Curriculum for Undergraduate Degree (B.Tech.) in Electronics and Communication Engineering (w.e.f. AY: 2020-21)

Part III: Detailed Curriculum

Fourth Semester

Course Name:	**Analog Communication**		
Course Code:	PC-EC401	**Category:**	Professional Core
Semester:	Fourth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Signals and Systems, PC-EC303
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To develop the basic concept of analog communication techniques.
2	To grow the knowledge of noise in communication system.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	***Introduction to Analog Communication*:** Elements of communication system - Transmitters, Transmission channels &receivers, Concept of Baseband signal, Concept of modulation, its needs.	4
2	***Continuous Wave Linear Modulation:*** (a)Time domain and frequency domain representation of signals, modulationindex , illustration of thecarrier and side band components; transmission bandwidth for AM;Phasor diagram of an AM signal;Calculation of Transmitted power & sideband power & Efficiency ;concept of under, over and critical modulation of AM-DSB-TC, single tone and multi-tone modulation. (b)Other Amplitude Modulations: Double side band suppressed carrier(DSBSC) modulation: time and frequency domain expressions,bandwidth and transmission power for DSB. Single side band modulation(SSB) both TC & SC and only the basic concept of VSB, Spectra andband-width.	5 4
3	***Generation & Detection of Amplitude Modulation:*** (a) Generation of AM: Concept of i) Gated and ii) Square law modulators, BalancedModulator. (b) Generation of SSB: Filter method, Phase shift method and the Third	7

	methodDemodulation for Linear Modulation:Demodulation of AM signals: Detection of AM by envelope detector,Synchronous detection for AM-SC, Effects of Frequency & Phase mismatch,Corrections. Principle of Super heterodyne receivers: Super heterodyningprinciple, intermediate frequency, Local oscillator frequency, image frequency.	
4	***Angle Modulation:*** (a) Frequency Modulation (FM) and Phase Modulation (PM): Time andFrequency domain representations, Spectralrepresentation of FM and PM for a single tone message, Bessel's functions andFourier series. ; Phasor diagram. (b) Generation of FM & PM: Narrow and Wide-band angle modulation, Basicblock diagram representation of generation of FM & PM, Concept of VCO &Reactance modulator. (c) Demodulation of FM and PM: Concept of frequency discriminators, Phase Locked Loop.	7
5	(a)Multiplexing:Frequency Division Multiplexing, Time Division Multiplexing, (FDM) (b)Stereo - AM and FM: Basic concepts with block diagrams	4
6	(i) Random Signals and Noise in Communication System: (a) Noise in Communication systems - Internal & External noise,Noise Temperature, Signal-to-Noise ratio, Whitenoise, thermal noise, Figure of Merit. b) Friss Formula, Introduction to Amplifier noise. c)Noise performance in Analog Communication systems: SNRcalculation for DSB/TC, DSB-SC, SSB-TC, SSB-SC & FM,	5
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Understand the need for modulation and type of modulation.
2	Compare between the different demodulation methods.
3	Apply the basic concepts of Multiplexing in time (TDM) and frequency (FDM).
4	Understand basic operation and application of Super heterodyne receiver.
5	Analyze the noise performance of different modulation technique .

Learning Resources:	
1	B. P Lathi: Modern Digital and Analog Communication Systems, 4th Edition, Oxford Series,2011
2	Analog and Digital Communications by Dr Sanjay Sharma, Kataria Publishers, 7th edition, 2017
3	Principles of Communication Systems by H. Taub and D.L.Schilling, Goutam Saha, TMH Publishing Co., 4th edition, 2017
4	Carlson and Crilly: Communication Systems, 5th Edition, Mc-Graw-Hill, 2011.
5	Communication Systems by Simon Haykin, Wiley, 4th edition, 2006

Course Name:	**Digital System Design**		
Course Code:	PC-EC402	**Category:**	Professional Core
Semester:	Fourth	**Credit**	3
L-T-P:	**3-0-0**	**Prerequisite**	Basic Electrical & Electronics Engineering ES-EE101
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Introduction to basic concept of different number system and their conversions.
2	Developing the concept of venn diagram, Logic gates,SOP,POS and K-Map for logic simplification.
3	Developing the knowledge of different combination and sequential circuits and their design.
4	Developing the conception of different converter circuit and logic families.

Course Contents:

Module No.	**Description of Topic**	**Contact Hrs.**
1	a) Data and number systems; Binary, Octal and Hexadecimal representation and their conversions ; BCD,ASCII, EBCDIC, Gray codes and their conversions; Signed binary number representation with r's and (r-1)'s complement methods. b) Venn diagram, Boolean algebra; Various Logic gates- their truth tables and circuits; Representation in SOP and POS forms; Minimization of logic expressions by algebraic method, K-map method	5 6
2	a) Combinational circuits- Adder and Subtractor circuits; Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator, Design of Combinational circuits using MUX, b) Memory Systems: RAM, ROM, EPROM, E^2PROM c) Design of combinational circuits-using ROM, Programming logic devices and gate arrays. (PLAs and PLDs)	5 4 4
3	Sequential Circuits- Basic memory element-S-R, J-K, D and T Flip Flops, Race around condition, Various types of Registers and counters , Design of synchronous and asynchronous counter , Irregular counter and design, Introduction to Finite State Machine (FSM) , Design of Sequence Detector using FSM.	6
4	a) Different types of A/D and D/A conversion techniques. b) Logic families- TTL, ECL, Tri-State Logic, MOS and CMOS, their operation and specifications.	4 6
Total		**40**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Understanding the different number system and their conversions.
2	Understanding the Venn diagram, logic gates, SOP,POS and K-Map for logic simplification.
3	Design and Analyze the modular combinational circuits
4	Design and Analyze sequential logic circuits.
5	Apply the combinational and sequential circuit understanding for the analyze of converter circuit and logic families.

Learning Resources:	
1	Digital Logic and Computer Design, Morries Mano, 2016, Pearson India
2	Modern Digital Electronics, R.P.Jain, 4th ,2010, Mc Graw Hill
3	Digital Electronics: Principles, Devices and Applications, A.K.Maini,2007, Wiley India
4	Fundamentals of Digital Circuits, A.Anand Kumar , 3rd, PHI
5	Digital Systems Principles and Applications, Ronald J. Tocci , Neal S.Widmer & **Gregory L. Moss**, 10th, 2007,Pearson
6	Digital Electronics Principles and Applications ,S.K.Mandal, 2010, Mc Graw Hill.
7	Digital Principles and Application, Leach, Malvino & Saha ,8th, Mc Graw Hill
8	Digital Fundamentals, Floyed & Jain ,8th,2005,Pearson

Course Name:	Microprocessors & Microcontrollers		
Course Code:	PC-EC403	**Category:**	Professional Core
Semester:	Fourth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	Basic Electrical & Electronics Engineering ES-EE101
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To introduce architecture and operation of microprocessor and microcontroller
2	To learn assembly language programming for microprocessor and microcontroller
3	To understand and design microprocessor and microcontroller based real world applications.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	Intel 8085: pin description, architecture, addressing modes, interrupts, timing diagrams. Intel 8086: Pin description, architecture, memory segmentation, pipelining, min/max mode, addressing modes, data structure / access, interrupts.	8

2	Instruction Set and Assembly Language Programming of 8085 and 8086 microprocessors. Instruction formats, addressing modes, instruction set, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.	8
3	Memory interfacing of 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine. Introduction to DOS and BIOS interrupts, Interfacing Interrupt Controller 8259, DMA Controller 8257.	4
4	8255 PPI various modes of operation and interfacing to 8085 and 8086. Intel 8279 : Keyboard & display controller ,D/A and A/D converter and other applications.	6
5	Overview of Intel 8051 microcontroller. Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, simple program.	6
6	Serial communication standards, Serial data transfer schemes. 8251 USART architecture and interfacing. RS- 232. IEEE-4-88, Prototyping and trouble shooting, Introduction to Advanced Processors (Intel 80286, Intel 80486) and PIC Microcontroller	8
Total		**40**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Apply a basic concept of digital fundamentals to Microprocessor based personal computer system
2	Identify the detailed s/w & h/w structure of the Microprocessor.
3	Illustrate the operation , interface and instructions of microprocessor and microcontroller
4	Apply the microprocessor and microcontroller understanding in a multidisciplinary environment
Learning Resources:	
1	Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 2013, Penram International Publishing. .
2	Fundamentals of Microprocessor and Microcomputer, B Ram, 2017, Dhanpat Rai Publications.
3	Advanced Microprocessor and Peripherals, K M Bhurchandi, A K Ray, 2017, McGraw Hill Education.
4	The 8051 Microcontroller, Kenneth J. Ayala, 1996, PenramInternational Publishing
5	The 8051 Microcontroller and Embedded Systems: Using Assembly and C, M. A. Mazidi, J. G. Mazidi and R D McKinlay, 2007, Pearson.
6.	Microprocessors & Interfacing, Douglas V. Hall and SSSP Rao, 2017, McGraw Hill Education.
7	Computer Organization and Design: The Hardware/Software Interface, David A. Patterson, John L. Hennessy, 2016, Morgan Kaufmann Publishing

Course Name:	**Operating System**		
Course Code:	ES-CS 401	**Category:**	Engineering Science
Semester:	Fourth	**Credit:**	3
L-T-P:	3-0-0	**Pre-Requisites:**	ES-CS201 Programming for Problem Solving
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	To Learn Operating System concepts and algorithms
2	To gain the knowledge about the application and analysis of algorithms

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.	3
2	Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR	6
3	Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, RAG, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	4
4	Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, The Producer Consumer Problem, Semaphores, Event Counters, Message Passing, Classical IPC Problems: Producer-Consumer Problem, Reader's & Writer's Problem, Dinning Philosophers Problem etc.	5
5	Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging, Protection and sharing, Disadvantages of paging, segmentation	6

6	Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Not recently used (NRU) and Least Recently used (LRU).	6
7	Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Boot-block, Bad blocks	3
8	File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table).	3
Total		**36**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Recall and understand introductory concepts of operating system
2	Apply and analyze process scheduling methods and deadlock handling schemes
3	Understand inter process communication
4	Understand, apply and analyze memory management and disk management procedures

Learning Resources:	
1	Operating System Concepts, Silberschatz, Galvin and Gagne, Wiley
2	Principles of Operating System, Naresh Chauhan, Oxford
3	Operating System, Deitel, Deitel, Pearson

Course Objectives:	
1	To understand probability theory and its applications.
2	To know the concept of Complex Analysis.
3	To learn Fourier series & transform.
4	To use the concept of generating function in solving recurrence relation

Course Name:	**Mathematics-III**		
Course Code:	BS-M402	**Category**:	Basic Science
Semester:	Fourth	**Credit**:	3
L-T-P:	3-0-0	**Pre-Requisites:**	High school mathematics and BSM-101
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Probability :** (i) Definition of random experiment, sample space, events and probability. (ii)Basic theorems (Statement only) of probability. (iii)Conditional probability and independent events; Multiplication theorem; Baye's theorem (statement only) and related problems. **Probability Distribution :** (i) Definition of random variable; Discrete and continuous random variable; Probability mass function (p.m.f.) and probability density function (p.d.f.) of single random variable; Cumulative distribution function (c.d.f.); Applications. (ii) Expectation and variance of random variable; Properties and applications. (iii) Some special types of distributions Discrete probability distribution: Binomial and Poisson distributions; Mean and variance (no proof) and examples. Continuous probability distribution: Uniform, Exponential and Normal distributions; Mean and variance (no proof) and examples.	10
2	**Fourier Series :** (i) Periodic function and periodic extension of function; Odd and even functions. (ii)Special wave forms: square wave, half wave rectifier, full wave rectifier, saw-toothed wave, triangular wave (graphical illustration only).Euler's formulae for Fourier series; Fourier series of functions of period 2 ; Fourier series of functions of period 2 ; Dirichlet's conditions and related problems. Half range Sine and Cosine series and related problems. Parseval's identity (statement only) and related problems. **Fourier Transforms** (i)Definition of Fourier transforms; Properties of Fourier transforms: Linearity, Shifting, Change of scale property; Fourier transforms of some elementary functions; Fourier transforms of derivatives.(ii) Fourier sine and cosine transforms and related problems.(iii) Inverse Fourier transforms and convolution theorem; related problems.	10
3	**Differential Calculus of Complex Variables:** Introduction to differential calculus of function of complex variable(i) Function of complex variable.(ii) Concept of Limit, continuity and differentiability.(iii)Analytic function; Cauchy-Riemann equations (Statement only); Sufficient conditions for a function to be analytic; Harmonic function and Conjugate Harmonic function; related problems.(iv) Construction of Analytic function; Milne-Thomson Method; related problems	6
4	**Integral Calculus of Complex Variables:** (i)Zeros and singularities of an analytic function: Zeros of an analytic function; Singularities of an analytic function, Nature and Location of Singularities, Pole; Examples. (ii)Concept of simple curve, closed curve, smooth curve and contour; Line integrals along a piecewise smooth curve; Examples.	6

	(iii)Cauchy's Theorem (statement only), Cauchy-Gousrsat Theorem (statement only), Examples. (iv) Cauchy's Integral Formula; examples. (v) Taylor's series, Laurent's series; examples. (vi) Residues of a given function. (vii)Cauchy's Residue Theorem (statement only); evaluation of definite integrals involving sine and cosine.	
5	**Recurrence Relation & Difference Equation- z-Transforms & Generating Function**: z-Transforms (i)Definition of z-transforms; Properties of z-transforms: Linearity, Shifting, Change of scale property and examples (ii)Region of Convergence (ROC) of finite and infinite duration signals; related problems. (iii)Inverse z-transforms, Convolution theorem and related problems. (iv)Solution of Difference Equations by z-transforms. **Generating Function** (i)Introduction to generating function (ii)Some standard generating functions (iii)Solution of recurrence relations by generating functions	8
Total		40

Course Outcomes:	
After completion of the course, students will be able to:	
1	Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.
2	Apply calculus of complex function for analysing complex field.
3	Learn the tools of Fourier transform to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.
4	To solve engineering problems using z transform and probability theory.

Learning Resources:	
1	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
2	Michael Greenberg, Advanced Engineering Mathematics, Pearson
3	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers
4	Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning
5	Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
6	N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill
7	S. Ross, A First Course in Probability, Pearson Education India
8	W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley

Course Name:	Biology		
Course Code:	BS-BIO401	**Category:**	Basic Science
Semester:	Fourth	**Credit:**	2
L-T-P:	2-0-0	**Pre-Requisites:**	Basic knowledge of Physics, Chemistry and Mathematics
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Bring out the fundamental differences between science and engineering
2	Discuss how biological observations of 18th Century that lead to major discoveries

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	**Module 1- Introduction to Biology:** To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	2
2	**Module2-Classification System in Biology:** The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. *E. coli, S. cerevisiae, D. melanogaster, C. elegance, A. thaliana, M. musculus.*	2
3	**Module 3: Genetics:** To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be given not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Importance of stem cell research.	2

4	**Module 4: Biomolecules**: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.	4
5	**Module 5: Enzymes:** To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Discuss at least two examples.	2
6	**Module 6: Information Transfer:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.	4
7	**Module 7: Macromolecular analysis:** How to analyse biological processes at the reductionist level Proteins-structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	4
8	**Module 8: Metabolism:** ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.	2
9	**Module 9: Microbiology:** Concept of microscopic organisms. Concept of species and strains. Identification and classification of microorganisms. Sterilization and media compositions. Growth kinetics. Microscopy: simple, compound, phase-contrast, SEM, TEM, Confocal: principle and applications.	2
Total		**24**

Course Outcomes:	
After completion of the course, students will be able to:	
1	State different engineering applications from biological perspective.
2	Classify biological systems and identify different organisms and microorganisms depending on their morphological, biochemical and ecological criterion.
3	Explain the concept of recessiveness and dominance during the passage of genetic material from parent to offspring and describe DNA as a genetic material in the molecular basis of information transfer.
4	Discuss structures of different biomolecules starting from basic units and hence understand different biological processes at the reductionistic level.
5	Describe protein structures and enzymology and also compare different mechanisms of enzyme action.
6	Describe energy transformation processes in biological systems.

Learning Resources:	
1	Biology for Engineers. Arthur T. Johnson. CRC Press.
2	Biology and Engineering of Stem Cell Niches. A K Vishwakarma and Jefferey Karp, Elsevier.
3	Environmental Biology for Engineers and Scientists. David A. Vaccari, P. P. Storm and J. F Alleman. ELBS
4	Biology for Engineers. G. K. Suraishkumar. Oxford

Course Name:	**Analog Communication Laboratory**		
Course Code:	PC-EC491	**Category:**	Professional Core
Semester:	Fourth	**Credit:**	1
L-T-P:	0-0-2	**Pre-Requisites:**	Knowledge of Handling CRO, Function Generator
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	Learn to perform different Analog Modulation techniques
2	Observe the waveform of different modulation and measurement of modulation index
3	Measurement of Signal to Noise Ratio

Course Contents:		
Module No.	**Description of Topic/ Experiment**	**Contact Hrs.**
1	Measurement of modulation index of an AM signal	2
2	Measurement of output power with varying modulation index an AM signal(for both DSB- &SSB).	2
3	Measurement of distortion of the demodulated output with varying modulation index of an AMsignal (for both DSB-SC & SSB).	2
4	Measurement of power of different frequency components of a frequency modulated signal &the measurement of the bandwidth.	2
5	Design and set up a PLL using VCO & to measure the lock frequency.	2
6	Design and set up a FM demodulator using PLL	2
7	Measurement of SNR of a RF amplifier	2
8	Measurement of selectivity, sensitivity, fidelity of a super heterodyne receiver.	2
9	One innovative experiment.	2
Total		**18**

Course Outcomes:	
After completion of the course, students will be able to:	
1	The learner will be able to grow knowledge about carrier, modulating signal, modulated waveform
2	The learner can apply the conceptof VCO in FM generation
3	The learner can apply the concept of signal to noise ratio in noise measurement

Learning Resources:	
1	Laboratory Manual

Course Name:	**Digital System Design Lab**		
Course Code:	PC-EC492	**Category:**	Professional Core
Semester:	**Fourth Semester**	**Credit:**	1
L-T-P:	**0-0-2**	**Pre-Requisites:**	Basic Electrical & electronics Laboratory ES-EE191
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	Introduction to digital lab related all required circuit components.
2	Developing concept of different combinational circuit making and verifying its operations.
3	Developing concept of different sequential circuit making and verifying its operations.

Course Contents:		
Module No.	**Description of Topic/ Experiment**	**Contact Hrs.**
1	Realization of basic gates using Universal logic gates.	2
2	Implementation of the Given Boolean Function using Logic Gates in Both SOP and POS Forms.	2
3	Realization of suitable code conversion circuits and vice-versa.	2
4	Realization of parity generator and comparator circuits.	2
5	Construction of simple Encoder and Multiplexer circuits using logic gates.	2
6	Construction of simple Decoder and De-Multiplexer circuits using logic gates.	2
7	Construction of simple arithmetic circuits-Adder, Subtractor.	2
8	Realization of RS,JK,T and D flip-flops using suitable logic gates.	2
9	Realization of Asynchronous Up/Down counters.	2
10	Realization of Synchronous Up/Down counters.	2
11	Design of Sequential Counter with irregular sequences.	2
12	Realization of Ring counter and Johnson's counter.	2
Total		**24**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Identify the various digital ICs and understand their operation
2	Develop the concept of Boolean laws and digital systems.
3	Apply Boolean laws for the different combinational logic circuit design.
4	Design the different sequential logic circuits.

Learning Resources:	
1	Digital Logic and Computer Design, Morries Mano, 2016, Pearson India
2	Modern Digital Electronics, R.P.Jain, 4th ,2010, Mc Graw Hill
3	Digital Electronics: Principles, Devices and Applications, A.K.Maini,2007, Wiley India
4	Fundamentals of Digital Circuits, A.Anand Kumar , 3rd, PHI
5	Digital Systems Principles and Applications, Ronald J. Tocci , Neal S.Widmer & **Gregory L. Moss**, 10th, 2007,Pearson
6	Digital Electronics Principles and Applications ,S.K.Mandal, 2010, Mc Graw Hill.
7	Digital Principles and Application, Leach, Malvino & Saha ,8th, Mc Graw Hill
8	Digital Fundamentals, Floyed & Jain ,8th,2005,Pearson

Course Name:	Microprocessor & Microcontrollers Lab			
Course Code:	PC-EC493	**Category:**	Professional Core	
Semester:	Fourth	**Credit:**	1	
L-T-P:	0-0-2	**Pre-Requisites:**	Basic Electrical & electronics Laboratory ES-EE191	
Full Marks:	100			
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05	

Course Objectives:	
1	To write and execute assembly language program using a trainer kit and simulator
2	To understand interfacing
3	To design and implement microprocessor and microcontroller based applications

Course Contents:		
Module No.	**Description of Topic/ Experiment**	**Contact Hrs.**
1	Familiarization with Intel 8085 & Intel 8051simulator on PC	2
2	Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the KIT	2
3	Programming using kit and simulator for: i) Table look up ii) Copying a block of memory iii) Shifting a block of memory iv) Packing and unpacking of BCD numbers v) Addition of BCD numbers vi) Binary to ASCII conversion vii) String Matching, Multiplication using shift and add method and Booth's Algorithm	4

4	Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly.	2
5	Study of timing diagram of an instruction on oscilloscope. Serial communication between two trainer kits.	2
6	Interfacing of 8255: Keyboard and Multi-digit Display with multiplexing using 8255. Study of 8051 Micro controller kit and writing programs as mentioned in S/L3.	6
7.	Writing of programs to interface of Keyboard, DAC and ADC using the kit.	2
Total		**20**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Illustrate & Execute assembly language program using kit and simulator
2	Apply the interface of PPI to microprocessor and microcontroller
3	Design and implement applications based on microprocessor and microcontroller

Learning Resources:	
1	Microprocessor Architecture, Programming and Applications with the 8085, Ramesh Gaonkar, 2013, Penram International Publishing. .
2	Fundamentals of Microprocessor and Microcomputer, B Ram, 2017, Dhanpat Rai Publications.
3	Advanced Microprocessor and Peripherals, K M Bhurchandi, A K Ray, 2017, McGraw Hill Education.
4	The 8051 Microcontroller, Kenneth J. Ayala, 1996, PenramInternational Publishing
5	The 8051 Microcontroller and Embedded Systems: Using Assembly and C, M. A. Mazidi, J. G. Mazidi and R D McKinlay, 2007, Pearson.
6.	Microprocessors & Interfacing, Douglas V. Hall and SSSP Rao, 2017, McGraw Hill Education.
7	Computer Organization and Design: The Hardware/Software Interface, David A. Patterson, John L. Hennessy, 2016, Morgan Kaufmann Publishing

Course Name:	Soft Skill Development Lab		
Course Code:	HM-HU491	**Category:**	Humanities and Social Sciences including Management
Semester:	Fourth	**Credit:**	1
L-T-P:	0-0-2	**Pre-Requisites:**	Students must have basic knowledge of English Language.
Full Marks:	100		
Examination Scheme:	Semester Examination: 60	Continuous Assessment: 35	Attendance: 05

Course Objectives:	
1	To equip the students with good communication skills.
2	Enable the students to think and speak effectively on everyday topics, including topics related to technical concepts.
3	To prepare them for interviews and future job environments.
4	Developing industry-ready attitude towards professional communication.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1.	Conversation Practice Sessions - General Conversation - Warm-up sessions - Basics of Communication, verbal and non-verbal communication.	4
2.	Group Discussion - Group Discussion & Debates, Do's & Don'ts, etc., Intensive Practice Sessions.	6
3.	Interview sessions: Principles and practices of Personal Interview • Do's and Don'ts of facing an interview. • SWOC Analysis • Rigorous practices of mock-interviews.	8
4.	Presentations: Fundamentals of presentation skills, Secrets of an effective presentation, Presentation Practice Sessions with the help of power point presentation and other audio-visual aids, Face question answer sessions at the end of their presentation.	6
Total		**24**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Honing over all Communicative Competence.
2	Develop Team Building and Leadership Quality.
3	Deliver an enthusiastic and well-practiced presentation
4.	ommunicate with clarity and confidence thereby enhancing employability skills of the students.

Learning Resources:	
1	Soft Skills: Key to success in Workplace and Life, Meenakshi Raman and Shalini Upadhyay.
2	Communication Skills. Sanjay Kumar and PushpLata, Oxford University Press, 2011.
3	Monipally: Business Communication, Tata McGraw Hill
4	Madhukar: Business Communications; Vikas Publishing House.
5	Senguin J: Business Communication; Allied Publishers.
6.	Business Communication: Rajendrapal & Korlahalli

Course Name:	**Constitution of India**		
Course Code:	MC472	**Category:**	Mandatory Courses
Semester:	Fourth	**Credit:**	0
L-T-P:	2-0-0	**Pre-Requisites:**	Nil
Full Marks:	100		
Examination Scheme:	Semester Examination: 70	Continuous Assessment: 25	Attendance: 05

Course Objectives:	
1	Develop an understanding of the nation's constitution.
2	Develop knowledge about the various levels of governance in the country.

Course Contents:		
Module No.	**Description of Topic**	**Contact Hrs.**
1	**Introduction:** : Sources and Constitutional history. Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.	3
2	**Union Government and its Administration :** Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Lok Sabha, Rajya Sabha Supreme Court	6
3	**State Government and its Administration** Governor.Role and Position, CM and Council of ministers High Court	6

4	**Local Administration District's Administration head:** Role and Importance, Municipalities: Introduction, Mayor, and role of Elected Representative. Pachayati raj: Introduction, Zila Pachayat, Elected officials and their roles. Importance of grass root democracy	6
5	**Election Commission:** Role and Functioning, Chief Election Commissioner	2
Total		**23**

Course Outcomes:	
After completion of the course, students will be able to:	
1	Understanding the constitution of India.
2	Understanding the various levels of governance in the country.

Learning Resources:	
1	'Indian Polity' by Laxmikanth
2	'Indian Administration' by Subhash Kashyap
3	'Indian Constitution' by D.D. Basu
4	'Indian Administration' by Avasti and Avasti