Scheme & Syllabus of UG

Engineering Program

Bachelor of Technology

(B.Tech.)

Electronics & Communication Engineering

2023-24

IPS ACADEMY

INSTITUTE OF ENGINEERING & SCIENCE, INDORE

(A UGC Autonomous Institute affiliated to RGPV)

IPS Academy, Institute of Engineering & Science, Indore
(A UGC Autonomous Institute, Affiliated to RGPV)
Scheme & Syllabus Based on AICTE Flexible Curricula (B. Tech.)
Electronics & Communication Engineering Department

Bachelor of Technology (B.Tech.) V Semester

S.No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam	Quiz/ Assignment	End Sem	Term work / Lab Work & Sessional		L	T	P	
1.	PCC-EC09	PCC	Microprocessor & Microcontroller	60	25	15	-	-	100	3	-	-	3
2.	PCC-EC10	PCC	Digital Communication	60	25	15	-	-	100	3	-	-	3
3.	PCC-EC11	PCC	Digital Signal Processing	60	25	15	-	-	100	2	1	-	3
4.	PEC- EC01	PEC	Professional Elective Courses-I	60	25	15	-	-	100	3	-	-	3
5.	HSMC-HS05	HSMC	Humanities and Social Sciences Open Courses - I	60	25	15	-	-	100	2	-	-	2
6.	IFC-DS-001	IFC	Interdisciplinary Foundation Course-II	60	25	15	-	-	100	2	-	-	2
7.	LC-EC08 (P)	LC	Microprocessor and Microcontroller	-	-	-	60	40	100	-	-	2	1
8.	LC-EC09 (P)	LC	Digital Communication	-	-	-	60	40	100	-	-	2	1
9.	LC-EC10 (P)	LC	Digital Signal Processing	-	-	-	60	40	100	-	-	2	1
10.	LC-EC11 (P)	LC	Communication Network and Transmission Line (CNTL) Lab	-	-	-	60	40	100	-	-	2	1
11.	LC-EC12 (P)	LC	Java Lab	-	-	-	60	40	100	-	-	2	1
12.	SBC-EC04 (P)	SBC	Electronics Workshop-III (IoT and Embedded System Design)	-	-	-	60	40	100	-	-	4	2
13.	MLC03	MLC	Environmental Studies	-	-	-	-	-	-	1	-	-	Audit
			Total	360	150	90	360	240	1200	16	1	14	23

Professional Elective Courses (PEC) - I, EC01 (Any One Course)	Humanities & Social Sciences Open Courses (HSMC I, HS05 (Any One Course)	Interdisciplinary Foundation Course (IFC) -II, IFC-DS-001
(a) Electro Magnetic Theory and Communication Network and Transmission Line (EMT &CNTL)	(a) English Language Proficiency	Foundation of Data Science
(b) Data Communication	(b) German Language	
(c) Probability and Stochastic Process	(c) French Language	
(d) Mixed Signal Circuits and Interfacing	(d) Japanese Language	
	(e) Soft Skills & Interpersonal Communication	

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

PCC-EC09	Microprocessor & Microcontroller	3L: 0T: 0P (03 hrs.)	Credits: 03

Prerequisite: - Digital electronics, basics of computer architecture, buses & instructions cycle.

Course Objective: The objective of this course is that students can learn fundamental architectural & programming concepts of basic processors like 8085, 8086 and 8051 microcontroller, their interfacing with peripherals to design real life applications.

MODULE I **(8 hrs.)**
Microprocessor & Microcontroller history, evolution, applications, 8 bit processor 8085 Architecture, Instruction set, Addressing modes, Interrupts, Timing Diagrams, Memory & I/O interfacing, Assembly Language Programming with 8085.

MODULE II **(8 hrs.)**
Introduction to 16/32 bit microprocessors (8086, 8088, 68000 etc.), Architecture of 8086, instruction set, Minimum and Maximum mode configurations, Assembly Language Programming with 8086.

MODULE III **(8 hrs.)**
Peripherals & Interfacing- RAM, ROM, Programmable Peripheral Interface (8255), Programmable Interval Timer (8253/54), Interrupt Controller (8259), DMA controller 8257, USART. Interfacing of 8/16 bit processor & designing of Applications using RS232, A/D, D/A converter, external memory, LCD, keyboard and stepper motor.

MODULE IV **(8 hrs.)**
Architecture of ATmega32 microcontrollers, focusing on key components such as memory organization, including flash, SRAM, and EEPROM, along with the Harvard architecture-based CPU structure. I/O port configuration and functionalities, timer modules for delay and event counting, and the built-in ADC module for analog signal conversion. Interfacing of ATmega32 with external ADC and DAC devices, LCD modules for data display.

MODULE V **(8 hrs.)**
Overview of PIC architecture, memory organization, and features. Study of core instructions, addressing modes. ADC (Analog to Digital Converter) Interfacing, DAC (Digital to Analog Converter) Interfacing, LCD Interfacing for display control. Architecture and features of AVR, comparison with PIC microcontrollers.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course Outcome: -
Students earning credits will develop ability to:

1. Understand architecture & programming of 8 bit microprocessors.
2. Understand architecture & programming of 16 bit microprocessors.
3. Design and analyze various peripheral interfacing required for microprocessor and microcontroller based circuits.
4. Understand architecture & programming of 8 bit microcontroller.
5. Design and analyze microprocessor based circuits.

Text/ Reference Book:

1. Rey Bhurchandi, "Advanced Microprocessor Architecture", 2nd edition, TMH, 2001.
2. Bray, "The Intel Microprocessors: Architecture, Programming and Interfacing", 2nd edition, PHI, 2003.
3. Soumitra Kumar Mandal, **"**Microprocessors And Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 And 8051", 1st edition, Mc Graw Hill India, 2011.
4. Muhammad Ali Mazidi, "The 8051 Microcontroller and Embedded Systems using Assembly and C", 2nd edition, Pearson, 2012.

PCC-EC10	Digital Communication	3L: 0T: 0P (03 hrs.)	Credits: 03

Recommended Prerequisite: Engineering Mathematics, Electronics

Course Objective: To understand the key Modules of digital communication systems with emphasis on digital modulation techniques. To get introduced to the concept and basics of information theory and the basics of source and channel coding/decoding.

MODULE I **(8 hrs.)**

Cumulative distribution function, Probability density function, Mean, Variance and standard Deviations of random variable, Gaussian distribution, Error function, Correlation and Autocorrelation, Central-limit theorem, Error probability, Power Spectral density of digital data.

MODULE II **(8 hrs.)**

Sampling theorem, sampling of band pass signals, Pulse Amplitude Modulation (PAM), types of Sampling (natural, flat-top), equalization, signal reconstruction and reconstruction filters, aliasing and anti-aliasing filter, Pulse Width Modulation (PWM), Pulse Position Modulation (PPM).Quantization, quantization error, Pulse Code Modulation (PCM), commanding, scrambling, TDM-PCM, Differential PCM, Delta modulation, Adaptive Delta modulation, vocoders, bit rate & baud rate & bandwidth requirements, introduction to MIMO

MODULE III **(8 hrs.)**

Phase shift Keying (PSK)- Binary PSK, differential PSK, differentially encoded PSK, Quadrature PSK, M-arry PSK. Frequency Shift Keying (FSK)- Binary FSK (orthogonal and no orthogonal), M-arry FSK. Comparison of BPSK and BFSK, Quadrature Amplitude Shift Keying (QASK), Minimum Shift Keying (MSK), GMSK.

MODULE IV **(8 hrs.)**

Encoding techniques: On-Off, signaling, Polar signaling, RZ-NRZ signaling, Bipolar signaling, AMI, Manchester code, Differential encoding their advantage and disadvantages Pulse shaping to reduce inter channel and inter symbol interference, matched filter .

MODULE V **(8 hrs.)**

Introduction to information theory, uncertainty and information, average mutual Information and entropy, source coding theorem, Huffman coding, Shannon-Fano-Elias coding, Introduction, channel models, channel capacity, channel coding, Information Capacity theorem, Shannon limit.

Assessment: Internal Viva, continuous evaluation of experiments, journal write up, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

1. To know the basics of random variable and distribution functions in digital Communications
2. To understand how the signal is converted from analog to digital signals

3. To learn the digital modulation techniques
4. To know how the signal is received and demodulation techniques
5. To understand the information theory used for channel coding

Text/ Reference Books:

1. Taub and Schilling, "Principles of Communication Systems", 2ed Edition, TMH, 2007.
2. Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2010.
3. Simon Haykins, "Communication Systems", 5th Edition, John Wiley, 2009.
4. Ranjan Bose, "Information TheoryCoding and Cryptography", 2th Edition, TMH, 2008.
5. Skylar and Ray, "Digital Communications", 2th Edition, Pearson Education, 2001.
6. Rao, "Digital Communications", 2th Edition, TMH, 2017.

PCC-EC11	Digital Signal Processing	2L: 1T: 0P (3 hrs.)	Credits: 03

Recommended Prerequisite: Mathematics

Course Objective: The purpose of this subject is to make the students learn about theoretical basis of DSP, with the method of description of discrete and digital signals and systems in the domain-and transform domain, including discrete and Fast Fourier Transform and also learn the different DSP processor.

MODULE I **(9 hrs.)**

Discrete-time signals, discrete-time systems, the z-Transform, Analysis of linear time-invariant systems in the z- domain, Analysis of stability and causality in z domain, block diagrams and signal flow graph representation of digital network, matrix representation.

MODULE II **(9 hrs.)**

Frequency Analysis of Discrete Time Signal: Discrete fourier series (DFS), properties of the DFS, discrete Fourier transform (DFT), properties of DFT, two dimensional DFT, circular convolution

MODULE III **(8 hrs.)**

Efficient Computation of the DFT FFT algorithms, decimation in time algorithm, decimation in frequency algorithm, decomposition for N" composite number.

MODULE IV **(6 hrs.)**

Digital filters Design Techniques Design of IIR and FIR digital filters, Butterworth, Chebyshev and Elliptic Approximations, impulse invariant and bilinear transformation, windowing techniques rectangular and other windows, examples of FIR filters, design using windowing.

MODULE V **(9 hrs.)**

Fundamentals of DSP: DSP Architecture, compare with other processor, architecture of TMS320C 5416/6713/DSP56374 architecture, Bus Structure & memory, CPU, addresses modes. Multiplier and Multiplier accumulator, Modified Bus Structures and Memory access in P-DSPs, Multiple access memory , Multi-ported memory , VLIW architecture, Pipelining , Special Addressing modes in P- DSPs , On chip Peripherals, Computational accuracy in DSP processor, Von Neumann and Harvard Architecture, MAC.

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Analyze and Implement the discrete time LTI system, Z-Transform to realize the digital network and evaluate ROC.
2. Compute DFT by using FFT algorithm to analyze the complex discrete sequence.
3. Design IIR and FIR filters and evaluate the performance of digital filters.
4. Understanding the fundamentals of DSP Processors.

5. Understanding the different architecture of DSP Processor.

Text/Reference Books:

1. Oppenheim and Schafer: Digital Signal Processing, PHI Learning.1975.
2. Proakis: Digital Signal Processing, Pearson Education.2009
3. Sanjay Sharma, "Digital Signal Processing" 5th Edition, S. K. Kataria & Sons. 2009.
4. Ingle and Proakis, "Digital Signal Processing- A MATLAB based Approach, Thompson, Cengage Learning.2012.

PEC- EC01 (A)	Electromagnetic Theory& CNTL	3L: 0T: 0P (03 hrs.)	Credits: 03

Recommended Prerequisite: Engineering, Physics, and Mathematics.

Course Objective: The purpose of this subject is to cover the underlying concepts and techniques used in EMT & also how EM-waves travel in the medium. In this subject we discuss various principles, standards and modes for propagation of waves. Also fundamentals of transmission lines theory are studied in the subjects.

MODULE I **(8 hrs.)**

Transmission line fundamentals: Transmission line fundamentals: Voltage and current on a transmission line, infinite line, characteristic impedance and propagation constant, waveform distortion, attenuation and phase equalizers, reflection coefficient, standing wave ratio, open and short circuit lines. Smith chart and impedance matching using transmission lines.

MODULE II **(8 hrs.)**

Characteristic Parameters of symmetrical and asymmetrical two port networks and their design Image impedance, iterative impedance, characteristic impedance symmetrical and asymmetrical attenuators and their design. Passive LC Filters Analysis and design of Low pass, high pass, band pass and band elimination filters, m-derived filters.

MODULE III **(8 hrs.)**

Electromagnetism and Maxwell's Equations: Basic of vector calculus, Basics of electrostatics Gauss law, Boundary relations. Electric field in dielectric and conductor, continuity equation, methods of images. Basic laws of magnetostatics, Ampere's law, Boundary conditions, vector magnetic potential, magnetization vector and its relation to magnetic field. Development of Maxwell's Equation

MODULE IV **(8 hrs.)**

Uniform plane waves: Wave equations and their solutions, wave polarization, Poynting vector, phase and group velocity, Plane electromagnetic waves in free space, dielectric medium and conducting medium, Skin depth.

MODULE V **(8 hrs.)**

Waves at interface of different mediums: Waves propagation in lossy dielectrics, plane waves in lossless dielectrics, reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Brewster's angle.

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Analyze transmission line and find the line parameter at various points in different load conditions.
2. Apply various principles related to EM field to real life problems.
3. Analyze plane wave as solution to specific application and can find the effect of medium on wave propagation.
4. Analyze the EM wave propagation to real life mediums which can be classified as lossy and lossless mediums.
5. Understand the effects and parameters associated with different layers of atmosphere affecting the propagation of EM waves.

Text/Reference Books:

1. R. K. Shevgaonkar, "Electromagnetic waves", 2nd Edition, Tata McGraw Hill, 2001.
2. W. Hayt, "Engineering Electromagnetics", 4th Edition,Tata McGraw Hill, 1999.
3. David K. Cheng, "Field and Wave Electromagnetics**"**, 2nd Edition, Pearson, 2003.
4. Matthew N.O. Sadiku, "Elements of Electromagnetics**"**, 4th Edition, Oxford University Press, 2017.
5. B. Singh, H. Hiziroglu, "Electromagnetic field theory fundamentals", 2nd Edition, Oxford Press, 2005.
6. E. Jordan, K. G. Balman, "Electromagnetic waves and radiating system", 2nd Edition, Prentice Hall India, 2002.
7. By Mahmood Nahvi, Joseph Edminister,"Schaum's Outline of Electromagnetics, Fifth Edition" October 1, 2018

PEC- EC01 (B)	Data Communication	3L: 0T: 0P (03 hrs.)	Credits: 03

Prerequisite: - Communication System, Digital Communication

Course Objective: The course is designed to understand the basic technologies used in data communication like mode of communication, interfacing of devices, medium of communication and detection and correction of errors occurs during data transmission.

MODULE I **(8 hrs.)**

Introduction to data communication: Components, data representation, data flow and basic model, data representation, Serial & Parallel transmission, Modes of data transmission, Encoding: Unipolar, Polar, Bipolar line & block codes, Data compression, Frequency dependent codes, Run length encoding, Relative encoding, LZ Compression, Image and multimedia compression. Review of analog & digital transmission methods

MODULE II **(8 hrs.)**

Multiplexing: FDM, TDM, WDM, Synchronous & Statistical TDM, North American digital multiplexing hierarchy, European TDM, Spread spectrum: Frequency Hopping & Direct Sequence spread spectrum, terminal handling & polling. Switched Communication Networks: Circuit, Message, Packet & Hybrid Switching, Soft switch Architecture with their comparative study, X.25, ISDN, OFDM.

MODULE III **(8 hrs.)**

Physical Layer: Introduction, Interface, Standards, EIA-232-D, RJ-45, RJ-11, BNC connector & EIA-449 digital Interface: Connection, specifications & configuration, X.21 Modem: Types, features, signal constellation, block schematic, limited distance, dial up, baseband, line driver, Group Band and Null modems etc., ITU-T V-series modem standards Connecting Devices: Active and Passive Hubs, Repeaters, Bridges, Two & Three layer switches & Gateway. Study of various types of topology and their comparative study

MODULE IV **(8 hrs.)**

Transmission Media: Transmission line characteristics, Guided Media: Unguided media, Telephone Network, Digital Subscriber Line: ADSL, HDSL, SDSL, VDSL, and Cable TV network for data transfer.

MODULE V **(8 hrs.)**

Transmission Errors: Content Error, flow integrity error, methods of error control, Error detection, Error correction, Bit error rate, Error detection methods: Parity checking, Checksum Error Detection, Cyclic Redundancy Check, Hamming code, Interleaved codes, Block Parity, Convolution code, Hardware Implementation, Checksum .

Course Outcomes:

Students earned credits will develop ability to

1. Illustrate the different modes of data transmission, encoding techniques.
2. Illustrate the different types of multiplexing technique and switching techniques.
3. Illustrate the interfacing and connecting devices and standards used in communication.
4. Summarize the Different types of media of transmission and networks.
5. Analyze the problem of errors in communication and technique of error detection and corrections in transmission.

Text/Reference Books:

1. Behrouz A Forouzan, "Data communication and networking", 4th edition, McGrawHill Education, 2017.
2. Tanenbaum A. S., "Computer Networks", Pearson Education, 5th edition, 2011.
3. William Stallings, "Data & Computer Communication", Pearson Education, 8th edition, 2006.
4. Comer, "Internetworking with TCP/ IP Vol-1", Pearson education, 6th edition, 2015.
5. S .Salivahanan, "Digital signal processing": Tata McGraw-Hill Education. 2011.

PEC- EC01 (C)	Probability Theory and Stochastic processing	3L: 0T: 0P (03 hrs.)	Credits: 03

Prerequisite: Probability Theory, Random Processes

Course Objective: The objective is to understand basics concepts of probability theory, random variables, density & distribution functions and stochastic processes.

THEORY:

MODULE I **(6 hrs.)**
Probability and Random Variable Probability: Probability introduced through Sets and Relative Frequency, Probabilities: Joint, conditional, total, Mathematical Model of Experiments, Bayes' Theorem, Distribution: Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh and Conditional,

MODULE II **(8 hrs.)**
Random Variable: Random Variable: Discrete, Continuous and Mixed Random Variables random variable. Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Transformations of a Random Variable: Monotonic and Non-monotonic transformations.

MODULE III **(9 hrs.)**
Multiple Random Variables and Operations, Distribution Function and properties: Equal and Unequal, Joint, Sum of Random Variables, Central Limit Theorem, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

MODULE IV **(8 hrs.)**
Stochastic Processes – Stationary & Non-stationary Process, Deterministic and Nondeterministic Processes, The Stochastic Process Concept, Distribution and Density Functions, First- Order, Second-Order, N^{th} Order and Wide-Sense Stationary process, Ergodicity: Mean, Correlation, Autocorrelation Function, Cross- Correlation and their functions and Properties, Covariance, Linear System Response: Mean and Mean squared Value, Autocorrelation, Cross- Correlation, Gaussian and Poisson random processes.

MODULE V **(6 hrs.)**
Spectral Characteristics of Power Spectrum and System Response: Properties, Relationship between power Spectrum and autocorrelation function, cross-power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross- Correlation Function,

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course outcome:
Students earning credits will develop ability to:
1. Understand the random experiments, sample space and event probabilities
2. Study the random variables, density and distribution functions, moments and transformation of random variables.
3. Study operations on Multiple Random variables, Joint Distribution Function.

4. Understand Mean and covariance functions for simple random processes.
5. Explore the spectral characteristics of random processes.

Text/Reference Books:

1. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", 4Ed., TMH, 2001.
2. Scott Miller, Donald Childers, "Probability and Random Processes", 2 Ed, Elsevier, 2012.
3. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes, 4 Ed., TMH.
4. Pradip Kumar Gosh, "Theory of Probability and Stochastic Processes", University Press
5. Henry Stark and John W. Woods, "Probability and Random Processes with Application to Signal Processing", 3 Ed., PE.
6. George R. Cooper, Clave D. MC Gillem, "Probability Methods of Signal and System Analysis", 3 Ed., Oxford, 1999.
7. S.P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 1997.

HSMC-HS05	French Language (C)	2L: 0T: 0P (03 hrs.)	Credits: 02

Course Objective: To acquaint students with French and impart an understanding of the language at the beginner level.

Course Outcome: The student will be able to understand French grammar and hold a simple conversation in French.

MODULE I **(8 hrs.)**
Se présenter et présenter sa famille, Saluer, Les nationalites, Les nombres, Décrire une personne (son physique et son caractère)
Grammaire - Les verbes au présent, Les adjectifs possessifs

MODULE II **(8 hrs.)**
Décrire et situer un logement, Parler d'une ville et de ses commerces
Grammaire - Les pronoms interrogatifs où et combien de, Les articles contractés, Les prépositions de situation

MODULE III **(8 hrs.)**
Exprimer les goûts et les préférences, Décrire des vêtements et des couleurs, Parler des activités de loisirs
Grammaire - Les adjectifs démonstratifs, Les quantités

MODULE IV **(8 hrs.)**
Indiquer l'heure ou la date (le calendrier), Indiquer la fréquence d'une activité, Parler des préférences alimentaires (plats et boissons), Commander dans un restaurant
Grammaire - Les verbes pronominaux

MODULE V **(9hrs.)**
Décrire le temps, Parler des vacances, Réserver un billet et une chambre d'hôtel
Grammaire - Le passé composé

Course Outcomes:

1. Students will be able to recognize French language and apply its grammar to describe themselves and their family.
2. Students will apply French vocabulary to describe and locate accommodation in a city and also its businesses
3. Students will be able to use French to express their tastes and preferences as well as describe their hobbies.
4. Students will be able to apply their knowledge in practical situations like ordering in a restaurant and interpret time and dates
5. Students will be able to describe the weather and their vacations as well as schedule and book tickets and a room and compute bills.

Text/Reference Books:
1. Saison 1 Methode de Francais
2. Les Cles de Nouveau A1
3. https://www.lawlessfrench.com
4. https://www.youtube.com/user/learnfrenchwithalexa

IFC- DS001	Foundation of Data Science	2L: 0T: 0P (02 hrs.)	Credits: 02

Course Objective: This course provides a concise introduction to the fundamental concepts of Data Science

MODULE 1 **(5 hrs.)**
Introduction: What is Data Science? Big Data and Data Science – Datafication - Current landscape of perspectives - Skill sets needed; Matrices - Matrices to represent relations between data, and necessary linear algebraic operations on matrices Statistics: Descriptive Statistics: distributions and probability.

MODULE 2 **(05 hrs.)**
Data preprocessing: Data cleaning - data integration - Data Reduction Data Transformation and Data Discretization. Evaluation of classification methods –Exploratory Data Analysis - Basic tools (plots, graphs and summary statistics) of EDA.

MODULE 3 **(5 hrs.)**
Introduction to Machine Learning Concepts: Association Rule mining - Linear Regression Logistic Regression- Classifiers - k-Nearest Neighbors (k-NN), k-means -Decision tree.

MODULE 4 **(05 hrs.)**
Clustering: Choosing distance metrics - Different clustering approaches - hierarchical agglomerative clustering, k-means (Lloyd's algorithm), - DBSCAN - Relative merits of each method - clustering tendency and quality.

MODULE 5 **(05 hrs.)**
Case Studies/Projects related to data science.

Course Outcomes:

1. State the overview of the Data Science.
2. Explain the process of Data preprocessing.
3. Discuss the various Machine Learning Algorithms
4. Explain the clustering techniques.
5. Discuss the usage of Data Science technologies

LC-EC08 (P)	Microprocessor & Microcontroller Lab	0L: 0T: 2P (02 hrs.)	Credits: 01

Prerequisite: - Digital electronics, basics of computer architecture, buses & instructions cycle.

Course Objective: The objective of this course is that students can learn fundamental architectural & programming concepts of basic processors like 8085, 8086 and 8051 microcontroller, their interfacing with peripherals to design real life applications.

List of Experiments:

1. Write a program to add/ subtract two 8 bit numbers in 8085 and check for carry/ burrow
2. Write a program using 8086 for division of a defined double word by another word and verify
3. To add two binary numbers each 8 byte long in 8086.
4. To find the maximum number in a given string (16 bytes long) and store it in location 0310 in 8086
5. To sort a string of 8 bit numbers in descending order in 8086
6. To multiply an ASCII string of eight numbers by a string ASCII digit. The result is a string of unpacked BCD digits.
7. Write an ALP in 8051 to add/subtract/multiply/divide two 8 bit no's available at register R0 & R1 of bank 0 and store the result in register R0/R1/R2/R3 of bank 1 and display the same on LED one by one.
8. Write an ALP in 8051 to transfer a block of data from one location (00H-07H) to another location (08H-0FH).
9. Write an ALP in 8051 to run timer 0, timer1 for 1 msec. & 5msec. to generate square wave on P 0.0 & P 0.1.
10. Write an ALP in 8051 to design pulse counter on 3.4 using counter 0 and give output on P2.
11. Write an ALP in 8051 to generate square wave on P1.2 using timer 0 interrupt and frequency can be controlled with input data on P2.
12. Write an ALP in 8051 to display IES IPS on 16*2 LCD.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course Outcome: -
Students earning credits will develop ability to:

1. Understand architecture & programming of 8 bit microprocessors.
2. Understand architecture & programming of 16 bit microprocessors.
3. Design and analyze various peripheral interfacing required for microprocessor and microcontroller based circuits.
4. Understand architecture & programming of 8 bit microcontroller.
5. Design and analyze microprocessor based circuits.

Text/Reference Books:

1.Rey Bhurchandi, "Advanced Microprocessor Architecture", 2nd edition, TMH, 2001.
2.Bray, "The Intel Microprocessors: Architecture, Programming and Interfacing", 2nd edition, PHI, 2003.
3. Soumitra Kumar Mandal, **"**Microprocessors And Microcontrollers Architecture, Programming & Interfacing Using 8085, 8086 And 8051", 1st edition, Mc Graw Hill India, 2011.
4. Muhammad Ali Mazidi, "The 8051 Microcontroller and Embedded Systems using Assembly and C.

PCC- EC09 (P)	Digital Communication Lab	0L: 0T: 2P (02 hrs.)	Credits: 01

Recommended Prerequisite: Engineering Mathematics, Electronics

Course Objective: To understand the key Modules of digital communication systems with emphasis on digital modulation techniques. To get introduced to the concept and basics of information theory and the basics of source and channel coding/decoding.

List of Experiments:
1. Study of Sampling Process and Signal Reconstruction and Aliasing.
2. Study of PAM, PPM and PDM.
3. Study of PCM Transmitter and Receiver.
4. Time Division Multiplexing (TDM) and Demultiplexing.
5. Study of ASK, PSK and FSK Transmitter and Receiver.

Assessment: Internal Viva, continuous evaluation of experiments, journal write up, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

1. To know the basics of random variable and distribution functions in digital Communications
2. To understand how the signal is converted from analog to digital signals
3. To learn the digital modulation techniques
4. To know how the signal is received and demodulation techniques
5. To understand the information theory used for channel coding

Text/ Reference Books:

1. Taub and Schilling, “Principles of Communication Systems”, 2ed Edition, TMH, 2007.
2. Lathi, “Modern Digital and Analog Communication Systems”, 4th Edition, Oxford University Press, 2010.
3. Simon Haykins, “Communication Systems”, 5th Edition, John Wiley, 2009.
4. Ranjan Bose, “Information TheoryCoding and Cryptography”, 2th Edition, TMH, 2008.
5. Skylar and Ray, “Digital Communications”, 2th Edition, Pearson Education, 2001.
6. Rao, “Digital Communications”, 2th Edition, TMH, 2017.

LC-EC10 (P)	Digital Signal Processing Lab	0L: 0T: 2P (2 hrs.)	Credits: 01

Recommended Prerequisite: Mathematics

Course Objective: The purpose of this subject is to make the students learn about theoretical basis of DSP, with the method of description of discrete and digital signals and systems in the domain-and transform domain, including discrete and Fast Fourier Transform and also learn the different DSP processor.

List of Experiments:

1. Write a MATLAB program for Addition, Subtraction, Multiplication & Division operation
2. Generation, analysis and plots of discrete-time signals (Unit impulse, unit step, Ramp).
3. Generation, analysis and plots of discrete-time signals (Sine, Cosine)
4. Implementation the scaling, shifting and folding operations on discrete time sequences
5. Computation and plot of DFT of sequences
6. Computation and plot of IDFT of sequences
7. Computation and plots circular convolution of two sequences.
8. Compute the DFT & IDFT of sequences using FFT Algorithm
9. Computation and plot poles and zeros of Z-transform.
10. IIR filter design using bilinear transformation.
11. To study the Architecture of TMS320VC67XX DSP processor
12. To Study the various addressing modes of TMS320C5416 XX DSP processor.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Course outcome:

Students earning credits will develop ability to:

1. Analyze and Implement the discrete time LTI system, and apply Z-Transform to realize the digital network and evaluate ROC.
2. Compute DFT and IDFT and analyze the complex discrete sequence
3. Compute DFT using FFT algorithm to analyze the complex discrete sequence.
4. Design IIR and FIR filters and evaluate the performance of digital filters.
5. Understand the fundamentals and different architecture of DSP Processor.

Text/Reference Books:

1. Oppenheim and Schafer: Digital Signal Processing, PHI Learning.1975.
2. Proakis: Digital Signal Processing, Pearson Education.2009
3. Sanjay Sharma, “Digital Signal Processing” 5th Edition, S. K. Kataria & Sons. 2009.
4. Ingle and Proakis, “Digital Signal Processing- A MATLAB based Approach, Thompson, Cengage Learning.2012.

PCC- EC11 (P)	Communication Networks and Transmission Lines Lab	0L: 0T: 2P (02hrs.)	Credits: 01

Prerequisite: Engineering Mathematics, Electromagnetic theory.

Lab Objective: The main objective of CNTL lab is to understand the fundamentals of communication networks and their relation with transmission lines. Study of characteristic impedance, input impedance, attenuators, filters and various types of transmission lines using kits comes under laboratory practical of CNTL.

List of Experiments:

1. To measure the characteristic impedance of a transmission line.
2. To measure the input impedance of a transmission line.
3. To measure the Attenuation of a transmission line.
4. To measure the phase difference between the current and voltage at the input of a transmission line.
5. To draw frequency characteristic of a line.
6. To Study of stationary waves.
7. To plot phase shift along line.
8. To locate the fault within the transmission line.
9. To study transmission line under pulsed condition.

Experiments on virtual labs:

1. Observe the transient phenomenon of terminated coaxial transmission lines in order to study their time domain behavior.
2. Study the behavior of terminated coaxial transmission lines in frequency domain.
3. Introduction to Smith chart and its application for the unknown impedance measurement.
4. Find the change in characteristics impedance and reflection coefficients of the transmission line by changing the dielectric properties of materials embedded between two conductors.

Assessment: Internal viva, Continuous evolution of experiments, Journal write-up, Quiz and End semester exam.

Text/ Reference Books:

1. Umesh Sinha, “Transmission lines and networks”, 2nd Edition, SatyaPrakashan, 2016.
2. B. R. Gupta, “Networks filters and transmission lines”, 2nd Edition, S. K. Kataria Publication, 2001.
3. J. D. Ryder,”Networks, Lines and Fields”, 2nd Edition, Prentice Hall of India, 2008.

PCC- EC12 (P)	Java Lab	0L: 0T: 2P (hrs.)	Credits: 01

Prerequisite: Computer Programming

Course Objectives:

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in Java and be familiar of the important concepts like class, inheritance and multithreading, AWT and JDBC.
3. Students will able to use the Java SDK environment to create, debug and run simple Java programs.

PRACTICALS

List of Experiments:

1. Write a program that accepts two numbers from the user and print their sum.
2. Write a program to calculate addition of two number using prototyping of methods.
3. Program to demonstrate function overloading for calculation of average.
4. Program to demonstrating overloaded constructor for calculating box volume.
5. Program to show the detail of students using concept of inheritance.
6. Program to demonstrate package concept.
7. Program to demonstrate implementation of an interface which contains two methods declaration square and cube.
8. Program to demonstrate exception handling in case of division by zero error.
9. Program to demonstrate multithreading.
10. Program to demonstrate JDBC concept using create a GUI based application for student information.
11. Program to display “Hello World” in web browser using applet.
12. Program to add user controls to applets.
13. Write a program to create an application using concept of swing.
14. Program to demonstrate student registration functionality using servlets with session management.

Course Outcomes:

On the completion of this course students will be able to understand:

1. Understand concepts of Java programming
2. The basic terminology used in computer programming and write, compile and debug programs in JAVA language.

3. Analyze different data types, decision structures, loops, functions to design Java programs.
4. Develop program using the java collection API as well as the java standard class library.
5. Develop Java applets

SBC- EC04 (P)	**Electronics Workshop-III (IOT & Embedded System Design)**	**0L: 0T: 4P (2 hrs.)**	**Credits: 02**

Course Objective: The purpose of this lab is to learn, implement and simulation of various embedded system using different controllers.

List of Experiments:

1. Write a program in embedded c to blink LED on PORT1 of 8051.
2. Write a program in embedded c to transfer one byte of data on serial port of 8051.
3. Write a program in embedded c for 8051 to control motor speed using PWM.
4. Write a program in embedded c to blink LED on PORTA of pic16f877a.
5. Write a program in embedded c to transfer one byte of data on serial port of pic16f877a.
6. Write a program in embedded c for pic16f877a to control motor speed using PWM.
7. Write a program in embedded c to blink LED using AVR controller.
8. Write a program in embedded c to transfer one byte of data on serial port of AVR controller.
9. Write a program in embedded c for pic16f877a to control motor speed using AVR controller.
10. Write a program in embedded c to blink LED using ARM controller.
11. Write a program in embedded c to sense obstacle using Arduino UNO.
12. Write a program in embedded c to sense different type of gases using Arduino UNO.
13. Write a program in embedded c for Arduino UNO to control motor speed using PWM.

Assessment: Internal viva, Continuous evolution of experiments, Quiz and End semester exam.

Course outcome:

1. The students will be able to analyze the mathematical and physical foundations of embedded c programming on different controllers.
2. The students will be able to critically evaluate alternate assumptions, approaches, Procedures, tradeoffs, and results during embedded system design.
3. The students will be able to design variety of electronic circuits using embedded systems.
4. The students will be able to demonstrate their design and able to present views.
5. The students will be able to get skilled and deliver technical presentation.

MLC03	Environmental Studies	1L: 0T: 0P (1 hrs.)	Credits: Audit

Course Objective: The central objective of this course is to provide an interdisciplinary understanding of complex environmental issues by integrating concepts from the natural, social, and humanities sciences. The course aims to equip students with the knowledge, analytical skills, and ethical perspectives necessary to assess the causes and consequences of environmental degradation, and to critically evaluate and advocate for sustainable solutions at local, national, and global levels.

Module 1 **(4 hrs.)**
Energy: Introduction, conventional and non-conventional energy resources - coal, oil, gas, solar energy, wind energy, geothermal energy, Hydropower, Bio-energy, Nuclear energy. Energy survey in India. Current and future energy requirements in India and across the world including associated environmental problems.

Module 2 **(4 hrs.)**
Ecosystem and Biodiversity: Introduction of an ecosystem, Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, rivers, oceans),Biodiversity at global, national and local levels. Threats to biodiversity, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic adoption values; Endangered and endemic species of India. Conservation of biodiversity: In-Situ and Ex-Situ.

Module 3 **(4 hrs.)**
Air pollution and Water Pollution: Definition, Cause, effects and control measures of Air pollution; Mobile and stationary sources of air pollutants, effective stack height concept, CO, CO2, H2S, SOx, NOx emissions, and its control. Definition, Classification, Cause, effects and control measures of water pollution, Measurement of levels of pollution such as DO, BOD, COD.

Module 4 **(4 hrs.)**
E-Waste: Definition, Classification, Cause, effects and control measures of e-waste, global trade issues of e-waste, Recycling method of e-waste & its benefit.

Module 5 **(4 hrs.)**
Environment Impact & Protection Act Environment: Protection Act; Air (Prevention and Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness. Environmental Impact Assessment. Measuring environmental impacts and policies for the regulation of environmental impacts.

Course Outcomes:

1. Classify different conventional and non-conventional energy resources such as coal, oil, gas, solar, wind, hydro, and nuclear energy.
2. Describe the structure and functions of various ecosystems (forest, grassland, desert, and aquatic).
3. Identify the causes and effects of air and water pollution.
4. Define and classify electronic waste and its major sources.
5. Explain key environmental laws and acts in India (Air, Water, Forest, Wildlife, Environment Protection Acts).

LLC03	Liberal Learning Course-III	0L: 0T: 2P (02 hrs)	Credits: 00

Course Objective: The objective is to develop critically-thinking, interdisciplinary scholars who possess broad domain expertise, utilize evidence-based reasoning to solve complex problems, appreciate and connect diverse cultural and social experiences (including sports) to individual life, and are equipped for global citizenship through effective communication, self-awareness, and a commitment to lifelong learning.

Liberal Learning Course (LLC) -III, LLC03 (Any One Course from NCC/NSO/NCA)

A. NCC

B. NSO

- Any one Sports at State Level

C. NCA

(a) Music
(b) Dance
(c) Photography
(d) Cinematography
(e) Podcasting
(f) Theatre
(g) Painting

Course Outcomes:

1. Possess expertise and understanding across various domains; illustrate the interdisciplinary intersections between two or more liberal arts disciplines.
2. Display critical thinking skills by employing evidence-based reasoning to solve problems and make well-informed decisions.
3. Contemplate pluralism and cultural legacies; grasp and value human cultural, Sports, and social experiences, and adeptly connect them to individual experiences.
4. Effectively communicate to diverse audiences the significance of students' individualized liberal studies plans, their educational journey, and the knowledge they have acquired.
5. Equip oneself for global citizenship by fostering self-awareness, social responsibility, and a commitment to lifelong learning.