DEPARTMENT OF ELECTRONICS ANDCOMMUNICATION ENGINEERING
NATIONAL INSTITUTE OFTECHNOLOGY KURUKSHETRA

B.Tech. in Industrial Internet of Things (IIoT) Programme Scheme

For Academic Year 2023-24 onwards

The Course Structure for B. Tech. Programme shall have the following categories of courses:

Sr. No.	Category
1	Institute Core (IC)
2	Non-Conventional Institute Core (NC)
3	Program Core (PC)
4	Program Elective (PE)
5	Open Elective (OE)

Course category explanation

Course category	Explanation
IC	Basic Sciences
	Engineering Arts and Sciences
	Humanities and Social Sciences
PC	Courses specific to the relevant discipline
PE	Elective Courses specific to the relevant discipline
OE	Elective Courses from any domain
NC	Courses only qualifying in nature

Course category summery sheet:

Course Category	SEMESTER								Total Courses
	I	II	III	IV	V	VI	VII	VIII	
IC	**06**	**05**	**01**	**01**	**-**	**-**	**01**	**01**	**15**
PC	**00**	**01**	**05**	**05**	**02**	**03**	**01**	**01**	**20**
PE	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**08**
OE	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**04**
NC	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**02**
Total Credits	**20**	**20**	**21**	**21**	**20**	**21**	**18**	**20**	**49 161**

SEMESTER —I

Course Category	S.No	Course Title	CourseCode	Lecture(L)/ Tutorial(T)/ Practical(P) per week			Credits
				L	T @	P	
IC	1	Communication Skills in English	HSIC 101	2	0	2	3
		(OR)					
		Financial Education	HSIC 103	3	0	0	
	2	Differential Calculus and Differential Equations	MAIC 101	3	0	0	3
	3	Engineering Physics	PHIC 101	2	0	2	3
	4	Engineering Practice	MEIC 102	1	0	3	2
	5	Problems Solving and Programming using C	CSIC 103	3	0	2	4
	6	Energy and Environment Science	CHIC 101	2	0	2	3
NC	7	Human Values and Social Responsibility	HSNC 101	2	0	0	2
		Sanskrit Language Skills	HSNC 102				
		Hindi Language Skills	HSNC 103				
		Telugu Language Skills	HSNC 104				
		Constitution of India	HSNC 105				
		Vedic Mathematics	MANC 101				
	8	NCC/ Sports /Yoga	SWNC 101	0	0	4	2*
	9	NSS/Club/Technical Societies	SWNC 102	0	0	4	
		Total Credits					20

*Continuous Evaluation Model as per guidelines and the credit to be awarded at the end of 6th semester based on Cumulative performance up to 6th semester.

Minimum number of students required to register for the subject to be offered is 50 and maximum number is 80 in one lecture group, limited to only 2 lecture groups for any subject.

@ In lieu of tutorial, wherever necessary, assignments and interactions with the students may be conducted at their own convenience by the faculty concerned.

SEMESTER —II

Course Category	S.No	Course Title	Course Code	Lecture(L)/ Tutorial(T)/ Practical(P) per week			Credits
				L	T @	P	
IC	1	Economics for Engineers (OR) Business Studies	HSIC 102	3	0	0	3
			HSIC 104	3	0	0	
	2	Integral Calculus and Difference Equations	MAIC-102	3	0	0	3
	3	Advanced Engineering Physics	PHIC 105	2	0	2	3
	4	Engineering Graphics (Web Design)^	CSIC 102	1	0	3	2
	5	Programming using Python	CSIC 104	3	0	2	4
NC	6	Indian Knowledge Systems	HSNC 106	2	0	0	2
		Teachings of Gita	HSNC 107				
		French Language Skills	HSNC 108				
		German Language Skills	HSNC 109				
		Japanese Language Skills	HSNC 110				
		Thought Lab and Practices	HSNC 111				
	7	NCC/ Sports /Yoga	SWNC 101	0	0	4	2*
	8	NSS/Club/Technical Societies	SWNC 102	0	0	4	
PC	9	Circuit Theory (Theory & Lab)	IIPC 101	3	0	2	4
Total Credits							**20**

^Treated as a practical course (not integrated), evaluation will be as per practical course.
*Continuous Evaluation Model as per guidelines and the credit to be awarded at the end of 6th semester based on Cumulative performance up to 6th semester.

Minimum number of students required to register for the subject to be offered is 50 and maximum number is 80 in one lecture group, limited to only 2 lecture groups for any subject.

@ In lieu of tutorial, wherever necessary, assignments and interactions with the students may be conducted at their own convenience by the faculty concerned.

SEMESTER —III

Course Category	S.No	Course Title	Course Code	Lecture(L)/ Tutorial(T)/ Practical(P) per week			Credits
				L	T @	P	
IC	1	Applied Linear Algebra	MAIC 204	3	0	0	3
PC	2	Analog & Digital Electronics	IIPC 201	3	0	0	3
	3	Signals, Systems &Random Variables	IIPC 202	3	0	0	3
	4	Automation Fundamentals	IIPC 203	3	0	0	3
	5	Introduction to IoT	IIPC 204	3	0	0	3
	6	Principles of Communication Engineering	IIPC 205	3	0	0	3
	7	Electronics-Lab	IIPC 206	0	0	2	1
	8	Signals & Communication Lab using MATLAB	IIPC 207	0	0	2	1
	9	IoT Lab	IIPC 208	0	0	2	1
NC	10	NCC/ Sports /Yoga	SWNC 101	0	0	4	2*
	11	NSS/Club/Technical Societies	SWNC 102	0	0	4	
		Total Credits					**21**

SEMESTER —IV

Course Category	S.No	Course Title	Course Code	Lecture(L)/ Tutorial(T)/ Practical(P) per week			Credits
				L	T@	P	
IC	1	Machine Learning & Data Analytics (INT)	CSIC 221	3	0	2	4
PC	2	Microprocessors & Computer Architecture	IIPC 209	3	0	0	3
	3	Data Structures and Algorithms	IIPC 210	3	0	0	3
	4	Industry 4.0 and IIoT	IIPC 211	3	0	0	3
	5	Data Communication & Networking	IIPC 212	3	0	0	3
	6	Object Oriented Programming with JAVA (INT)	IIPC 213	2	0	2	3
	7	Microprocessors Lab	IIPC 214	0	0	2	1
	8	Programming for IoT Devices Lab	IIPC 215	0	0	2	1
NC	9	NCC/ Sports /Yoga	SWNC 101	0	0	4	2*
	10	NSS/Club/Technical Societies	SWNC 102	0	0	4	
		Total Credits					**21**
Six-week internship during summer vacation Mandatory and it is to be evaluated in the V semester.							

*Continuous Evaluation Model as per guidelines and the credit to be awarded at the end of 6th semester based on Cumulative performance up to 6th semester.

SEMESTER —V

Course Category	S.No	Course Title	Course Code	Lecture(L)/ Tutorial(T)/ Practical(P) per week			Credits
				L	T@	P	
PC	1	IoT Architecture & Computing	IIPC 301	3	0	0	3
	2	Wireless Sensor Networks	IIPC 302	3	0	0	3
PE	3	Program Elective-I	IIPE xxx	3	0	0	3
	4	Program Elective -II	IIPE xxx	3	0	0	3
OE	5	Open Elective-I	IIOE xxx	3	0	0	3
PC-Lab	6	Wireless Sensor Networks Lab (*to be established*)	IIPC 303	0	0	2	1
	7	Verilog HDL Lab	IIPC 304	0	0	2	1
	8	Simulation & Modeling Lab	IIPC 305	0	0	2	1
	9	Seminar	IIPC 306	0	0	2	1
	10	# Summer Training	IIPC 307	Six Weeks			1
NC	11	NCC/ Sports /Yoga	SWNC 101	0	0	4	2*
	12	NSS/Club/Technical Societies	SWNC 102	0	0	4	
		Total Credits					**20**

LIST OF PROGRAM ELECTIVES & OPEN ELECTIVES

Sr.No	Course Code	Course Title
PROGRAM ELECTIVE-I		
1	IIPE 301	Control System Engineering
2	IIPE 302	Information Theory and Coding
3	IIPE 303	Verilog HDL
4	IIPE 304	Digital Signal Processing
5	IIPE 305	Real Time Operating systems
6	IIPE 306	Neuro- Fuzzy Systems
PROGRAM ELECTIVE-II		
1	IIPE 307	Data Acquisition Systems
2	IIPE 308	Analog IC Design
3	IIPE 309	Mobile Computing
4	IIPE 310	Optimization Techniques
5	IIPE 311	Simulation & Modeling
6	IIPE 312	Smart Materials for IoT Devices
Open Elective-I		
1	IIOC 301	Industry 4.0 and IIoT
2	IIOC 302	Automation Fundamentals

SEMESTER —VI

Course Category	S.No	Course Title	Course code	Lecture(L)/ Tutorial(T)/ Practical(P) per week			Credits
				L	T@	P	
PC	1	Cybersecurity	IIPC 308	3	0	0	3
	2	Embedded System Design	IIPC 309	3	0	0	3
	3	Cloud Computing	IIPC 310	3	0	0	3
PE	4	Program Elective-III	IIPE xxx	3	0	0	3
	5	Program Elective -IV	IIPE xxx	3	0	0	3
OE	6	Open Elective-II	IIOE xxx	3	0	0	3
PC-Lab	7	Embedded System Design Lab	IIPC 311	0	0	2	1
	8	Deep learning Lab	IIPC 312	0	0	2	1
	9	Process Instrumentation Lab	IIPC 313	0	0	2	1
NC	10	NCC/ Sports /Yoga	SWNC 101	0	0	4	2*
	11	NSS/Club/Technical Societies	SWNC 102	0	0	4	
		Total Credits					21
# Six-week internship during summer vacation mandatory and it is to be evaluated in the VII-sem.							

LIST OF PROGRAM ELECTIVES & OPEN ELECTIVES

Sr.No	Course Code	Course Title
PROGRAM ELECTIVE-III		
1	IIPE 313	Image Processing Computer Vision
2	IIPE 314	Robotics
3	IIPE 315	Energy Harvesting
4	IIPE 316	Wireless Communication Technologies for IoT
5	IIPE 317	Advanced Microcontroller Architecture
6	IIPE 318	Digital IC Design
PROGRAM ELECTIVE-IV		
1	IIPE 319	Deep Learning
2	IIPE 320	Data Base Management Systems
3	IIPE 321	Introduction to Operational Technologies Networks
4	IIPE 322	Mechatronics Systems & Applications
5	IIPE 323	Data Visualization and Presentation
6	IIPE 324	Digital Forensics
Open Elective-II		
1	IIOE 303	Cyber Physical Systems
2	IIOE 304	Microcontroller Programming & Interfacing

SEMESTER —VII

Course Category	S.No	Course Title	Course code	Lecture(L)/ Tutorial(T)/ Practical(P) per week			Credits
				L	T@	P	
IC	1	Entrepreneurship & Start Ups	XXIC XXX	3	0	0	3
PC	2	Edge & Fog Computing	IIPC 401	3	0	0	3
PE	3	Program Elective-V	IIPE xxx	3	0	0	3
	4	Program Elective -VI	IIPE xxx	3	0	0	3
OE	5	Open Elective-III	IIOE xxx	3	0	0	3
PC-Lab	6	Project-I	IIPC 402	0	0	4	2
	7	# Summer Training	IIPC 403	Six Weeks			1
		Total Credits					18

LIST OF PROGRAM ELECTIVES & OPEN ELECTIVES

Sr.No	Course Code	Course Title
PROGRAM ELECTIVE-V		
1	IIPE 401	Cognitive Radio
2	IIPE 402	Biomedical Electronics
3	IIPE 303	Optical Communication Networks
4	IIPE 404	RF Microelectronics
5	IIPE 405	Mobile Application Development
6	IIPE 406	Optical Networking &Switching
7	IIPE 407	ASICs & FPGAs
8	IIPE 408	RADAR & Navigation
PROGRAM ELECTIVE-VI		
1	IIPE 409	Vehicular Ad-hoc Networks
2	IIPE 410	Quantum Communication
3	IIPE 411	Optical Wireless Techniques for IoT & 5G/6G systems
4	IIPE 412	IoT Project Management
5	IIPE 413	Block Chain Technologies
6	IIPE 414	Wearable Computing
7	IIPE 415	Sensor Data Mining/ Data Stream Mining
8	IIPE 416	Parallel Computing
Open Elective-III		
1	IIOE 401	Sensors and Actuator Devices for IoT
2	IIOE 402	Robotics

SEMESTER —VIII

Course Category	S.No	Course Title	Course code	Lecture(L)/ Tutorial(T)/ Practical(P) per week			Credits
				L	T@	P	
IC	1	Professional Ethics &IPR	XXIC XXX	3	0	0	3
PC	2	IoT Security & Privacy	IIPC 404	3	0	0	3
PE	3	Program Elective-VII	IIPE xxx	3	0	0	3
	4	Program Elective -VIII	IIPE xxx	3	0	0	3
OE	5	Open Elective-IV	IIOE xxx	3	0	0	3
PC-Lab	6	IoT Security Lab (*to be established*)	IIPC 405	0	0	2	2
	7	Project-II	IIPC 406	0	0	6	3
		Total Credits					20

LIST OF PROGRAM ELECTIVES & OPEN ELECTIVES

Sr.No	Course Code	Course Title
PROGRAM ELECTIVE-VII		
1	IIPE 418	LiDAR & Remote Sensing
2	IIPE 419	MEMS
3	IIPE 320	VLSI Physical Design
4	IIPE 421	DSP Architecture
5	IIPE 422	IoT Enhanced AR&VR
6	IIPE 423	Quantum Computing
7	IIPE 424	6G N/W
PROGRAM ELECTIVE-VIII		
1	IIPE 425	Nano Sensors
2	IIPE 426	Bio-Sensors
3	IIPE 427	SCADA System Applications
4	IIPE 428	Selected Topics in Sensors & IoT
5	IIPE 429	E-Commerce and ERP
6	IIPE 430	Soft Computing & Expert Systems
7	IIPE 431	Industrial IoT Markets & Security
Open Elective-IV		
1	IIOE 403	Computer N/W & Cryptography
2	IIOE 404	Applications of Image Processing

SECOND SEMESTER

ECPC 101: CIRCUIT THEORY (INT)

Pre-requisite: Mathematics (MAIC-101)

L	T	P	Credits	Total contact hours
3	0	2	4	40

BRIEF DESCRIPTION ABOUT THE COURSE:

The aim of this course is to make student competent in analyzing electrical circuits, apply Kirchhoff's current and voltage laws to circuits in order to determine voltage, current and power in branches of any circuits excited by DC voltages and current sources.

COURSE CONTENT

UNIT I 12hrs.

BASIC CIRCUITS & NETWORK THEOREMS

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Initial conditions. Network reduction: voltage and current division, source transformation – star delta conversion. Theorems: Thevenin's and Norton's, Superposition, Maximum power transfer, Substitution, and Reciprocity Theorems.

UNIT II 10hrs.

RL, RC and RLC CIRCUITS & RESONANCE

Series and parallel resonance – their frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits –Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input – Bandwidth and High *Q* circuits.

UNIT III 10hrs.

S – DOMAIN ANALYSIS OF CIRCUITS

Complex Frequency – Definition of the Laplace Transform – Laplace Transforms of Simple Time Functions – Inverse Transform Techniques – Basic Theorems for the Laplace Transform – The Initial – Value and Final –Value Theorems – Z(s) & Y(s) – Nodal and Mesh Analysis in s–Domain – Additional Circuit Analysis Techniques – Poles, Zeros, and Transfer Functions – Convolution Transfer Function.

UNIT IV 8hrs.

TWO–PORT NETWORKS

ONE–Port Networks – Admittance Parameters – Some Equivalent Networks – Impedance Parameters – Hybrid Parameters – Transmission Parameters.

Text/ Reference Books:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6 th edition, New Delhi, 2003.

2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGrawHill, New Delhi, 2001. 4th ED

3. M.E. Van Valkenburg, Ahmed Rumel, "Network Analysis", Prentice-Hall of India Pvt.Ltd.; 3rd edition

Course outcomes:

On completion of this course, you should be able to:

CO 1. Apply KCL and KVL in electrical circuits to calculate currents, voltages and powers in typical linear electric circuits
CO 2. Apply circuit theorems and reduce more complicated circuits into the Thevenin's and Norton's equivalent circuits.
CO 3. Analyze AC and DC Circuits.
CO 4. Describe circuit elements in phasor domain and perform steady-state analysis using phasors.
CO 5. Analyze resonance circuits and to develop transfer functions.
CO 6. To understand Two–Port networks and its parameters.

CIRCUIT THEORY LAB

Brief Description about the course: The aim of course is to make student competent in analyzing electrical circuit, apply Kirchhoff's Voltage and Current Laws to circuit in order to determine voltage, current and power in branches of any circuits excited by DC voltage and current sources.

S.NO	**Experiments**	**Objectives**
1	DC Measurement	(i) To understand the basics of DC (direct current) circuits. (ii) To use a digital multimeter (DMM) to measure DC voltage, current and resistance. (iii) To understand the valid measurement condition for a digital multimeter.
2	Network Analysis Methods	(i) To analyze a resistive circuit using node or mesh analysis. (ii) To understand Thevenin's and Norton's theorems. (iii) To verify the superposition principle.
3	AC Measurement	(i) To understand the basics of AC (alternating current) circuits. (ii) To use an oscilloscope to display and record a waveform. (iii) To use an oscilloscope to measure frequency, period, voltage (magnitude, peak-to-peak, maximum, minimum, and etc), DC offset, etc, of the waveform. (iv) To use an oscilloscope to measure frequency, period, voltage (magnitude, peak-to-peak, maximum, minimum, and etc), DC offset, etc, of the waveform.
4	First order & Second order circuits	(i) To study the step response of first order circuits. (ii) To understand the concept of the time constant. (iii) To study the step response of second order circuits. (iv) To understand the difference between overdamped, critically damped and underdamped responses. (v) To determine theoretically and experimentally the damped natural frequency in the under-damped case.
5	Sinusoidal Steady State	(i) To understand and calculate the power factor of a passive circuit. (ii) To verify that resistive components dissipate power while reactive components do not.
6	Transfer Functions	(i) To Study the transfer function of a circuit. (ii) To use the transfer function to find the specified frequency specified in the different cases.
7	Series and Parallel Resonance	(i) To study the behavior of series and parallel LC circuits at resonance. (ii) To understand the resonance frequency, cut-off frequency, bandwidth and quality factor of a resonance circuit. (iii) To determine if the circuit is inductive or capacitive. (iv) To understand the circuit behavior at resonance.

Course outcomes:

At the end of the course, the students will be able to:

CO1: Apply KVL and KCL in electrical circuits to calculate current, voltage and power in typical linear electrical circuit.
CO2: Apply circuit theorems.
CO3: Analyze AC and DC circuits.
CO4: Reduce more complex circuits in to Thevenin's and Norton's equivalent circuits.
CO5: Describe circuit elements in phasor domain and perform steady state analysis using phasors.
CO6: Analyze resonance circuits.

THIRD SEMESTER

IIPC 201: ANALOG AND DIGITAL ELECTRONICS

Pre-requisite: PHIC 101, PHIC 105

L	T	P	Credits	Total contact hours
3	0	0	3	40-44

Brief Description about the course
The course focuses on fundamental principles, underlying mathematics, and implementation details of Analog and Digital Electronics. This course covers a broad spectrum of BJT/FET amplifiers, concept of feedback and oscillators. The course delves into the basics of operational amplifier circuits, A/D and D/A converters, combinational circuits, number systems, Flip-Flops, combinational and sequential logic circuits.

UNIT-I 12hrs

PN junction diode: Characteristics and analysis, Types of diodes, Rectifiers and Filter Circuit: Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier and their Analysis, Filters; Series and Shunt Diode Clippers, Clamping Circuit; Basic Regulator Supply using Zener Diode.

Transistor fundamentals: Construction and Characteristics of BJT, DC operating point and Biasing, Transistor Configuration: CB, CE, CC Configuration; Transistor at Low Frequency, Small Signal Low Frequency Transistor Model (h-parameters), Analysis of Transistor Amplifier (CE) using h-parameters.

UNIT-II 10hrs

Amplifiers: MOS amplifiers; Multistage amplifiers, frequency response of amplifiers, Feedback Sinusoidal oscillators.
Introduction to Op-Amp, ideal Op-Amp, equivalent circuit, transfer characteristics, Op-Amp with negative feedback, inverting and non-inverting amplifiers, frequency response, and slew rate. Applications of Op-Amp: Integrator, Differentiator, summing etc. Digital-to-Analog Converters (DAC), Analog-to-Digital Converters (ADC).

Unit – III 12hrs
Number Systems and Codes: Binary, octal, and hexadecimal number systems, Conversion between number systems, Complements of binary numbers.
Boolean Algebra and Logic Gates: Boolean algebra: Boolean laws, De Morgan's theorem, Boolean functions, Karnaugh maps. Basic logic gates, Universal gates and their applications.

Unit – IV 10hrs
Combinational Logic Circuits: Decoders, encoders, multiplexers, de-multiplexers and their application; three state devices, comparators, programmable logic devices,
Sequential Logic Circuits: Latches and flip-flops, SR, D, J-K, T flip-flops &conversions, shift registers, counters, design and analysis of synchronous and asynchronous sequential circuits.

Text/Reference Books

1. Sedra & Smith, *Microelectronic Circuits* - 5th Edition
2. Boylestad & Nashelsky, *Electronic Devices and Circuit Theory* - 9th Edition
3. A.P. Malvino, Electronic Principles, Tata Mcgraw Hill Publications
4. William Kleitz, Digital Electronics, Prentice Hall International Inc
5. R. T. Howe and C. G. Sodini, *Microelectronics: An Integrated Approach*, Prentice Hall Inc. 1997.
6. Jacob Millman, and C.C. Halkias, "Electronic devices and circuits", TMH Publications.
7. Ben G. Streetman, *Solid State Electronic Devices*, PHI, 5th Ed, 2001
8. Michael Shur, *Introduction to Electronic Devices*, John Wiley & Sons Inc., 2000

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

CO1: Develop the ability to analyze and design analog electronic circuits using discrete components.
CO2: Understand the amplifiers, concept of feedback and oscillators.
CO3: Describe the design and analysis of Op-Amp.
CO4: Design the digital circuits using Flip-Flops.

IIPC 202: SIGNALS, SYSTEMS AND RANDOM VARIABLES

Pre-requisite: MAIC 101, MAIC102

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course

The course on signals, systems and random variables provides a foundation for the design and analysis of various engineering and behavioral science systems. It contains description of various discrete time and continuous signals, convolution integral and convolution sum, LTI systems, Fourier series and Fourier Transform and their important properties. Random variables and processes are dealt with in detail. Several important distribution functions applicable to different engineering fields are included. The students shall be able to apply the knowledge to various science and engineering fields.

UNIT - I 10 hrs.

LTI Systems: Continuous time and discrete time signals, Even and Odd signals. Classification of signals, Continuous time and Discrete time LTI Systems, convolution Integral and convolution sum, Properties of LTI Systems, causality; stability, time invariance, linearity. Differential and Difference equations. Singularity functions.

UNIT – II 10 hrs.

Fourier Analysis of Signals: Fourier series representation of continuous time and discrete time periodic signals. Fourier series and LTI Systems. Continuous Time Fourier Transform (CTFT), Convergence of FT. Properties of CTFT. Discrete time Fourier Transform (DTFT). Properties of DTFT. Systems characterized by Linear constant co-efficient differential equation and difference equations. Magnitude and phase spectrum, group delay.

UNIT - III 12 hrs.

Random Variables: Probability, Conditional Probability, definition of random variables, cumulative distribution function, probability density function, discrete random variables, continuous random variables, moments of random variables. Chebyshev inequality. Distribution functions: uniform, rectangular, Gaussian, Bernoulli, binomial, Poisson, Exponential, Rayleigh, etc. Sum of random variables, Functions of random variables. Joint distribution, marginal and conditional distributions, statistical independence, Central Limit Theorem, moments and Characteristic Functions.

UNIT - IV 8 hrs.

Random Processes: Definition and description of Random Processes, Classification of random processes, statistical characterization, mean, correlation and covariance functions, Stationary random processes, Ergodicity, Power Spectral density, Weiner-khintchine theorem, Response of memory- less and linear systems to random inputs, discrete time stochastic processes, Cyclo-stationary processes, Gaussian, Poisson, Markov processes.

Text / Reference Books:

1. Oppenheim Willsky and Nawab, Signals and Systems, PHI. 4th Ed
2. Simon Haykin , Signals and Systems, John Wiley 4th Ed
3. Taub and Schilling, Principles of Communication Systems, TMH. 4th Ed
4. Papoulis, A. Probability, Random Variables and Stochastic Processes, MGH, 3rd Ed.
5. Gray, R.M. Davission, L. D. Introduction to Statistical Signal Processing- Web Edition-1999.
6. Sundarapandian, V. Probability, Statistics and Queueing Theory, PHI Learning Private Limited, 3rd Ed.

Course Outcomes

CO1: Utilize the concepts of Discrete time and Continuous time signals and their transformations.
CO2: Analyze the Fourier series of periodic and Fourier transform of non-periodic discrete time and continuous time signals.
CO3: Understand and apply the concepts of Fourier series and Fourier transform.
CO4: Characterize probability models and function of random variables based on single & multiples random variables.
CO5: Understand the concept of random processes and determine covariance and spectral density of stationary random processes.

IIPC 203: AUTOMATION FUNDAMENTALS

Pre-requisite: Mathematics

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course

Automation is playing a key role in Industries. Industries rely heavily on automation for economic viability and mass production. It is important for the students to learn basic of automation, how system works and importance of PLC, SCADA and robots in automation. This course will provide opportunity to learn industrial automation techniques.

UNIT - I 8 hrs.

Introduction to Automation: 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. Role of computers in measurement and control. Hydraulic and Pneumatic Systems in Automation

UNIT – II 10 hrs.

Automation components: Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT - III 12 hrs.

Programmable logic controllers: Programmable controllers, Programmable logic controllers, Analog digital input and output modules, 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 10 hrs.

Distributed Control System: Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS, Overview of Industrial automation using robots.

Text Books / Reference:

1. Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies
2. Process Control Instrumentation Technology By. C.D. Johnson, PHI
3. Industrial control handbook, Parr, Newnem
4. Programmable logic controller, Dunning, Delmar
5. Mikell Groover, Automation, Production Systems, and Computer-Integrated Manufacturing, 5th Edition, Pearson, 2019.
6. Jon Stenerson, Industrial Automation and Process Control, Pearson, 2003.
7. Frank Lamb, Industrial Automation: Hands On, McGraw-Hill Education, 2013.

Course Outcomes:

CO1: Understanding of automation components and systems application.

CO2: Identify suitable industrial automation hardware for given application.

CO3: Measure industrial parameters like temperature, pressure, force, displacement, speed, flow, level, humidity and pH.

CO4: Integration of SCADA with PLC Systems.

IIPC 204: INTRODUCTION TO IOT

Pre-requisite:

L	T	P	Credits	Total contact hours
3	0	0	3	40-45

Brief Description about the course:
This course will be focused on introducing students to new trends, applications, system architecture and challenges involved in developing/deploying internet of things systems using real industrial use cases. A number of systems are getting connected to the internet, where the sensor data is analyzed to monitor and control the systems. Correctly analyzing data coming from multiple sensors, choosing the right hardware given the power and performance tradeoff, hardware heterogeneity and security are some of the challenges involved in developing

UNIT-I 10hrs.

Concept of IoT, Vision, Impact, Challenges in IoT, IoT network architecture, Reference Model, Functional stack, Machine to Machine Communication, Standardization

UNIT-II 10hrs.

Smart 'Things', Sensors, Actuators, Devices for IoT, Interfaces, Data Aggregation, Data analytics for IoT, Big data analytics, IoT security and Privacy

UNIT-III 10hrs.

Communication technologies- IEEE 802.15.24, IEEE 802.15.4e, IEEE 802.11ah, NB-IoT, IoT network layer, 6LoWPAN, 6Lo, IoT application layer, Transport methods- CoAP, MQTT, AMQP

UNIT-IV 15hrs.

Applications and Case Studies, Implementation of IoT with Raspberry Pi,

Case studies: smart homes, smart cities, connected vehicles, Agriculture, Healthcare, environmental monitoring, smart manufacturing

Text Books / Reference:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, 2018, Pearson India,
2. Rajkumar Buyya, Amir V. Dastjerdi, "Internet of Things: Principles and Paradigms", 2016, Morgan Kaufmann Publisher

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

CO1: To understand fundaments of IoT and its architectural framework

CO2: Ability to use sensors and wireless sensor networks for data collection

CO3: Ability to perform big data analysis

CO4: Ability to use IoT technology in real life scenarios

IIPC 205: PRINCIPLES OF COMMUNICATION ENGINEERING

Pre-requisite: Signals & Systems

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course

The course will provide the fundamentals and basic concepts of different analog and digital modulation and demodulation schemes. The effect of AWG noise on these systems.

UNIT - I 10 hrs.

Amplitude Modulation (AM) and Demodulation, Double Sideband Suppressed Carrier (DSB-SC) Modulation and Demodulation, Single Sideband Modulation (SSB), Vestigial Sideband Modulation (VSB), Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency, Carsons Rule for FM Bandwidth, FM Demodulation, Super-heterodyne receivers

UNIT - II 10 hrs.

Introduction to Sampling, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation, Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, Non-Uniform Quantizers, Pulse Code Modulation, DPCM Delta Modulation, Inter-Symbol Interference.

UNIT - III 10 hrs.

Geometric Representation of Signals, Maximum likelihood detection, Matched filter, Correlation receiver, Coherent Binary Digital Modulation Schemes (Binary PAM, BPSK, QPSK, BFSK), their Spectral Efficiency and Error Performance.

UNIT – IV 10 hrs.

M-ary Digital Modulation Schemes, Noncoherent Modulation and Demodulation, Principle of Spread Spectrum systems, Pseudo-Noise Sequences, Direct Sequence Spread Spectrum and Frequency-Hopped Spread Spectrum systems, CDMA.

Text / Reference Books:

1. Simon Haykins, Communication Systems, Wiley & Sons, 4th Edition.
2. Herbert Taub, and Donald L. Schilling, Principles of Communication Systems, McGraw-Hill.
3. B.P. Lathi, Modern Digital and Analog Communications, Oxford.
4. George Kennedy and Bernard Davis, Electronics & Communication Systems.

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

CO1: Understanding of communication fundamentals.
CO2: Understand different analog modulation and demodulation schemes.
CO3: Understand different digital modulation and demodulation schemes and analyse their performance.
CO4: Understand different spread spectrum systems and their applications.

IIPC 206: ELECTRONICS LAB

Pre-requisite: PHIC-101, PHIC-103, IIPC-201

L	T	P	Credits	Total contact hours
-	-	2	1	24-28

Brief Description of the Course:
This course is designed to apply knowledge of analog electronics& digital electronics to a hands-on laboratory experience. To design and analyze various electronic circuits using p-n junction diode, Zener diode, assemble and make performance measurements on analog circuits. To familiarize students with the working of ICs of logic gates, MUXs, Encoder, Decoder, Flip-Flops etc. To demonstrate students the realization of MUXs/De-MUX, Encoder, Decoder, Flip-Flops etc. with the help of basic ICs.

List of Experiments:
1. PN Junction diode characteristics.
    A. Forward bias
    B. Reverse bias.
2. Zener diode characteristics and voltage regulator.
3. Half wave Rectifier with and without filter &Full wave Rectifier with and without filter.
4. Introduction to Digital Design Lab- Nomenclature of Digital ICs, Specifications, Study of the Data Sheet, Concept of V_{cc} and Ground, Verification of the Truth Tables of Logic Gates using TTL ICs.
5. Study and Verify (a) Demorgan's Theorem for 2 variables. (b) The sum-of product and product-of-sum expressions using universal gates.
6. Design and implementation of (a) Full Adder using basic logic gates. (b) Full subtractor using basic logic gates.
7. Implementation and Verification of Decoder/De-Multiplexer and Encoder using Logic Gates.
8. Realization of the following flip-flops using NAND Gates. (a) Clocked SR Flip-Flop (b) JK Flip-Flop.
9. Realization of following shift registers using IC7474 (a) SISO (b) SIPO (c) PISO (d)PIPO.
10. Design and implementation of MOD-12 up and down counter.

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

CO 1. To demonstrate students the working and input-output characteristics of p-n junction diode, Zener diode,

CO 2: Construct digital circuit to examine Boolean algebra, truth table of different logic gates.

CO 3: Design various combinational and sequential circuits after analyzing their timing properties.

CO 4: Understand the use of digital ICs of different logic functions.

IIPC 207: SIGNALS & COMMUNICATION LAB USING MATLAB

Pre-requisite:

L	T	P	Credits	Total contact hours
0	0	2	1	24-28

Brief Description of the Course:
This lab aims to get familiarize the students about the numerical computing in various fields. MATLAB allows matrix manipulations, plotting the function by using polar & contour3 commands, implementation of algorithms & creation of user interfaces. It calculates their design, waveforms, graphs, circles, circular helix and solves various integral and differential equations. The purpose of this course is to familiarize the students about the practical implementation Signals and Communication topics such as analog and digital modulation and demodulation schemes.

List of Experiments

1. (i) To define and use variables, vectors, matrices, and their functions in MATLAB.

   (ii) To study various arithmetic operators and mathematical functions in MATLAB.

2. (i) To create and use m-files.

   (ii) To study various MATLAB commands for creating two- and three-dimensional plots.

3. Write a MATLAB program to plot the following continuous-time and discrete-time signals:

   1. Step Function
   2. Impulse Function
   3. Exponential Function
   4. Ramp Function
   5. Sine Function

4. (i) Write a MATLAB program to perform amplitude-scaling, time-scaling, and time-shifting on a given signal.
   (ii) Write a MATLAB program to obtain linear convolution of the given sequences.

5. Write a MATLAB program to generate the Fourier series of (i) a square wave and (ii) a triangular wave.

6. Write a MATLAB program to calculate and plot the Fourier transform of:

   (i) Rectangular pulse (ii) Triangular pulse (iii) Gaussian pulse

7. Write a MATLAB program to find the impulse response and step response of a system from its difference equation.

8. Write a MATLAB program for:

   (i) amplitude modulation and demodulation.

   (ii) frequency modulation and demodulation

9. Write a MATLAB program for:

   (i) DSB-SC modulator and detector

   (ii) SSB-SC Modulator and Detector (Phase Shift Method).

10. Write a MATLAB program for the verification of the sampling theorem for:

    (i) Low pass signals (ii) Band pass signals

11. Write a MATLAB program for PAM, PWM, PPM and PCM modulation and demodulation schemes.

12. Write a MATLAB program for PSK, FSK, and ASK modulation and demodulation schemes.

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

CO1 Learn basics of MATLAB Programing.

CO2 Write MATLAB Programs for analysis of signals & systems

CO3: Simulate various modulation and demodulation schemes.

IIPC 208: IOT LAB

Pre-requisite:

L	T	P	Credits	Total contact hours
0	0	2	1	24-28

Brief Description of the Course:
This lab aims to get familiarize the students about the numerical computing in various fields. Internet of Things has emerged as a leading technology around the world.

List of Experiments:

1. Familiarization with **Development board (Arduino/Raspberry Pi etc..,)** and perform necessary software installation.
2. To interface LED/Buzzer with **Development board (Arduino/Raspberry Pi etc..,)** and write a program to turn ON LED for 1 sec after every 2 seconds.
3. To interface Push button/Digital sensor (IR/LDR) with **Development board (Arduino/Raspberry Pi etc..,)** and write a program to turn ON LED when push button is pressed or at sensor detection.
4. To interface DHT11 sensor with **Development board (Arduino/Raspberry Pi etc..,)** and write a program to print temperature and humidity readings.
5. To interface motor using relay with **Development board (Arduino/Raspberry Pi etc..,)** and write a program to turn ON motor when push button is pressed.
6. To interface OLED with **Development board (Arduino/Raspberry Pi etc..,)** and write a program to print temperature and humidity readings on it.
7. To interface Bluetooth with **Development board (Arduino/Raspberry Pi etc..,)** and write a program to send sensor data to smartphone using Bluetooth.
8. To interface Bluetooth with **Development board (Arduino/Raspberry Pi etc..,)** and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.
9. Building Intrusion Detection System with **Development board (Arduino/Raspberry Pi etc..,)** Development Board and Ultrasonic Sensor.
10. Modules and Sensors Interfacing (Relay, RGB LED) using **Development board (Arduino/Raspberry Pi etc..,)**.

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

CO1: Understand the concept of Internet of Things.

CO2: Understand the data acquisition from various sensors.

CO3: Implement interfacing of various sensors with Arduino/Raspberry Pi.

CO4: Apply IoT concept in simple real-life applications.

FOURTH SEMSTER

IIPC 209: MICROPROCESSORS & COMPUTER ARCHITECTURE

Pre-requisite:

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course:
The course focuses on fundamental principles, underlying mathematics, and implementation details of Micro-Processor & Computer Architecture. This course covers a broad spectrum of topics including Microprocessors, like the 8085, are explored—architecture, pin configurations, addressing modes, and peripheral interfacing devices. The study extends to microcontrollers, focusing on the 8051's architecture, I/O ports, interrupts, and interfacing with components like LEDs, and seven-segment displays through assembly language programming. The broader context encompasses basic computer architecture, performance measurement, CISC and RISC processors, and pipeline concepts including hazards and optimization. The discussion also covers memory technology, cache memory, virtual memory, and techniques to enhance performance by managing memory hierarchies effectively included.

UNIT - I 10 hrs.
Microprocessors: 8085-architecture, operation, pin configuration and functions, bus organization, control signal generation for external operations- fetch, IO/M, read/write, machine cycles and bus timings. Addressing mode, instruction set, Overview/concept of peripheral interfacing devices-8251, 8253, 8255 and 8279.

UNIT – II 10 hrs.
Microcontrollers: 8051-architecture, operation, pin configuration and functions, memory organization, register, I/O ports, addressing modes, instruction sets. Assembly language programming, Interrupts in 8051. Timer/Counter programming, waveform generation. Interfacing with LEDs and seven segment display.

UNIT - II I 10 hrs.
Introduction to basic computer architecture. Register transfer and micro-operations, CISC and RISC processors. Hardwired control, Micro programmed control, Pipelining: Basic concepts, instruction pipeline, hazards, techniques for handling hazards. Pipeline optimization techniques.

UNIT – IV 10 hrs.
Input-Output Organization: Peripheral devices, I/O interface, Data transfer schemes, Program control, Interrupt, DMA transfer, I/O processor. Memory Unit: Memory hierarchy, High-speed memories, Cache memory, Associative memory, Interleave, Virtual memory, Memory management. Introduction to Parallel Processing: Characteristics of multiprocessors, Interconnection structures, Interprocessor arbitration, Interprocessor communication & synchronization.

Text/ Reference Books:

1. 8085 Microprocessors Architecture Application and Programming, Ramesh S. Goankar, Penram International, 5th Edition.
2. The 8051 Microcontroller, Kenneth J. Ayala, Cangage learning, 3rd Edition.
3. Microprocessor Architecture, Programming & Applications with the 8085/8080A by R.S. Gaonkar, Wiley Eastern Ltd.
4. Microprocessors & Interfacing by D.V. Hall, McGraw Hill.
5. Microprocessors: Theory & Applications (Intel & Motorola) by M. Rafiquzzman, PHI.
6. Mano, Morris M., Computer System Architecture, Prentice Hall (1992) 3rd Edition.
7. Hayes, J.P., Computer Architecture and Organization, McGraw Hill (1998) 3rd Edition.
8. Hennessy, J.L., Patterson, D.A, and Goldberg, D., Computer Architecture a Quantitative Approach, Pearson Education Asia (2006) 4th Edition.
9. C.Hamacher Z. Vranesic and S. Zaky, "Computer Organization", McGraw-Hill, 5th ed

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Understand the architecture of architecture, memory organization of 8085 and 8051.

CO2: Distinguish various types of Micro-Processor & Computer Architecture along with Impart the knowledge about the instruction set.

CO3: Understand the basics of instruction sets and their impact on processor design.

CO4: Demonstrate an understanding of the design of the functional units of a digital computer system.

CO5: Design a pipeline for consistent execution of instructions with minimum hazards.

IIPC 210: DATA STRUCTURES AND ALGORITHMS

Pre-requisite:

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course

To introduce first level topics covering basics in Algorithms and Data Structures. To provide examples for various design paradigms. To identify the basic properties of graphs and trees and model simple applications.

UNIT - I 8 hrs.

Mathematical preliminaries, time complexity and space complexity, worst-case and average-case analyses, use of order notations and related results, divide and conquer recurrences, recurrence relations: substitution method, recurrence trees, Master's theorem and its applications. Randomized Algorithms and their Applications.

UNIT – II 12hrs.

Quick Sort and its analyses, Merge Sort recurrence, Strassen's matrix multiplication, fast multiplication of large integers, binary search trees, priority queues, Heaps and Heap Sort. Data structures for disjoint sets, Path compression, union by rank, Prim's and Kruskal's algorithms, Huffman coding, LZW coding, shortest paths, greedy activity selection, set cover and greedy heuristics. Introduction to advanced data structures like Fenwick trees or segment trees

UNIT - III 10 hrs.

Dynamic Programming basics, matrix chain multiplication, DP solution for traveling salesman and 0/1 Knapsack problems, least common subsequences, independent sets and backtracking algorithm, Breadth/depth-first algorithms. Introduction to network flow problems beyond shortest paths and spanning trees.

UNIT – IV 10 hrs.

Topological sort, recursive graph algorithms, string matching: KMP algorithm, Rabin-Karp algorithm, number theory algorithms: basics, GCD and extended Euclidean algorithm, primality testing. Introduction to algorithmic game theory or online algorithms.

Text/ Reference Books:

1. T.Cormen, C.Lieserson, R.Rivest, and C.Stein, "Introductions to Algorithms", Prentice-Hall/India, 3rd edition, 2009

Course Outcomes:

CO1: Ability to comprehend the basics in algorithms and data structures
CO2: Ability to solve problems that involve these concepts/similar problems
CO3: Ability to provide algorithmic solutions/approaches to new problems

IIPC 211: INDUSTRY 4.0 AND IIOT

Pre-requisite:

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description of the course

The course covers the Industrial IoT (IIoT) Systems, including the Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories in the exchange of information between communicating devices protocols. Also deals with the Next Generation Sensors, Industrial IoT- Applications:

UNIT-I 12Hrs.

Introduction to Industrial IoT (IIoT) Systems: The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.

Implementation systems for IIoT: Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Wireless Sensor nodes with common communication protocols.

UNIT-II 10Hrs.

IIoT Data Monitoring & Control: IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology.

UNIT-III 8Hrs.

Cyber Physical Systems: Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Big Data and Advanced Analysis, Digital Twins.

UNIT-IV 10Hrs.

Industrial IoT- Applications: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Case Studies of IIoT Systems: IIoT application development with Embedded PC based development boards, Development of mini-Project on new version of Operating systems and Edge development board. That project should also address to the current societal needs.

Text/ Reference Books:

1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications: A press

2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.

3. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.

4. Dr. Ovidiu Vermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers

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

CO 1: Understand the concept of Industry 4.0.
CO 2: To be well versed with the design flow of IIoT based systems.
CO 3: Able to understand different communication protocols like GPRS and Wi-Fi for connecting IIoT nodes to server.
CO 4: To be capable of developing the state-of-the-art IIoT based systems, suitable for real life and Industry applications.

IIPC 212: DATA COMMUNICATION & NETWORKING

Pre-requisite: Principles of Communication Engineering

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description of the course

The course covers the theoretical aspects of computer networks, including the protocols involved in the exchange of information between communicating devices

UNIT – I 10 hrs.

Introduction to Data Communication: Goals and Applications of Networks, Wireless Networks, Interfaces, and Services. Reference Models: The OSI reference model and TCP/IP reference model. **Physical Layer**: Data and Signals, Digital and Analog transmission, Transmission Media, Wireless transmission, Switching.

UNIT – II 12 hrs.

Data Link Layer: Data link layer design issues, Services provided to Network layers, Framing, Error control, Flow control, Error detection and correction, Elementary data link protocols, An unrestricted Simplex protocol, A Simplex Stop-and-Wait protocol, Simplex Protocol for a noisy channel, Sliding Window protocols, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocol-HDLC, PPP.

UNIT – III 10 hrs.

Medium Access Control Sublayer: Channel Allocations, Random Access, ALOHA, Carrier Sense Multiple Access Protocols, Collision free Protocols, Limited contention protocols, Controlled Access, Channelization, Wired LANs: Ethernet, Wireless LANs.
Network Layer Network: Layer Design issue, Logical Addressing, Address Mapping, Error Reporting and Multicasting, Delivery, Forwarding and Routing.

UNIT – IV 8 hrs.

Transport Layer: Process to Process Delivery: UDP, TCP, and SCTP.
Application Layer: Design issues of the layer, Domain Name systems, File Transfer, HTTP, web documents, and Virtual Terminals.

Text/ Reference Books:

1. Tanenbaum A.S, “Computer Networks”, Pearson, 4th ed., 2003.
2. Forouzan B.A, “Data Communications and Networking”, Tata McGraw Hill, 4th ed. 2006.
3. Stallings W, “Data and Computer Communications”, PHI, 9th ed., 2011.
4. Kurose & Ross K. W., “Computer Networking: A Top-Down Approach featuring theInternet”, Pearson, 5th edition, 2010.
5. S. Keshav, “An Engineering Approach on Computer Networking”, Welsey.
6. Wayne Tomasi “Introduction to Data Communications and Networking” Pearson.

Course outcomes:

At the end of the course, the student will be able to:

CO1 Understand the computer network hardware and software.

CO2 Compare the OSI and TCP/IP protocol stacks.

CO3 Examine the protocols operating at different layers of network architecture.

CO4 Categorize the services offered by all layers of the network's protocol stack.

IIPC 213: Object Oriented Programming with JAVA

Pre-requisite: Mathematics

L	T	P	Credits	Total contact hours
2	0	0	3	24-28

Brief Description about the course
To learn object-oriented programming on JAVA frameworks and utilize it in practical applications by demonstrating adeptness of object-oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation, features of exception handling, dynamic binding, polymorphism, and applets.

UNIT - I 6 hrs.
Introduction: Procedure Oriented Programming, Object Oriented Programming. Properties of Object-oriented models. Concepts of Classes and Objects, Nature of an object, Nature of a class, Relationships among objects and classes. Modeling techniques of classes and objects. Overview of abstraction. Information hiding. Polymorphism. Method Overloading. Inheritance. Method overriding. Dynamic Binding. Message Passing.

UNIT – II 8 hrs.
Fundamentals of Java: Basics of Java: JVM and Bytecode, Data types, variables, expressions. Control Statements. Type conversion and casting. Automatic type promotion. Implementation of Object-Oriented Programming using Java: Java Classes and Objects, Constructors. this pointer. Garbage Collection. Method overloading. Nested and Inner class. Inheritance. super pointer. Multilevel class hierarchy. Method overriding. Abstract classes. Interfaces. Packages.

UNIT - III 8 hrs.
Intermediate Java: Exception Handling: Fundamentals. try and catch keywords. Nested try. throw, throws, finally keywords. Java's built-in exceptions and creating custom exceptions. Multithreaded Programming: Basic concept of threading, Java thread model. The main thread. Creating custom thread. isAlive() and join() methods. Thread priorities.

UNIT - IV 6 hrs.
Advanced Java: Java IO and Applets: Reading and Writing to Console. PrintWriter class. Reading and writing to files. Formatting output. Applet Fundamentals.

Text Books / Reference:

1. Object-Oriented Analysis and Design with Applications by Grady Booch et. al.
2. Object-Oriented Modeling and Design with UML by Blaha, Rumbaugh
3. Java: The Complete Reference 9th Edition by Herbert Schildt
4. Effective Java by Joshua Bloch

Course Outcomes:

CO1: Understand the concepts of the object-oriented programming.
CO2: Comprehend the adeptness of object-oriented programming in developing solution to problems demonstrating usage of data abstraction, encapsulation and inheritance.
CO3: Implement patterns involving dynamic binding and utilization of polymorphism.
CO4: Create graphical user interface for different applications.

Object Oriented Programming with JAVA lab

Pre-requisite:

L	T	P	Credits	Total contact hours
0	0	2	3	24-28

Brief Description about the course:
This lab aims to get understanding of the basic concepts in object-oriented programming including encapsulation, abstraction, inheritance, and polymorphism. The student will design, implement, test, and debug programs to solve real-world problems in Java. Further, this course is dedicated to enhance the programming skills of the students by giving practical assignments and also requisite knowledge about Object Oriented Programming through Java to develop Applications/Projects.

List of Experiments

1. To study the object and classes in object-oriented programming using Java.
2. Understanding of array of objects in JAVA and create a database of students using class with various attributes.
3. Write a java program to represent Abstract class with example.
4. Write a java program to implement Interface using extends keyword.
5. Write a java program to create user defined package.
6. Write a java program to create inner classes.
7. To study dynamic memory allocation using operators and pointer to objects.
8. Write a Java program that implements a multi-thread application that has three threads.
9. Write a java program to display File class properties. Also represent ArrayList class.
10. Create a graphical user interface (GUI) with necessary features in Java using AWT package

Course Outcomes: At the end of the course, the students will be able to:
CO1: Gain knowledge and understanding of object-oriented programming concepts.
CO2: Analyze and Apply the generic classes concepts in programming problem.
CO3: Apply the object-oriented programming concepts as and when required in the application development.
CO4: Implement patterns involving dynamic binding and utilization of polymorphism.
CO5: Understanding of Java packages for GUI development

IIPC 214: MICROPROCESSORS LAB

Pre-requisite: Mathematics

L	T	P	Credits	Total contact hours
0	0	2	1	24-28

Brief Description about the course: To study Microprocessor and its basics and to develop skills for designing flowcharts and writing algorithms also to offer skills for writing Embedded programs and enable the students to debug programs

List of Experiments:

PART- A
Assembly Language Programming experiments using 8050 Trainer kit.

1. Find the Factorial of a number
2. Find if a number is prime or a perfect square.
3. Write a program to read an integer number of max (16 bit), store that number in a register and display it digit by digit.
4. Write modular program to perform addition, subtraction, multiplication and division of two 16-bit numbers.
5. Check whether a given string is palindrome or not. Reverse an input string.
6. To find the largest and smallest number in an array of data using 8085 instruction set.

PART –B
Interfacing experiments using 8051 Trainer kit and interfacing modules.

1. To interface 8253 programmable interval timer to 8085
2. To interface Stepper Motor with 8085.
3. Generate square wave, triangular wave, sawtooth wave for a given frequency and duty cycle.

PART –A
Assembly Language Programming experiments using 8051 Trainer kit.

1. Data transfer/exchange between specified memory locations.
2. Largest/smallest from a series.
3. Sorting (Ascending/Descending) of data.
4. Addition / subtraction / multiplication / division of 8/16 bit data.
5. Sum of a series of 8 bit data.
6. Multiplication by shift and add method.
7. Square / cube / square root of 8 bit data.
8. Matrix addition.
9. LCM and HCF of two 8 bit numbers.
10. Code conversion – Hex to Decimal/ASCII to Decimal and vice versa.

PART –B

Interfacing experiments using 8051 Trainer kit and interfacing modules.

1. Time delay generation and relay interface.
2. Display (LED/Seven segments/LCD) and keyboard interface.
3. ADC interface.
4. DAC interface with wave form generation.
5. Stepper motor and DC motor interface.
6. Realization of Boolean expression through port.
7. Elevator interfacing.

PART –C

Programming / interfacing experiments with IDE for 8051/PIC/MSP/Arduino/Raspberry Pi based interfacing boards/sensor modules (Direct downloading of the pre-written ALP/'C'/Python programs can be used).

1. Relay control
2. Distance measurement.
3. Temperature measurement / Digital Thermometer
4. Txr-Rxr interface.
5. Alphanumeric LCD display interface.
6. Simple project work including multiple interfaces.

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

CO1: Write algorithms and programming task involved for a given problem

CO2: Design and develop modular programming skills

CO3: Develop a basic understanding of syntax of instruction set of 8086.

CO4: Able to apply the knowledge of assembly language to solve various problems.

CO5: Develop the knowledge to implement various interfaces through assembly language programming.

IIPC 215: PROGRAMMING FOR IOT DEVICES LAB

Pre-requisite:

L	T	P	Credits	Total contact hours
0	0	2	1	24-28

Brief Description:

This lab aims to get familiarize the students about the numerical computing in various fields. Internet of Things has emerged as a leading technology around the world. Also, the advancements in Artificial Intelligence and Machine Learning have made the automation of IoT devices easy.

List of Experiments (Any Ten experiments should be performed)

1. Create any cloud platform account, explore IoT services and register a thing on the platform.
2. Write a program on **Development board (Arduino/Raspberry Pi etc..,)** to upload temperature and humidity data to cloud space.
3. Write a program on **Development board (Arduino/Raspberry Pi etc..,)** to retrieve temperature and humidity data from cloud space.
4. To install MySQL database on **Development board (Arduino/Raspberry Pi etc..,)** and perform basic SQL queries.
5. Write a program on **Development board (Arduino/Raspberry Pi etc..,)** to publish temperature data to MQTT broker.
6. Write a program on **Development board (Arduino/Raspberry Pi etc..,)** to subscribe to MQTT broker for temperature data and print it.
7. IoT based Web Controlled Home Automation using **Development board (Arduino/Raspberry Pi etc..,)**.
8. Design an IoT based air pollution control system which monitors the air pollution by measuring carbon monoxide, ammonia, etc and gives alarm or sends message when the pollution level is more than pre-defined threshold.
9. Design an IOT-based application for agriculture farming for water supply-based humidity measurement.
10. Identify a problem in your local area or college which can be solved by integrating the things you learned and create a prototype to solve it (Mini Project).

11. Write a program to create TCP server on **Development board (Arduino/Raspberry Pi etc..,)** and respond with humidity data to TCP client when requested.
12. Write a program to create UDP server on **Development board (Arduino/Raspberry Pi etc..,)** and respond with humidity data to UDP client when requested.

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

C01: Implement interfacing of various sensors with Arduino/Raspberry Pi.

CO2: Demonstrate the ability to transmit data wirelessly between different devices.

CO3: Show an ability to upload/download sensor data on cloud and server.

CO4: Apply IoT concepts with cloud in real life applications.