spectrum Analyzer for testing and measurement. Upon completion of this course, students will demonstrate the ability to:

Course Outcomes:

CO1: Select and use precise/accurate instrument for measurement of various electrical Parameters and to Understand its technical specifications.

CO2: Identify and minimize errors in electrical/electronic measurement.

CO3: Select suitable transducer for measurement of physical parameters.

CO4: Interpret the data using statistical analysis.

CO5: Understand modern trends in data acquisition systems

Course Content:

UNIT – I: REVIEW OF INDICATING, INTEGRATING INSTRUMENTS and INSTRUMENTATION: (14 Marks)

Purpose of instrumentation, Basic elements of instrumentation, Statistical analysis and measurement of errors, Principle and operation of ammeters, voltmeters and wattmeters, moving iron and moving coil, dynamometer, Multimeter and Energy Meter. Transducers, classification & selection of transducers, strain gauges, inductive & capacitive transducers, piezoelectric and Hall-effect transducers, thermisters, thermocouples, photo-diodes,photo-transistors encoder type digital transducers, signal conditioning and Data Acquisition Systems.Sensors for measurement of Liquid level, Gas flow, liquid flow, Pressure, Humidity, Temperature, Vibration, Acceleration etc.

UNIT – II: DETECTORS AND BRIDGES: (14 Marks)

PMMC galvanometer, dc & ac voltmeter, ammeter, multimeter, watt-hour meter, three phase wattmeter, power factor meter, instrument transformers. Measurement of low, medium and high resistance. General Balance Equation; Circuit diagram; Phasor diagram and Advantages as well as Disadvantages and Applications of Wheat stone, Kelvin, Max-well, Hay, Schering, Weinbridge Potentiometers, Measurement of Inductance, capacitance using AC bridges like Anderson, Ownens; DeSauty's. Shielding and earthing.

UNIT – III: ANALOG/ DIGITAL MEASUREMENT SYSTEMS: (14Marks)

Signal conditioning measurement meters,Electronicmultimeter, Q-meter, RF power and voltage measurements. Measurement of Energy- A.C. single phase and poly-phase induction type energy meters. Oscilloscope: Digital storage oscilloscope – 2 and 4 channel, delay line, multiple trace, Triggering, delayed sweep. HMI systems for SCADA,

UNIT – IV: FREQUENCY AND POWER MEASUREMENT: (14Marks)

Frequency, and Time measurement, signal analysis. frequency counters – measurement of frequency and time interval – extension of frequency range. Function generators – RF signal generators – Sweep generators – Frequency synthesizer –wave analyzer – Harmonic distortion analyzer – spectrum analyzer, Recent trends/developments.

UNIT V: TELEMETRY SYSTEMS: (14Marks)

What Is Telemetry? How Telemetry Works, Benefits of Telemetry, Challenges. Learn by exploring some of the tutorials on following platforms -

- Windows Azure: Telemetry Basics and Troubleshooting
- Instrumenting Your App for Telemetry and Analytics
- Software Project Telemetry
- Telemetry Dashboard Documentation – Mozilla
- Building a Scalable Geolocation Telemetry System in the Cloud using the Maps API

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1. All Experiments are from Virtual Labs.
2. At least 1 experiment activity should be conducted from every unit.
3. Some additional simulation-based activities feasible to be executed in classrooms can be added by the course teachers.
4. At least 10 activities to be conducted in every course in classroom.

5. Course faculty is permitted to use any other open source or licensed platform in classroom.
6. Course faculty can add any other activity as per the feasibility in classroom-based teaching learning process.

Suggested List

1. Measurement of Capacitance by Carey Foster Bridge
2. Measurement of Self Inductance of High Quality Factor Coil by Hay's Bridge
3. To study the Kelvin Double Bridge for Low resistance measurement
4. Measurement of Self Inductance by Maxwell's Bridge
5. Q meter Experiment
6. Measurement of Capacitance by Wien Series Bridge
7. Measurement of Capacitance by De Sauty's (Modified) bridge
8. Measurement of Self Inductance by Owen Bridge
9. Measurement of Self-Inductance by Maxwell Bridge
10. Measurement of Capacitance by Schering Bridge
11. Measurement of Self Inductance accurately by Anderson's Bridge
12. To determine the High Resistance by Megohm Bridge method
13. To study the Wien Robinson's Frequency Bridge
14. To find Galvanometer Constant
15. Mutual Inductance measurement by Campbell's Modification of Heaviside Bridge
16. Precision Resistance Measurement by Carey Foster Slide-Wire Bridge
17. Mutual Inductance measurement by Heydweiller Bridge
18. Verification of Reciprocity Theorem
19. Verification of Maximum Power Transfer Theorem
20. Determination of different parameters of Two-port network and verification of their interrelations. Frequency Response of 2nd order Active Filters
21. Estimation of Fourier Coefficients of a Periodic Signal through passive Network
22. Verification of Norton Theorem
23. Verification of Thevenin Theorem
24. Verification of Tellegen's Theorem
25. Verification of Superposition Theorem
26. Verification of Millman’s Theorem
27. Three Phase Power Measurement
28. R-L-C Circuit Analysis
29. Tests on Single Phase Transformer
30. Verification of Compensation Theorem

Web links:

1. http://vlabs.iitkgp.ernet.in/asnm/index.html#

Text Books:

1. Electrical Measurement: A.K.Sawhney, DhanpatRai& Sons Publication, 11 Edition

2. Electronic Measurement Systems, 2nd revised edition, 2009: U. A. Bakshi, A. V. Bakshi, K. A. Bakshi, Technical Publications Pune

Reference Books:

1. Electronic Instrumentation & Measurement Technique: W. D. Cooper & A.D. Helfrick., 3rd Edition

B.E. THIRD SEMESTER

ELECTRONICS WORKSHOP I

Subject Code: BEETC-307P/BEEN-307P/BEEC-307P Credits 01
Teaching Scheme Lectures: 2 Hours/ Week
Examination Scheme P (U): 25 Marks, P (I): 25 Marks

Objectives:

To study basic concepts, of all active, passive components, sensors, actuators, and different types of Electronic components used DC circuits, AC circuits, semiconductors, Semiconductor devices, Power supply, Bipolar and Field effect transistor amplifiers, Frequency response of amplifier.

Course Outcome:

After completion of the practical the students will be able to

1. Get The Basic Concepts Of Different Semiconductor Components With Their Usage Physically As Per Their Types
2. Use of Semiconductor Devices In Different Electronic Circuits And Projects.
3. Calculate Different Performance Parameters ofActive and Passive Devices and their Datasheets.
4. Plot and Study the Characteristics of Semiconductor Devices.

Instructions:

Methodology

a. In each turn it is expected that students will handle all types of components mentioned for that term.
b. Teacher will give simple masked circuit diagram with description to the group of students and ask them to generate the bill of material by doing the design calculations. Teacher will guide how to do the calculations.
c. Teacher will take viva on the content which is covered.
d. In the 9th turn of practical, students will execute the mini project.
e. A detailed instructional manual will be provided to all teachers and students regarding its step by step execution.

List of Experiments:

1. Study of Resistors(All types and their applications)
2. Study of Capacitors (All types and their applications)
3. Study of Inductors (All types and their applications)
4. Study of Diodes-(All types and their applications)
5. Study of Transistors/ MOSFETs/IGBTs
6. PCB Designing on software
7. Study of Photodiodes/Phototransistor

8. Study of Optocoupler
9. Study of Solar Cell
10. Study of Sensors/Encoders/Accelerometer
11. Study of Actuators
12. Study of All kinds of motors like DC motor/Induction motors.
13. Study of Stepper Motors and their drives.
14. One mini Project on above experiential learning.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

B.E. ELECTRONICS / ELECTRONICS & TELECOMMUNICATION / ELECTRONICS & COMMUNICATION ENGINEERING

SYLLABUS

B.E. FOURTH SEMESTER

MICROCONTROLLER AND APPLICATIONS

Subject Code: BEETC-401T/BEEN-401T/BEEC-401T Credits: 04
Teaching Scheme Lectures (including activity based learning): 3 Hours/ Week
Tutorial: 1 Hours / Week
Examination Scheme T (U): 70 Marks, T (I): 30 Marks
Duration of University Exam. : 03 Hrs

Course Objectives: -

The objective of this course is to provide students with understanding of

1. To study and understand architecture of microcontrollers and its programming concept.
2. To understand the interrupt mechanism, PPI and I/O devices interfacing and its programming.
3. To study and impart different programming languages & tools for design of embedded systems.
4. To gain knowledge about advanced processors/controllers like ARM, PIC, MSP-430 etc.
5. To learn about Arduino platform for designing embedded system applications.

Course Outcomes: -

Upon completion of this course, students will demonstrate the ability to:

C01: Demonstrate the programming model of various microcontrollers.

C02: Design and implement 8051 microcontroller-based systems for various applications

C03: Illustrate & program AVR / RISC microcontrollers in Integrated Development environment.

C04: Design and implement advanced processor/controllers-based systems for various applications

C05: Design and develop Arduino based embedded system applications.

Course Contents:

UNIT I: INTRODUCTION TO MICROCONTROLLERS: (14 Marks)

Overview of MC-51 family, Architecture and Programming Model of 8051, Instruction Set, Assembly Language Programming, Stack, Interrupt , Timers, Serial Communication, SFRs, PPI and Port Programming.

UNIT II: Applications of 8051 Microcontroller(14Marks)

Interfacing and Programming of - Memory, LED / LCD Display, Keyboard, Stepper & DC Motor, A/D and D/A. Introduction to CAN, Bluetooth and USB protocols and its interfacing, Water Level Controller

UNIT III: Integrated Development Environment (IDE) for Microcontrollers (14 Marks)

Editor, linker, Loader, Debugger, Simulator and Emulator. Instruction Set and Formats, Assembler Directives, Addressing Modes of AVR Microcontroller. Basic programming using AVR assembly instructions. Introduction to Embedded- C, Integrated Development Environment (IDE), cross compiler, ISP, simple program for delay generation.

UNIT IV: INTRODUCTION TO OTHER ADVANCED MICROCONTROLLERS (14 Marks)

Introduction to ARM and PIC Processors of MSP 430 Microcontroller, 16 bit Micro-controllers overview; features, Architecture, Addressing Modes. Low power feature of MSP 430.

UNIT V: INTRODUCTION TO ARDUINO: (14Marks)

Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, Introduction to Embedded C and Arduino platform.

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1. All Experiments are from Virtual Labs.
2. At least 1 experiment activity should be conducted from every unit.
3. Some additional simulation-based activities feasible to be executed in classrooms can be added by the course teachers.
4. At least 10 activities to be conducted in every course in classroom.
5. Course faculty is permitted to use any other open source or licensed platform in classroom.
6. Course faculty can add any other activity as per the feasibility in classroom-based teaching learning process.

Suggested List:

1. LCD - MCU interfacing and displaying a string
2. MCU interfacing take a input from keypad and display on LCD
3. Stepper Motor Control Using ATMEGA-16 Microcontroller
4. Interface a LED matrix and display a number on the matrix.
5. Interfacing 4x4 switch matrix with the microcontroller
6. Implementation of Digital FIR Filter on 8051 Microcontroller
7. Serial Communication between micro controller and PC
8. Temperature control using ATmega16
9. Study hardware and software platforms for DCS
10. Simulate analog and digital function blocks
11. Study, understand and perform experiments on timers and counters
12. Logic implementation for traffic Control Application
13. Logic implementation for Bottle Filling Application
14. Tune PID controller for heat exchanger using DCS
15. FBD for autoclavable laboratory fermenter
16. Develop graphical user interface for the fermenter plant

Web links:

1. http://vlabs.iitkgp.ernet.in/rtes/index.html#
2. http://ial-coep.vlabs.ac.in/List%20of%20experiments.html

Text Books

1. The AVR Microcontroller and Embedded Systems: A System Approach by Muhammad A. Mazidi, 1st Ed., PHI, 2013.
2. Kenneth J. Ayala, "The 8051 Microcontroller", Penram International Publishing, 1996.
3. Embedded C Programming and the ATMEL AVR by R H Barnett 2nd Ed., Cengage Learning Publication, 2006.

Reference Books:

1. The 8051 Microcontroller: A System Approach by Muhammad Mazidi, 1st Ed., PHI, 2012
2. D. M Calcutt, Fredrick J. Cowan " 8051 microcontroller: an application based introduction".
3. SubrataGhoshal "8051 microcontroller" Pearson Education

B.E. FOURTH SEMESTER

MICROCONTROLLER AND APPLICATIONSLAB

Subject Code: BEETC-401P/BEEN-401P/BEEC-401P Credits: 01
Teaching Scheme Practicals: 2 Hours/ Week
Examination Scheme P (U): 25 Marks, P (I): 25 Marks

Course Objectives:

The course objectives are:

1. To perform a practical based on different microcontroller based systems.
2. To study assembly language programming skills.
3. Interface different peripherals with microcontrollers foritsits practical use.

Course Outcomes:

After the completion of practicals, the students will

1. Demonstrate the concept of Assembly languages and higher level language programming.
2. Interface various peripherals with 8051,Atmega 32, MSP 430 and Arduino.
3. Simulate the programs on different software platforms.

Instructions-

1. Minimum 9 experiments including one mini project needs to be conducted
2. Conduct at least 2 experiments on general assembly language programming of microcontroller 8051
3. Conduct at least 1 experiment on interfacing based circuits using microcontroller 8051
4. Conduct at least 2 experiments on AVR Atmega 32 microcontroller
5. Conduct at least 2 experiments on MSP 430 microcontroller
6. Conduct at least 1 experiments on Arduino microcontroller
7. One miniproject needs to be compulsorily developed using any microcontroller on etched PCB

List of Experiments

1. Write and execute ALP for 8051 to convert two digit decimal numbers present in external data memory into its equivalent ASCII code.
2. Write and execute ALP for 8051 to swap nibbles of 10 bytes present in external data memory.
3. Write an ALP for 8051 to finding the smallest and largest number from given data bytes stored in internal/external data memory location
4. Write and execute ALP for 8051 to exchange two data strings present in external data memory.
5. Write and execute an ALP for 8051 to exchange the data of two memory location.
6. Write and execute ALP for 8051 to convert two digit decimal number present in external data memory into its equivalent ASCII code.
7. Write a 8051 assembly language program to copy a data from DATA space(internal Ram) into the EXTERNAL memory space starting at address 8000H.

8. Assume that 5 BCD data items are stored in RAM locations starting at 40H. Write a 8051 assembly language program to find the sum of all the numbers. The result must be in BCD.
9. Write a 8051 assembly language program to find largest no. of given 10 bytes of data stored in memory location 5000H
10. MCU 8051 Timer interrupt programming using Timer0 model for blinking LED using interrupt
11. Interface 8 LEDs with 8051 and write a program to glow alternate LEDs. Modify the experiment further to blink an LED lamp of 230V AC/10W with an on and off time of 1 Second
12. Interface microcontroller 8051 with LCD display and display a string of "Welcome to microcontroller Programming" and a table of 5
13. Design an interfacing of seven segment display with microcontroller 8051 and generate all numbers from 0 to 9 with a time duration of 1 second.
14. Interface Microcontroller 8051 with DAC and generation of triangular wave of frequency 10kHz triggering through timer (on chip timer)
15. Design a Stepper Motor Controller Using 8051 Microcontroller. Rotate this motor with an RPM of 150 both in clockwise and anticlockwise directions
16. Design an MCU AVR Atmega32 interfacing with LCD and displaying string and table of 5. Modify this program to interface LM 34 for displaying temperature in Degree Centigrade and Fahrenheit on LCD display.
17. Write and execute ALP for AVR Atmega32 to generate square wave of 1kHzs frequency on any one of the pin of output port. Modify this experiment further to generate pulses of different duty ratios starting from 10% to 90 %.
18. Interface stepper motor with AVR Atmega 32 microcontroller and write a program to rotate in clockwise and anticlockwise direction at a speed of 150 RPMs
19. Design a water level controller using AVR Atmega 32 in a) timer mode of operation and sensor mode of operation(I/O programming)
20. Design an interfacing of alphanumeric display with AVR Atmega 32 and generate all numbers from 0 to 9 and all letters from A to Z with a time duration of 1 second.
21. Establish Serial Communication between two MSP 430 microcontrollers
22. Write a program to interface an LED to the port 2 of MSP 430 microcontroller. Use both conditions of active low and active high in program.
23. Write a program to generate PWM pulses of 1kHz using MSP 430 microcontroller at a varying duty cycle of 10 % to 90 %.
24. Interface MSP 430 microcontroller with a matrix keyboard and display different characters on LCD
25. Using Arduino interrupt programming concept, interface a push button switch with it and switch on and off an LED lamp of 230V AC/10 W.
26. Design a PWM speed control system of 12V DC motor using Arduinoand run it at a speed of 10 % to 100%..
27. Write a program to generate saw tooth waveform of frequency 1kHz with Arduino.
28. Design a traffic light controller using Arduino in timer mode for four roads. Use 3 LEDs, Red, Green and Yellow in each direction.

B.E. FOURTH SEMESTER

ANALOG AND DIGITAL COMMUNICATION

Subject Code: BEETC-402T/BEEN-402T/BEEN-402T Credits 04
Teaching Scheme Lectures (including activity based learning): 3 Hours/ Week
Examination Scheme T (U): 70 Marks, T (I): 30 Marks
Tutorial: 1 Hours / Week
Duration of University Exam. : 03 Hrs

Course Objectives: -

The objective of this course is to provide students with understanding of

1. The basic principles and techniques used in analog and digital communications.
2. Analog and digital modulation techniques, communication receiver and transmitter design, baseband and band pass communication techniques, line coding techniques, noise analysis, and multiplexing techniques.
3. Analytical techniques to evaluate the performance of communication systems.

Course Outcomes: -

Upon completion of this course, students will demonstrate the ability to:

CO1: Demonstrate a basic need of modulation and various types of amplitude and angle modulation techniques required for analog communication.

CO2: Analyze various AM-FM receivers, along with the effect of noise on analog communication systems.

CO3: Explain the designing of digital communication systems by applying knowledge of the various pulse modulation techniques.

CO4: Describe various digital modulation techniques and various parameters associated withit.

CO5: Identify different types of channel coding techniques and analyze the different spread spectrum methods.

UNIT I: AMPLITUDE MODULATION: (14Marks)

Need for modulation, Amplitude Modulation (AM), DSBSC, SSB, VSB and ISB transmissions, mathematical Analysis, modulation index, frequency spectrum, power requirement of these systems, AM Generation: Generation of DSBFC - Plate Modulated Class-C Amplifier.Concept of Angle modulation, Types of Angle Modulation, frequency spectrum, Narrow band & wide band FM, Modulation index, Bandwidth, Phase Modulation, Generation of FM (Direct & Indirect Method), Comparison of FM and PM. Pre-emphasis and De-emphasis.

UNIT II: AM & FM RECEIVERS: **(14Marks)**
AM Detection: Demodulation of DSBFC – Square Law Detector, Envelope Detector, Demodulation of DSBSC - Synchronous Detector, Demodulation of SSBSC. FM Receivers: Super-heterodyne Receiver: Block Diagram, Performance Characteristics - Sensitivity, Selectivity, Fidelity, Foster Seeley FM Discriminator .Types of Noises. Signal to Noise Ratio. Noise Figure.

UNIT III: DIGITAL COMMUNICATION :**(14Marks)**
Sampling theorem, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect. Pulse Analog modulation: PAM PWM & PPM.
PCM – Generation & reconstruction, Bandwidth requirement of PCM. Differential PCM, Delta Modulation & Adaptive DM. Companding in PCM.

UNIT IV: DIGITAL MODULATION TECHNIQUES: **(14Marks)**
Introduction to Digital Modulation Techniques ASK , PSK, FSK,QPSK, MSK, DPSK, OFDM. Introduction to information theory, channel capacity, Huffman, Prefix code, and LZ encoding algorithm. Rate distortion theory for optimum quantization, scalar and vector quantization.

UNIT V: REVIEW OF CHANNEL CODING AND SPREAD SPECTRUM: **(14Marks)**
Linear block codes, cyclic codes convolution encoding and decoding,Viterbi algorithm and Fano algorithm. Trellis coded modulation methods. Study of PN sequences, direct sequence methods, slow and fast Frequency hop methods. Application of spread spectrum, CDMA.

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1. All Experiments are from Virtual Labs
2. At least 1 experiment activity should be conducted from every unit.
3. Some additional simulation-based activities feasible to be executed in classrooms can be added by the course teachers
4. At least 10 activities to be conducted in every course in classroom
5. Course faculty is permitted to use any other open source or licensed platform in classroom.
6. Course faculty can add any other activity as per the feasibility in classroom-based teaching learning process.

Suggested List

1. To calculate modulation index by observation of AM wave
2. To study quantization
3. To study sampling theorem
4. To perform Lempel-Ziv encoding and decoding.
5. To perform convolution encoding and decoding.
6. Simulation of a Satellite Network

   Satellite | Simulating a Satellite network in ns2 | Geostationary satellite nodes | Terminal nodes | Polar orbiting satellite nodes(Non-geostationary satellite) | Satellite links | Handoffs | Routing | Structure of trace files in Satellite network

7. Simulating a Wi-Fi Network

   Wi-Fi Networks | IEEE 802.11 Standards | Hardware Requirements for Wi-Fi | How to connect to the Wi-Fi Networks? | Advantages of Wi-Fi | Limitations | MAC Protocols | Use of RTS/CTS to Exchange Data | Issues in Wi-Fi Networks | The Hidden Terminal Problem | Solution of Hidden Terminal Problem | Exposed Terminal Problem | Solution to the Exposed Terminal Problem | Simulating a Wi-Fi using Network Simulator 3

8. Simulating a Wireless Sensor Network

   Wireless Sensor Networks | Basic Characteristics of WSNs | Operating Systems for WSNs | Differences with Mobile Ad hoc Networks | Types of Wireless Sensor Networks | Routing protocols for WSNs | Clusters and Cluster heads in WSNs | The LEACH Protocol | Operation of LEACH | Discussions on LEACH | Applications of WSNs | Simulating a WSN using Network Simulator 2

9. Setting up a Bluetooth Network

   Bluetooth Network | Who started Bluetooth ? | Bluetooth vs Wi-Fi | Bluetooth – Power Classes | Bluetooth - Versions | How does Bluetooth work ? | Networking of Bluetooth | How to connect Bluetooth ? | Simulating Bluetooth Network with NS-2

10. Setting up a ZigBee Network

    ZigBee Network | IEEE 802.15.4 and ZigBee | ZigBee vs. Bluetooth | Features & Characteristic of ZigBee Technology | Application of ZigBee Technology | Component of IEEE 802.15.4 LR-WPAN | Network Topologies | ZigBee Architecture | The Superframe structure | Nodes Configuration | Energy Model

Web links:

1. https://vlab.amrita.edu/index.php?sub=59&brch=163
2. http://vlabs.iitkgp.ac.in/ant/

Text Books

1. Communication Systems - B.P Lathi, BS Publication
2. Lathi B.P. - Modern Digital and Analog communications systems - PRISM Indian Ed.
3. Simon Haykin, “Digital Communication Systems”,JohnWiley&Sons,

Reference Books:

1. P Ramkrishna Rao, Digital Communication, McGraw-Hill Publication
2. J.G. Proakis, Digital Communication.
3. S. Haykin, Communication Systems
4. Leon W. Couch: Analog/Digital Communication, 5thEdition, PHI,2008

B.E. FOURTH SEMESTER

Analog and Digital Electronics Lab

Subject Code: BEETC-403P/BEEN-403P /BEEC-403P Credits 01
Teaching Scheme Lectures: 2 Hours/ Week
Examination Scheme P (U): 25 Marks, P (I): 25 Marks

Course Objectives:

The course objectives are:

1. To impart practical concepts of different analog and digital electronics circuits
2. To understand the basic fundamentals of analog and digital circuits.

Course Outcomes:

After the completion of practicals, the students will

1. Study the practical aspects of linear and non-linear applications of OP-AMP.
2. Design the various wave-shaping circuits, oscillators, signal conditioners and various application based circuits using OP-AMP and Transistors
3. Study various concepts of analog communication
4. Study various concepts of digital communication.
5. develop an application based project using industry based OPAMP

Instructions:-

1. Minimum 9 practicals including miniproject (3 from Analog Electronics Section, 2 from Analog Communication category, 3 from digital communication category)
2. One mini project to be developed with simulation and hardware on a general purpose or etched PCB. Use OPAMPs popularly used in Industry such LM324, LM 2902, LM 358, MC3403. A communication based miniproject can also be developed.
3. Perform Simulation of all experiments using any open-source or licensed software.

List of Experiments:
Analog Electronics

1. To use OPAMP for switching on and off a 230 V AC bulb of min 20W by designing necessary circuit
2. To use OPAMP for speed control of a 5V DC motor
3. To use OPAMP as an amplifier for amplifying thermocouple voltage to proportionate 12V DC
4. To use OPAMP as a current to voltage converter for amplifying solar cell signal
5. To use OPAMP as a voltage to current converter for converting 0-10V Dc to 4-20 mA DC
6. To use OPAMP as a triangular wave generator of frequency 5kHz
7. Use of OPAMP as PWM wave generator for frequency 10kHz and varying duty ration of 10% to 90 %
8. Use of OPAMP to generate switching pulses for a Power BJT with 15V DC

9. To use OPAMP as a digital latch with single switch and two switches and use it to for switching of a 230V/10 W LED bulb
10. To design load cell amplifier using concept of instrumentation amplifier and associated noise handling circuit
11. Design of an RTD amplifier and calibrate its gain with zero offset adjustment
12. To study and Design of a Voltage to frequency converter with linearity
13. To study and Design of a frequency to voltage converter with linearity
14. To design OP-AMP as Integrator and Differentiator and plot its input/output waveforms.
15. To design OP-AMP as Precision Half wave rectifier and plot the waveforms.
16. Design and verify Multivibrator circuits using IC 555 and generate switching pulses of 1kHz at different duty ratios for SMPS switching application
17. Design RC oscillator/ transistorized LC oscillator using OP-AMP and calculate its frequency.
18. Design first & second order low pass Butterworth filer with a cutoff frequency of 1kHz.
19. Design of series voltage regulators of 12V/5V DC with a current capacity of 500mA

Analog Communication for Mini Project

1. To calculate modulation index by observation of AM wave
2. To study quantization .
3. To study sampling theorem
4. To study companding
5. To study DSBSC transmitter and receiver.
6. To study time division multiplexing
7. To study Frequency modulation and compute the modulation index
8. To study FM generation using MATLAB
9. To study AM generation using MATLAB.

Digital Communication for Mini Project

1. To write SCILAB code for BASK modulation/demodulation.
2. To write SCILAB code for BFSK modulation/demodulation.
3. To write SCILAB code for BPSK modulation/demodulation.
4. To generate a Differential Binary Phase Shift Keying signal using PSK modulator and detect the message signal from DBPSK signal using PSK demodulator using SIMTEL.
5. To generate a Minimum Shift Keying signal and detect the message signal from MSK signal using SIMTEL.
6. Open Problem Statement 1: Prepare/Analyze any Digital Communication System /Any other system using XCOS.
7. To perform Lempel-Ziv encoding and decoding.
8. To perform convolution encoding and decoding.
9. To perform OFDM Transmission and Reception.
10. To perform CDMA-DSSS Transmission and Reception.

Some examples are of Mini projects are as follows

1. A Variable Audio Frequency Oscillator Using Op-amp
2. Adjustable Ripple-Regulated Power Supply Using OPAMP
3. Automatic Fence Lighting with Alarm
4. Auto-cut for Manual Stabilizers using IC

5. Automatic Light Operated Switch Using LDR and OPAMP
6. Bass Booster Using Op-amp
7. Battery Voltage State Indicator using
8. DC Volt Polarity Indicator Using IC
9. DIY Headphone Amplifier
10. Dual Trace Generator Circuit
11. Electronic Room Thermometer Using Op-amp
12. Four Channel Audio Mixture
13. High/Low Voltage Cut-out Using Op-Amp
14. Laser Based Communication Link
15. Light Sensor Switch Circuit using LDR
16. Listening Bug Using op-amp
17. Microphone Amplifier Using Op-amp
18. Operational Amplifier Tester
19. Sound Operated Intruder Alarm with Flash
20. Sort Circuit Protected Regulated Power Supply Using
21. Steam Whistle Circuit using IC
22. Temperature Deviation Indicator Using
23. Thermal Touch Switch Using Op-amp
24. Tone Control for Guitar Amplifier Using
25. Voltage into Frequency Converter
26. Wind Sound Generator Using IC
27. Sound detector circuit using op-amp
28. Electronic Fuse using OP-amp

B.E. FOURTH SEMESTER

ANALOG SYSTEM DESIGN

Subject Code: BEETC-404T/BEEN-404T/BEEC-404T Credits 04
Teaching Scheme Lectures (including activity based learning):3 Hours/ Week
Examination Scheme T (U): 70 Marks, T (I): 30 Marks
Tutorial: 1 Hour / Week
Duration of University Exam. : 03 Hrs

Course Objectives:

The objective of this course is to provide students with understanding of

1. To understand characteristics of various Analog Circuits.
2. To study and interpret the datasheet.
3. To design and analyze linear and nonlinear applications of Op-Amp.
4. To design DC regulated power supply.
5. To design RC & LC oscillators.
6. To design RC Filters and drivers.

Course Outcomes:

Upon completion of this course, students will demonstrate the ability to:

1. Understand and explain the basic concepts of OPAMP.
2. Demonstrate the working principle of various analog circuits.
3. Analyze analog circuits to evaluate various performance parameters.
4. Design Op-Amp based circuits.
5. Design DC Power Supply.
6. Design Oscillators, filters and drivers.

Course Contents:

UNIT-1: INTRODUCTION TO OPERATIONAL AMPLIFIER(14Marks)
Op-Amp Fundamentals: Block diagram of operational amplifier, Differential amplifiers using transistors. Op-Amp parameters, virtual ground concept, Ideal OP-Amp, Equivalent circuit, Voltage Transfer curve, Inverting & non inverting configurations.

UNIT-II: OP-AMP LINEAR APPLICATIONS(14 Marks)
Voltage follower, Summing amplifier, scaling and averaging amplifier, Instrumentation amplifier and applications, Integrator and differentiators, current to voltage converters, voltage to current converters, Peak detector, Log and antilog amplifiers and analog multipliers.

UNIT-III: OP-AMP NON LINEAR APPLICATIONS (14Marks)
Comparators, Schmitt trigger, Precision Rectifier. Multivibrators: Bistable, Monostable, Astable using Op-Amp, Sample/Hold circuits, 555 Timer and its applications, Phase lock loops.

UNIT-IV: DESIGN OF DC POWER SUPPLY(7 Marks)

Unregulated D.C. power supply system with rectifiers and filters, Design of series voltage regulators, Design of regulators using IC 78×× and 79××, protection circuitsfor regulators, Design of SMPS (Buck & Boost)

UNIT-VI: DESIGN OF SINUSOIDAL OSCILLATORS, FUNCTION GENERATOR and FILTERS (14 Marks)

OPAMP based Wein Bridge and Phase Shift oscillators, Transistorized Hartley &Colpitts oscillator, Crystal oscillators, Evaluation of figure of merit for all above oscillator circuits. Design of Butterworth Active Filters LPF, HPF, BPF, BRF etc,

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1. All Experiments are from Virtual Labs
2. At least 1 experiment activity should be conducted from every unit.
3. Some additional simulation-based activities feasible to be executed in classrooms can be added by the course teachers
4. At least 10 activities to be conducted in every course in classroom
5. Course faculty is permitted to use any other open source or licensed platform in classroom.
6. Course faculty can add any other activity as per the feasibility in classroom-based teaching learning process.

Suggested List

1. Log and antilog amplifiers
2. Voltage comparator
3. Wien bridge oscillator using operational amplifier
4. Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50mA
5. Voltage to current converters
6. Function generator using operational amplifier (sine, triangular & square wave)
7. Astable and monostablemultivibrator using IC 555
8. Study of basic properties of Operational Amplifier: Inverting and Non-Inverting Amplifiers
9. Study of Differentiator and Integrator using Operational Amplifier**

10. Non linear circuits using OPAMPs
11. Active filters

Web links:

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/analog-electronics/experimentlist.html
2. http://vlabs.iitkgp.ernet.in/be/index.html#
3. https://ee-iitb.vlabs.ac.in/index.html

Text Books:

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.
4. N. C. Goyal and Khetan 'A Monograph on Electronics Design Principals', Khanna Publications
5. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits"**,** McGraw Hill.

Reference Books:

1. Linear Integrated Circuits Manual I, II, and III: National Semiconductor.
2. Linear Applications Handbook National Semiconductors.
3. Regulated Power supply Handbook. Texas Instruments.
4. Electronics: BJT's, FETS and Microcircuits – Anielo.
5. Operational Amplifier Design and Applications Tobey, Graham, Huelsman McGraw Hill.

B.E. FOURTH SEMESTER

DATA STRUCTURE & ALGORITHMS

Subject Code: BEETC-405T/BEEN-405T/BEEC-405T Credits:03
Teaching Scheme Lectures(including activity based learning): 3 Hours/ Week
Examination Scheme: T (U): 70 Marks, T (I): 30 Marks
Duration of University Exam. : 03 Hrs

Course Objectives:

1. To make students understand efficient storage structures of data for an easy access.
2. To teach the difference between linear &non linear data structures and its respective benefits
3. To design and implement various data structures.
4. To develop application using data structures and algorithm and analysis.
5. To improve the problem solving efficiency.

Course Outcomes:

1. Student will be able to choose appropriate data structure based on the specified problem definition and analysis the algorithm.
2. Student will be able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
3. Students will be able to apply concepts learned in various domains like Operating Systems, DBMS etc.
4. Students will be able to use linear and non-linear data structures like stacks, queues, linked list, trees etc.

Course Contents:

UNIT I: Data Structures (7Marks)

Introduction to Data Structures, Need of Data Structure, Abstract Data type, Types of Data StructuresAlgorithms: Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations (Big O, Omega Ω, Theta θ), Time-Space trade-off.Searching- Linear & Binary Search, Sorting- Bubble Sort, Insertion Sort, Selection Sort, Algorithm design strategies - Divide and Conquer strategy, Merge Sort, Quick Sort, complexity analysis of sorting methods.

UNIT II: Abstract Data Types (ADTs) Arrays (8 Marks)

Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Application of arrays
Stacks- Introduction, PUSH and POP operations on Stacks, Prefix, Infix & Postfix expressions- Conversion and Evaluation, Multiple Stacks.
Queues- Introduction, Insertion & deletion in Queues, Circular Queues, Priority Queues.

UNIT III: Linked List- Linked List as ADT (7Marks)

Dynamic Memory Allocation Functions, Types of Linked Lists- (single, double, circular), Operations on Linked Lists- (create, insert, delete, reverse etc.), Applications of Linked List- Polynomial Representation (Addition/deletion/multiplication of two polynomials). Trees- Introduction, Implementation of Trees, Tree Traversals with an Application, Binary Trees, BST- Insertion & Deletion, Expression Trees, AVL Trees, Heap Trees.

UNIT IV: Graphs (7 Marks)

Graphs- Data Structures for Graphs, Graph Traversals Directed Graphs, Graph Storage Structures (Adjacency Matrix, Adjacency List) Weighted Graphs, Shortest Paths, and Minimum spanning Trees. Applications of DFS and BFS.
HASING TECHNIQUES
Symbol Tables: static tree tables, dynamic tree tables, hash tables, hash functions, Collision resolution, overflow handling, Applications

UNIT V: ALGORITHMS (7Marks)

Advanced algorithms based on the data structures. Shortest-Path Algorithms, Dijkstra's Algorithm, Graphs with Negative Edge Costs, Acyclic Graphs, Network Flow Problems, Matrix Chain Multiplication, Longest Common Subsequence, Optimal Binary Search Tree, Backtracking strategy - 4 queens problem, Hamiltonian Path.

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1) All Experiments are from Virtual Labs
2) At least 1 experiment activity should be conducted from every unit.
3) Some additional simulation based activities feasible to be executed in classrooms can be added by the course teachers
4) At least 10 activities to be conducted in every course in classroom
5) Course faculty is permitted to use any other open source or licensed platform in classroom.
6) Course faculty can add any other activity as per the feasibility in classroom based teaching learning process.

Suggested List:

1. Number Systems
2. Expression Evaluation using Stacks
3. Sorting using Arrays
4. Polynomials via Linked Lists
5. Search Trees
6. Expression Trees
7. Graph Traversals
8. Shortest Paths in Graphs
9. Minimum Spanning Trees
10. Bubble Sort
11. Merge Sort
12. Heap Sort
13. Quick Sort
14. Depth First Search
15. Breadth First Search
16. Tree Traversal
17. Binary Search Trees
18. Stacks and Queues
19. Infix to Postfix
20. Unsorted Arrays
21. Hashtables
22. Linked lists
23. Polynomial Arithmetic using linked lists
24. Selection Sort
25. Radix Sort
26. Topological Sort
27. Minimum Spanning Trees
28. Path algorithms: Dijkstra's shortest path
29. 2-3 Tree
30. Red Black Tree
31. Tries and Suffix Trees
32. Substring search: KMP algorithm

Text books:

1. Data Structures with C, Seymour Lipschutz, Schaums Outlines, Tata McGraw Hill Education.
2. Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed.
3. Data Structures using C and C++ by Y. Langsam, Pearson Education.
4. Data Structures using C by Tanenbaum, Pearson Education
5. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson

Reference books:

1. Data Structures and program design in C by Robert Kruse, Bruce Leung & Clovis Tondo.
2. Data Structures: A Pseudocode Approach with C by Richard F. Gilberg and BehrouForouzan.
3. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, SartajSahni,Computer Science Press.

4. Introduction to Algorithms, by Thomas Corman III edition, PHI
5. Analysis and Design of Algorithms: A Beginner's Approach, by Rajesh K. Shukla, Willey Publications
6. “Algorithms, Data Structuresand Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.

B.E. FOURTH SEMESTER

Numerical Mathematics and Probability Using MATLAB

Subject Code: BEETC-406T/BEEN-406T/BEEC-406T Credits 03
Teaching Scheme Lectures(including activity based learning): 3 Hours/ Week
Examination Scheme: T (U): 70 Marks, T (I): 30 Marks
Duration of University Exam. : 02Hrs

Course Objectives:

1. A primary objective is to introduce and develop advanced mathematical skills of students that are imperative for effective understanding of engineering subjects.

2. The topics covered will equip them with the techniques to understand advanced level Mathematics and its applications that would enrich logical thinking power.

Course Outcomes:

After completing the course, students will be able to

1. Learn and use MATLAB effectively in various applications as a simulation tool.

2. Find an approximate solution of algebraic and transcendental equations, system of linear equations and first order ordinary differential equations by various numerical methods and MATLAB commands.

3. Apply Z- transform to solve difference equations with constant coefficients.

4. Analyze real world scenarios to recognize when probability is appropriate, formulate problems about the scenarios; creatively model these in order to solve the problems using multiple approaches

5. Understand the impact of scientific and engineering solutions in a global and societal context.

6. Create the groundwork for post-graduate courses, specialized study, and research in mathematics.

Course Contents

Unit I: INTRODUCTION TO MATLAB (14 Hours)

Introduction, What is MATLAB?, The MATLAB system, MATLAB documentation, Starting and quitting MATLAB, MATLAB desktop matrices, array matrices and magic squares, MATLAB Expressions, Controlling command window input and output, Graphics overview of MATLAB plotting, Types of functions.

Unit II: NUMERICAL METHODS - I (14 Hours)

Error Analysis, Solution of Algebraic and Transcendental Equations: Method of False position, Newton–Raphson method and its convergence, Basic MATLAB command “fzero” to find real roots of f(x) = 0. Solution of system of simultaneous linear equations: Crout’s method (LU decomposition Method), Gauss-Seidel method, MATLAB Built-in function for LU and Gauss-Seidel method.

Unit III: NUMERICAL METHODS - II (14 Hours)

Numerical solution of ordinary differential equations: Taylor's series method, Euler’s modified method, Runge- Kutta 4th order method, Milne’s predictor corrector method, RungeKutta method to solve simultaneous first order differential equations, Introduction of MATLAB commands for solving ordinary differential equations.

Unit IV: Z-TRANSFORM (14 Hours)

Definition, Convergence of Z-transform and properties (Statement only), Inverse Z-transform by partial fraction method, Residue method (Inversion integral method), Convolution of two sequences, Solution of difference equations with constant coefficients by Z-transform, Use of MATLAB commands ztrans(f), ztrans(f, transVar), ztrans(f, var, transVar).

Unit V: PROBABILITY (14 Hours)

Review of discrete and continuous random variables, Mathematical expectation, Variance and Standard deviation, Moments, Moment generating function, Skewness and Kurtosis, Binomial distribution, Poisson distribution, Normal distribution, Exponential distribution, Use of MATLAB functions for numerical solution of special probability distributions.

Text/Reference Books:

(1) Applied Numerical Methods Using MATLAB (Wiley), Won Y. Yang, Wenwu Cao, Jaekwon Kim, Kyung W. Park, Ho-Hyun Park, JingonJoung, Jong-Suk Ro, Han L. Lee, Cheol-Ho Hong, TaehoIm.

(2) Numerical Methods Using MATLAB (PHI), John H. Mathews, Kurtis D. Fink.

(3) Numerical Methods for Engineers and Scientists (An introduction with Applications Using MATLAB) (WILEY), Amos Gilat, Vish Subramanian.

(4) Higher Engineering Mathematics (Khanna Publications), B. S. Grewal.

(5) Advanced Engineering Mathematics (Wiley), Erwin Kreyszig.

(6) Advanced Engineering Mathematics (S. Chand), H. K. Dass. (7) Probability and Statistics (Schaum's Outline Series), Murray Spiegel, John Schiller, R. A. Srinivasan

B.E. FOURTH SEMESTER

Programming for Problem Solving

Subject Code: BEETC-407T/BEEN-407T/BEEC-407T Credits 02
Teaching Scheme Lectures(including activity based learning): 2 Hours/ Week
Examination Scheme: T (U): 35 Marks, T (I): 15 Marks
Duration of University Exam. : 02Hrs

Course Objectives

1. To understand the basic concepts of Object Oriented Programming.
2. To implement the concepts of Inheritance in Problem solving.
3. To apply the concepts of Polymorphism and Interfaces.
4. To implement the concepts of Exception Handling
5. To design and implement program using file system.

Course Outcomes

1. Student will be able to understand the basic concepts of Object Oriented Programming and design simple java programs.
2. Student will be able to apply the knowledge of Inheritance in program development.
3. Student will able to develop programs using polymorphism and interfaces.
4. Student will be able to handle various exceptions using concepts of exception handling.
5. Student will able to use multithreading concepts to develop inter process communication.
6. Student will be able to understand and implement concepts on file streams and operations in java programming for a given application programs.

Course Contents

Unit-1 Introduction (4Hrs)

Introduction: Features of Java, Byte Code and Java Virtual Machine, JDK, Data types, Operator, Control Statements – If , else, nested if, if-else ladders, Switch, while, do-while, for, for-each, break, continue, Methods.

Unit 2: Classes and Objects (5Marks)

Class, Object, Object reference, Constructor, Constructor Overloading, Method Overloading, Recursion, Passing and Returning object form Method, new operator, this and static keyword, finalize() method, Access control, modifiers, Nested class, Inner class, Anonymous inner class, Abstract class.

Unit 3: Inheritance and Polymorphism (5Marks)

Use of Inheritance, Inheriting Data members and Methods, constructor in inheritance, Multilevel Inheritance – method overriding, Handle multilevel constructors – super keyword, Stop Inheritance - Final keywords.

Polymorphism: dynamic binding, method overriding, abstract classes and methods;

Unit-4: Interfaces and Packages (5Marks)

Interface: Interfaces vs. Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references, extending interface.

Packages: Defining, creating and accessing a package, understanding Class path, importing packages.

Unit-5: Exception Handling and I/O Streams (5 Marks)

Exception Handling: Benefits of exception handling, the classification of exceptions , exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re-throwing exceptions, GUI components in Java, Introduction to Database Connectivity.

I/O Streams: Concepts of I/O streams, Reading console Input and Writing Console output, File Handling.

Continuous Assessment (Internal Marks) evaluation guidelines:

1. A total mark allotted for internal marks is 30. Out of this, 10 marks shall be exclusively allotted to activity-based learning.
2. Remaining 20 marks can be based on continuous tests/ examinations, assignments etc. as per internal mark policy of the institute.

Activity Based Learning

Instructions for Activity Based Learning

1) All Experiments are from Virtual Labs
2) At least 1 experiment activity should be conducted from every unit.
3) Some additional simulation based activities feasible to be executed in classrooms can be added by the course teachers
4) At least 10 activities to be conducted in every course in classroom
5) Course faculty is permitted to use any other open source or licensed platform in classroom.
6) Course faculty can add any other activity as per the feasibility in classroom based teaching learning process.

Suggested List:

1. Accessing Instance and Variables
2. Parameterized Constructors
3. Reference Datatypes
4. Static variables

5. Enhanced Loop in Java
6. Concatenating Strings
7. String Methods
8. foreach loop
9. Call by value
10. Method Overloading
11. Command Line Arguments
12. Reading and Writing Files
13. Directories in Java
14. Exception Hierarchy
15. Multiple Catch Blocks
16. Finally Block
17. extends keyword
18. super keyword
19. Abstract class and methods
20. Implementing and Extending Interfaces
21. import keyword
22. Creating Packages

Text books:

1. Herbert Scheldt, "Java the complete reference", McGraw Hill, Osborne, 7th Edition, 2011.

Reference Books:

2. T. Budd, "Understanding Object- Oriented Programming with Java", Pearson Education, Updated Edition (New Java 2 Coverage), 1999.

B.E. FOURTH SEMESTER

Programming and Data Structure Lab

Subject Code: BEETC-407P/BEEN-407P/BEEC-407P Credits 02
Teaching Scheme Lectures: 4 Hours/ Week
Examination Scheme T (U): 25 Marks, T (I): 25 Marks

Course Objectives:

The course objectives are:

1. To understand the basic concepts of Object Oriented Programming.
2. To implement the concepts of Inheritance in Problem solving.
3. To apply the concepts of Polymorphism and Interfaces.
4. To implement the concepts of Exception Handling
5. To design and implement various data structures.
6. To develop application using data structures and algorithm and analysis.

Course Outcomes:

After the completion of practicals, the students will be

1. Able to choose appropriate data structure based on the specified problemdefinition and analysis the algorithm.
2. Able to handle operations like searching, insertion, deletionand traversingmechanism etc. on various data structures.
3. Apply the knowledge of Inheritance in program development.
4. Develop programs using polymorphism and interfaces.
5. Handle various exceptions using concepts of exception handling.

List of Experiments:

1,2. Practicals based on Introduction to Problem Solving
3. Practicals based on classes and objects
4. Practicals based on Inheritance
5,6. Practicals based on Polymorphism
7. Practicals based on Exception Handling
8,9. Practicals based on IO streams and File handling.
10.Practicals based on Stacks & Queues using Arrays
11. Practicals based on Linked Lists
12. Practicals based on Stacks & Queues using Linked Lists
13. Practicals based on Binary Search Trees
14. Practicals based on Graphs
15.Practicals based on Spanning trees