Total Contact Hours= 22 **Total Marks= 800** **Total Credits= 24**

Semester 5th		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BECES1-501	Microprocessors & Microcontrollers	3	1	0	40	60	100	4
BECES1-502	Information Theory & Coding	3	1	0	40	60	100	4
BECES1-503	Control System & Applications	3	1	0	40	60	100	4
BECES1-504	Control Systems Lab	0	0	2	60	40	100	1
BECES1-505	Microprocessors & Microcontrollers Lab	0	0	2	60	40	100	1
BECES1-506	Training- II*	-	-	-	60	40	100	4
BECED1-5XX	Departmental Elective-I	3	0	0	40	60	100	3
XXXXX	Open Elective	3	0	0	40	60	100	3
Departmental Elective - I (Select any one)								
BECED1-511	Antenna and Wave Propagation							
BECED1-512	VHDL Design							
BECED1-513	Computer Architecture							
BECED1-514	Industrial Automation							
Total		15	3	4	380	420	800	24

***Note:** During the summer vacation after 4th semester.

MICROPROCESSORS & MICROCONTROLLERS					
Subject Code: BECES1-501	**L**	**T**	**P**	**C**	**Duration: 60 Hrs.**
	3	1	0	4	

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the architecture, programming of microprocessor and microcontroller along with interfacing with peripherals:

1. To understand the architecture of various microprocessor and microcontroller.
2. To understand interfacing of microprocessor with memory and peripheral devices.
3. To learn assembly language programming for 8 bit microprocessors and microcontrollers.
4. To apply the interfacing and programming techniques of microprocessors and microcontrollers in practical problems/projects.

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

1. To learn architecture of microprocessors 8085 & 8086 and microcontroller 8051.
2. To understand interfacing of microprocessor 8085 with memory and peripheral devices.
3. To write assembly language programs for 8 bit microprocessors and microcontrollers.
4. To apply and implement the interfacing and programming techniques of microprocessors and microcontrollers in various practical problems/projects.

UNIT-I (15 Hrs)

Introduction: Intel 8085 microprocessor architecture, Pin functions, Bus configuration, Timing diagram, Addressing modes, Instruction Format, Instruction set, I/O & memory interfacing, Counters, Time Delays, Stack and Subroutines, interrupts and assembly language programming.

UNIT-II (15 Hrs)

Interfacing I/O Devices: Interfacing I/O ports, PPI chips 8155 & 8255, Interrupt controller 8259, DMA and DMA controller 8237, Serial and parallel data transfer chips, case studies: Traffic Light control, LED display, Keyboard display interface

UNIT-III (15 Hrs)

Overview of 8086: Block diagram, architecture, pipelining, flag register, register bank operation, memory segmentation, addressing modes, concept of virtual memory, cache memory, Max and Min modes, Introduction to Processor architectures of– 80286, 80486 and Pentium.

UNIT-IV (15 Hrs)

Introduction to Microcontroller: Comparison of microcontroller and microprocessors, 8051 microcontroller - architecture and pin functions, flag bits and PSW register, SFRs, register banks, addressing modes, Memory Organization, I/O Ports and Circuits, Timers, Stack, Interrupts, Serial Communication, Interfacing of External Memory, Interfacing LCD & Keyboard,8051 instruction set and Programming.

Recommended Text Books / Reference Books:

1. R.S. Gaonkar, 'Microprocessor Architecture Programming and Applications with the 8085', Penram International Pub.

2. D.V. Hall, 'Microprocessor and Interfacing Programming and Hardware', McGraw Hill Co.
3. Barry B. Brey, 'The Intel Microprocessors, Architecture Programming and Interfacing', PHI Publications.
4. Mazidi Muhammad Ali, 'The 8051 Microcontroller and Embedded Systems', Pearson Publications.
5. John Uffenbeck, "The 80x86 Family: Design, Programming, and Interfacing, Pearson Publications.
6. Kenneth J. Ayala, 'The 8051 Microcontroller', Thomson Publishers.

INFORMATION THEORY AND CODING					
Subject Code: BECES1-502	**L**	**T**	**P**	**C**	**Duration: 60 Hrs.**
	3	1	0	4	

Course Objectives:

1. To give insight of the information in a source.
2. To give a thorough understanding of various coding schemes.
3. To provide the detailed knowledge of modeling of channels.
4. To create awareness about the error detection and correction

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Explain measure of information and entropy.
2. Model the continuous and discrete communication channels.
3. Describe the encoding and decoding for various codes.

UNIT-I (15 Hrs)

Information Theory: Introduction, Units of information, Mutual Information, Entropy, Rate of Information, Channel Capacity, Channel Capacity Theorem

Source Coding: Introduction, classification of codes, Source coding theorem, Kraft Inequality, Shannon-Fano Coding, Huffman coding, Extended Huffman coding, Lempel – Ziv Algorithm

UNIT-II (15 Hrs)

Information Channels: Introduction, channel models-channel matrix, joint probability matrix and Binary symmetric channel. Binary Erasure Channel, channel capacity of Lossless, deterministic, noiseless, and Binary symmetric channels. continuous channels, differential entropy

UNIT-III (15 Hrs)

Error Control Coding: Introduction, Need for error control coding, types of codes, coding gain

Linear Block Codes: matrix description of linear block codes, error detection and error correction capabilities of Linear Block codes, single error correcting hamming codes, Look up Table decoding approach

UNIT-IV (15 Hrs)

Cyclic Codes: Algebraic structure of cyclic codes, encoding using an (n-k) bit shift register, syndrome calculation, error detection and correction

Convolution Codes: Convolution encoder-connection diagram, Impulse response of encoder, Polynomial Representation, State Representation and State diagram, Tree diagram, trellis diagram, Disatnce properties of convolutional codes, Viterbi Decoding Algorithm

Recommended Text Books / Reference Books:

1. K. Sam Shammugam, “Digital and Analog Communication Systems”, John Wiley India Pvt Ltd, 1996.
2. Simon Haykin, “Digital Communication”, John Wiley India Pvt Ltd, 2008.
3. Muralidhar Kulkarni, K.S. Shivaprakasha “Information Theory and Coding”, John Wiley India Pvt Ltd, 2015.

4. Ranjan Bose, "ITC and Cryptography", Tata Mc Graw Hill, 2007.
5. J. Das, S.K. Mullick, P.K. Chatterjee, "Principles of Digital Communicationn", John Wiley.
6. K.N. Haribhat, D. Ganesh Rao, "Information Theory and Coding", Cengage Learning, 2017.

CONTROL SYSTEMS & APPLICATIONS					
Subject Code: BECES1-503	**L**	**T**	**P**	**C**	**Duration: 60 Hrs.**
	3	1	0	4	

Course Objectives:

1. To introduce the elements of control system and their modeling using various Techniques.
2. To introduce methods for analyzing the time response, the frequency response and the stability of systems
3. To introduce the state variable analysis method.
4. Design the compensation technique that can be used to stabilize control systems.

Course Outcomes: Upon completion of the course, students will be able to:

1. Perform time domain and frequency domain analysis of control systems required for stability analysis.
2. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
3. Express and solve system equations in state-variable form (state variable models).
4. Determine the (absolute) stability of a closed-loop control system
5. Apply root-locus technique to analyze and design control systems.

UNIT-I (15 Hrs)

Basic Concepts: Control system, Examples of control systems, Definitions, Classification, Relative merits and demerits of open and closed loop systems.

Mathematical Models of Control System: Linear and non-linear systems, Transfer function, Mathematical modelling of Electrical, Electronic & Mechanical, Analogies, Reduction of Multiple subsystems using Block diagram reduction techniques and signal flow graphs.

Control Components: DC servomotor, AC servomotor, Potentiometers, Stepper-motor, Synchros.

UNIT-II (15 Hrs)

Time Domain Analysis: Test signals, Time response, Transient response of first and second order systems time domain specifications, Steady-state errors and error constants, Response with P, PD, PI and PID types of controllers.

Frequency Domain Analysis: Frequency response and frequency domain specifications, correlation between time domain and frequency domain analysis.

UNIT-III (15 Hrs)

Stability Analysis of Control Systems: Concept of stability, Absolute and relative stability, Routh- Herwitz criterion for absolute stability. Root Locus method for analysis and design for transient response and stability. Frequency response plots: Bode Plots, Nyquist plots for stability analysis.

UNIT-IV (15 Hrs)

State Variable Analysis: Introduction, Concept of State variables & State models, State Space representation of linear continuous time systems. State models for linear continuous –time systems, State variables and linear discrete time systems, Solution of state equations, Concept of Controllability & Observability

Recommended Text Books / Reference Books:

1. Norman S Nise, “Control Systems Engineering”, John Wiley & Sons, Inc.
2. K. Ogata, 'Discrete time Control Systems', Prentice Hall International.
3. Nagrath and Gopal, 'Control System Engineering', New Age International.
4. Farid Golnaraghi, Benjamin C. Kuo, “Automatic Control Systems”, John Wiley & Sons, Inc.
5. Warwick, Kevin, 'An Introduction to Control Systems', World Scientific Publishing Co. Pvt. Ltd.
6. W.S. Levine, 'Control System Fundamentals', CRC Press.
7. Williams, Ivan J. Distefano, Joseph J. Stubberud, Allen R., 'Feedback and Control Systems', Schaum’s Outlines.

CONTROL SYSTEMS LAB					
Subject Code: BECES1-504	**L**	**T**	**P**	**C**	**Duration: 30 Hrs.**
	0	0	2	1	

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the various control systems along with their behavior in time and frequency domain.

1. To introduce methods for analyzing time and frequency response of control systems.
2. To design the compensation technique that can be used to stabilize control systems.
3. Apply root locus technique to analyze and design control systems.

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

1. Perform time domain and frequency domain analysis of control systems required for stability analysis.
2. Apply root-locus technique to analyze and design control systems.
3. Use servomotor and potentiometers for various control system applications.

LIST OF EXPERIMENTS

1. To develop elementary signal function modules for standard test signals.
2. Determine the step response of first order and second order systems with unity feedback.
3. To determine time domain specifications of a typical second order system.
4. To determine the frequency response of second order control system and evaluate its frequency domain specifications.
5. To plot Root Locus for a typical control system and to determine gain and phase margins using MATLAB control system toolbox.
6. To plot Bode Plot for a typical control system and to determine gain and phase margins using MATLAB control system toolbox.
7. To plot Nyquist Plot for a typical control system and to determine gain and phase margins using MATLAB control system toolbox.
8. To study and draw the speed-torque characteristics of a two-phase ac & dc servomotor.
9. To study the characteristics of potentiometers and to use 2-potentiometers as an error detector in a control system.
10. To use Synchros Transmitter-Receiver set as an error detector.

MICROPROCESSORS & MICROCONTROLLERS LAB

Subject Code: BECES1-505	L	T	P	C	Duration: 30 Hrs.
	0	0	2	1	

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the assembling language programming using 8085/8086/8051:

1. To introduce assembling language programming concepts.
2. To differentiate serial and parallel interface.
3. To interface different I/Os with microprocessor(s) and microcontroller.
4. Introduce the practical concepts to control speed of DC and stepper motor.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Interface different I/Os with processor.
2. Execute various assembling language programs in 8085/8051.
3. Write programs for 8051 micro controller kit.
4. Understand programs for speed control of stepper motor and DC motor.

LIST OF EXPERIMENTS

1. Study of 8085/8086 microprocessor(s) and 8051 microcontroller kits.
2. Write a program to add two 8-bit/16-bit numbers using 8085.
3. Write a program to subtract two 8-bit/16-bit numbers using 8085.
4. Write a program to multiply two 8 bit numbers by repetitive addition method using 8085.
5. Write a program to sort series using bubble sort algorithm using 8085.
6. Write a program to control the operation of stepper motor using 8085 microprocessor and 8255 PPI.
7. Write a program to add two numbers lying at two memory locations and display the result using 8051.
8. Write a Program to arrange 10 numbers stored in memory location in ascending and descending order using 8051.
9. Write a program of Flashing LED connected to port 1 of the microcontroller using 8051.
10. Write a program to generate a Ramp waveform using DAC with microcontroller using 8051.

DEPARTMENT ELECTIVE-I

ANTENNA AND WAVE PROPAGATION					
Subject Code: BECED1-511	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives:

1. To give insight of the fundamental concepts of antennas.
2. To give a thorough understanding of the radiation characteristics of different types of antennas.
3. To provide the detailed knowledge of antenna arrays and smart antennas.
4. To create awareness about the different types of propagation of radio waves at different frequencies

Course Outcomes: At the end of the course, students will demonstrate the ability to:

1. Understand the properties and various types of antennas.
2. Describe the radiation from a current element.
3. Analyze the properties of different types of antennas and their design.
4. Analyze the antenna arrays, aperture antennas and smart antennas.
5. Describe the different modes of wave propagation.

UNIT-I (10 Hrs)

Basic Concepts: Physical concept of radiation, Radiation Patterns, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Wires and Loops: Infinitesimal dipole, finite length dipole, half wave dipole, small circular loop, square loops.

UNIT-II (12 Hrs)

Broadband Antennas: Log periodic and Ygi-Uda antennas, frequency independent antennas, broadcast antennas.

Microstrip Antennas: Basic characteristics of microstrip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

UNIT-III (11 Hrs)

Antenna Arrays: Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extensions to planar arrays.

Fundamental Concepts of Smart Antennas: Concept and benefits of smart antennas, fixed weight beam forming, adaptive beam forming.

UNIT-IV (12 Hrs)

Wave Propagation: Modes of propagation, Structure of atmosphere, Ground wave propagation, Tropospheric propagation, Duct propagation, Troposcatter propagation, Flat earth

and Curved earth concept, Sky wave propagation – Virtual height, critical frequency, Maximum usable frequency – Skip distance, Fading , Multi hop propagation.

Recommended Text Books / Reference Books:

1. John D. Kraus and Ronald J. Marhefka, "Antennas for all Applications", Mc Graw Hill, 2005.
2. Constantine A. Balanis "Antenna Theory Analysis and Design", John Wiley, 2006.
3. Edward C. Jordan and Keith G. Balmain "Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2006
4. R. E. Collin, "Antennas and Radio wave Propagation", Mc Graw Hill, 1985.
5. K.D. Prasad, "Antennas and Wave Propagation", Satya Prakashan, Tech India Publications, New Delhi, 2001.
6. Robert S. Elliott "Antenna Theory and Design", John Wiley, 2006.
7. R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill 2005

VHDL DESIGN					
Subject Code: BECED1-512	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in VHDL Design:

1. To teach the students about CAD tools for digital system design.
2. To learn hardware description language VHDL for design of digital systems.
3. To model combinational and sequential digital systems using VHDL.
4. To learn and design dedicated and general-purpose microprocessor using VHDL.

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

1. Understand the hardware description language.
2. Model and design digital logic systems using VHDL.
3. Design of digital systems using ROMs, PALs, PLDs, etc.
4. Design and model dedicated and general-purpose microprocessor using VHDL

UNIT-I (10 Hrs)

Introduction: Introduction to computer-aided design tools for digital systems, hardware description languages, introduction to VHDL, identifiers, data objects and classes, data types, operators, operator overloading, type conversion, types of delays, entity and architecture declaration, different styles of VHDL modelling: behavioural, dataflow and structural models, packages & libraries.

UNIT-II (12 Hrs)

VHDL Statements: Concurrent and sequential statements**,** signal and variable assignment statements, conditional statements, case statements, if statements, wait statement etc., arrays and loops, resolution functions, aliases, generics.

UNIT-III (12 Hrs)

Combinational Circuit Design: VHDL models and simulation of combinational circuits such as adders and subtractors, multiplexers, demultiplexers, encoders, decoders, code converters, comparators, implementation of functions using ROMS, PLAs, PALs, CPLDs and FPGAs.

Sequential Circuit Design: Use of signed and unsigned data types for sequential circuit design, VHDL models and simulation of sequential circuits like latches and flip-flops, registers and shift registers, counters, application of shift registers as counters, Register files, Static Random Access Memory, larger memories.

UNIT-IV (11 Hrs)

Design of Microprocessor using VHDL: Overview of microprocessor, designing of datapaths; dedicated and general purpose, VHDL design of control unit, design of dedicated and general-purpose microprocessor using VHDL

Recommended Text Books / Reference Books:

1. IEEE Standard VHDL Language Reference Manual (1993)

2. "Fundamentals of Digital Logic with VHDL Design": Brown and Vranesic; TMH (2000)
3. "Digital Design & Modelling with VHDL & Synthesis": KC Chang; IEEE Computer Society Press.
4. "A VHDL Primmer": Bhasker; Prentice Hall 1995
5. "Digital System Design using VHDL", Charles. H. Roth; PWS (1998)
6. "VDHL-Analysis & Modelling of Digital Systems": Navabi Z; McGraw Hill
7. "VHDL Programming by Example" IV-Edition: Perry; TMH (2002)
8. "Introduction to Digital Systems": Ercegovac. Lang & Moreno; John Wiley (1999)
9. "Digital Logic and Microprocessor Design with VHDL", E. O. Hwang", Thomson Engineering.

COMPUTER ARCHITECTURE					
Subject Code: BECED1-513	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives: This course is meant to provide fundamental knowledge to students for understanding the basic principles of computers structure, its functioning, design, performance, and related issues

1. To make the students aware about the basic structure of computer.
2. To impart knowledge about the functioning of various computer blocks
3. To impart basic knowledge for design of hypothetical Computer

Course Outcomes: At the end of this course student will acquire the ability to:

1. Define the basic structure of a computer
2. Explain the principles of functional blocks of a computer
3. Analyze the performance of computers
4. Apply the knowledge to design a hypothetical computer

UNIT-I (10 Hrs)

Basic Functional Blocks of a Computer: CPU, memory, input-output subsystems, control unit; Von Neumann architecture, Computer function: instruction execution cycle; Performance issues and assessment, Clock and Instruction per cycle, Amdhal's law.

Data Representation and Computer arithmetic: Number formats, signed number representation, fixed and floating type representation, 1's and 2's complement addition and subtraction, Multiplication-shift-add, Booth multiplier, Division, Floating point arithmetic, IEEE 754 floating point formats

UNIT-II (13 Hrs)

Machine Instructions: Characteristics, Elements of Machine instruction, RTL representation of instructions, Types of instructions, addressing modes, Instruction set design, Instruction formats: Instruction length, allocation of bits, variable length instructions (Case study of x86 instruction formats), Assembly language: Stacks, Ques, Subroutines.

UNIT-III (12 Hrs)

Processor Organization: Register organization, ALU Design, CPU Control Unit design-Hardwired and micro-programmed design approaches, Case study - design of a simple hypothetical CPU

UNIT-IV (10 Hrs)

Memory Organization: Device characteristics, RAM, ROM, Memory management, concept of cache memory and associative memory, virtual memory

System Organization: input-output systems, I/O Transfer-program controlled, Interrupt driven, and DMA, Standard I/O interfaces

Recommended Text Books / Reference Books:

1. Wiiliam Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Pearson Education, 2010

2. Hayes, P.J., Computer Architecture and Organization, McGraw Hill (1998)
3. Mano M. M., Computer System Architecture, Pearson (2007)
4. Hennessy, L. J. and Patterson A. D., Computer Architecture: A Quantitative Approach, Elsevier (2007) 4th ed.
5. Leigh E. W. and Ali L. D., System Architecture: software and hardware concepts, South Western Publishing Co. (1988).
6. Carl Hamacher, Computer Organization, 5th Edition, Mc Graw Hill Publishers, 2002

INDUSTRIAL AUTOMATION					
Subject Code: BECED1-514	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives:

1. To make the students familiar about the industrial automation.
2. To provide understanding of computer aided measurement and control.
3. To provide the knowledge of detailed concepts of PLC and its applications.
4. To give awareness about the industrial automation using robots.

Course Outcomes: At the end of the course the students will be able to:

1. Understand various industrial automation components and control systems.
2. Explain architecture of industrial automation system.
3. Use Internet of Things for industrial automation.
4. Understand Programmable logic controllers, PLC programming, Advantage of using PLC for Industrial purposes.
5. Describe the overview of Industrial automation using robots.

UNIT-I (11 Hrs)

Introduction: Introduction: Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: modbus & profibus, Sensors & Actuators.

UNIT-II (12 Hrs)

Computer aided measurement and control systems: Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, process related interfaces, Industrial communication systems, Data transfer techniques, computer based data acquisition system, Internet of things (IoT) for plant automation.

UNIT-III (11 Hrs)

Programmable logic controllers: Programmable controllers, Programmable logic controllers, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT-IV (11 Hrs)

Distributed Control System (DCS): Overview of DCS, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

Overview of Industrial automation using robots: Basic construction and configuration of robot Pick and place robot, Welding robot.

Recommended Text Books / Reference Books:

1. Industrial Instrumentation and Control, By. S.K. Singh, Tata McGraw Hill.
2. Process Control Instrumentation Technology By. C.D. Johnson, PHI.
3. Industrial control handbook, Parr, Industrial Press.
4. Programmable logic controller, Dunning, Delmar.