Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR
(An Autonomous Institute affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Department of Electronics and Communication Engineering

AN AUTONOMOUS INSTITUTE

SECOND YEAR ENGINEERINGCURRICULUM

UNDER GRADUATE PROGRAMME

(B.Tech. Second Year)

Electronics and Communication Engineering

WITH EFFECT FROM THE ACADEMIC YEAR 2023-2024.

Lokmanya Tilak Jankalyan Shikshan Sanstha's

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR

(An Autonomous Institute affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Department of Electronics and Communication Engineering

SCHEME OF EXAMINATION (w.e.f. 2023-24)

THIRD SEMESTER B. TECH (Electronics & Communication Engineering)

Sr.No.	Course Code	Course Category	BOS/ Dept	Course	Contact Hours				Marks				Total Marks	ESE Duration
									Theory		Practical			
					L	T	P	Credits	CE	ESE	CE	ESE		
1	**24UEC401T**	**PCC**	**EC**	Analog Circuits	3	0	0	3	40	60			100	3 Hours
2	**24UEC401P**	**PCC**	**EC**	**Lab:** Analog Circuits	0	0	2	1			25	25	50	2 Hours
3	**24UEC402T**	**PCC**	**EC**	Analog & Digital Communication	3	1	0	4	40	60			100	3 Hours
4	**24UEC402P**	**PCC**	**EC**	**Lab:** Analog & Digital Communication	0	0	2	1			25	25	50	2 Hours
5	**24UEC403T**	**PCC**	**EC**	Signals & Systems	3	0	0	3	40	60			100	3 Hours
6	**24UEC404P**	**PCC**	**EC**	**Lab:** IoT Tools	0	0	2	1			25	25	50	2 Hours
7	**24UCT407P**	**MDM**	**CT**	MDM-II: [1]Object Oriented Programming	0	1	2	2			25	25	50	2 Hours
	24UCV404T		**CV**	MDM-II: Introduction to Green Technology and Sustainable Development	2	0	0	2	20	30			50	2 Hours
8	**24UOE4XXT**	**OE**	**EC**	Open Elective-II	2	0	0	2	20	30			50	2 Hours
9	**24UBS407T**	**AEC**	**ASH**	Professional Communication	2	0	0	2	20	30			50	2Hours
10	**24UBS410T**	**VEC**	**ASH**	Environmental Science	2	0	0	2	20	30			50	2Hours
					17	**2**	**8**	**23**	180	270	100	100	700	

Open Elective-II	
Course Code	**Subject**
24UOE441T	Mechatronics
24UOE442T	Internet of Things
24UOE443T	Industrial Applications of Raspberry Pi

[1] Using Java

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Multi-Disciplinary Minors (MDM) Courses
Basket 1: Computer Science Engineering(MDM)

Sr. No.	Course Code	Course Category	BOS/ Dept	Course	Contact Hours				Marks				Total Marks	ESE Duration
									Theory		Practical			
					L	T	P	Credits	CE	ESE	CE	ESE		
1	**24UBS309T**	**MDM**	**ASH**	MDM-I Probability Theory and Stochastic Processes	2	0	0	2	20	30			50	02 Hours
2	**24UCT407P**		**CT**	MDM-II: Object Oriented Programming Lab	0	1	2	2			25	25	50	
3	**25UCT506T**		**CT**	MDM-III: Database Management Systems	2	0	0	2	20	30			50	3 Hours
4	**25UCT506P**		**CT**	Database Management Systems Lab	0	0	2	1			25	25	50	
5	**25UBS606T**		**ASH**	MDM-IV: Aptitude and Interview Skills(Placement Foundation)	2	0	0	2	20	30			50	2 Hours
6	**26UCT703T**		**CT**	MDM-V: Computer Networks	2	0	0	2	20	30			50	2 Hours
7	**26UCT703P**		**CT**	Computer Networks Lab	0	0	2	1			25	25	50	
8	**26UCT704T**		**CT**	MDM-VI: Computer Architecture	2	0	0	2	20	30			50	2 Hours
					10	**1**	**6**	**14**	**100**	**150**	**75**	**75**	**400**	

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Basket2: Green Technology and Sustainability Engineering(MDM)

Sr. No.	Course Code	Course Category	BOS/ Dept	Course	Contact Hours				Marks				Total Marks	ESE Duration
									Theory		Practical			
					L	T	P	Credits	CE	ESE	CE	ESE		
1	**24UBS309T**	**MDM**	**ASH**	MDM-I Probability Theory and Stochastic Processes	2	0	0	2	20	30			50	02 Hours
2	**24UCV404T**		**CV**	MDM-II: Introduction to Green Technology and Sustainable Development	2	0	0	2	20	30			50	02 Hours
3	**25UCV506T**		**CV**	MDM-III::Green Materials	3	0	0	3	40	60			100	03 Hours
4	**25UCV506P**		**CV**	**Lab:** Green Materials Testing Laboratory	0	0	02	1			25	25	50	04 Hours
5	**25UBS606T**		**ASH**	MDM-IV: Aptitude and Interview Skills(Placement Foundation)	2	0	0	2	20	30			50	02 Hours
6	**26UCV703T**		**CV**	MDM-V: e-waste Management	2	0	0	2	20	30			50	02 Hours
7	**26UCV704T**		**CV**	MDM-VI: Renewable Energy	2	0	0	2	20	30			50	02 Hours
					13	**0**	**02**	**14**	**140**	**210**	**25**	**25**	**400**	

Fourth Semester

Course Title: Analog Circuits

Course Code: 24UEC401T **Course Category: PCC**

Teaching Scheme: L – T- P **Total Credits:** 03

3 -0 - 0

Scheme of Examination: ESE:60 Marks, **CE**: 40 Marks

Course Objectives:

1. Understand basic principles of analog integrated circuits for analog IC design.
2. Understand basics of OP-Amp, its parameters and applications.
3. Understand the linear and non-linear applications of OP-Amp.
4. Learn data converters and waveform generators.
5. Explain special function ICs and design circuits using it.

Course Outcomes:

After completion of this course students will be able to:

CO1: Describe the basic concept of Operational amplifier, its parameters and applications.

CO2: Demonstrate and analyze linear and non-linear applications of Op-Amp.

CO3: Design various types of Oscillators.

CO4: Design various types of Active Filters in analog circuits.

CO5: Describe and explain the basic concept of differential amplifier.

CO6: Design special function ICs for various applications.

Course Contents:

UNIT I [08 Hours]

Op-Amp Fundamentals:

Block Diagram of Operational Amplifier, Op-Amp Parameters, Input Bias and Offset Currents, Input Bias and Offset Voltage, Ideal OP-Amp, Equivalent Circuit, Voltage Transfer Curve, Virtual Ground Concept, Inverting Amplifier, Non-Inverting Amplifiers, Voltage Follower.

UNIT II [07 Hours]

Linear Applications of Op-Amp:

Unity Gain Amplifier, Summer, Difference Amplifier, Integrator, Differentiator, V to I Converter, I to V Converter, Instrumentation Amplifier and Transducer Bridge Amplifier.

UNIT III [08 Hours]

Oscillators:

Review of the basic concept, Barkhausen's criterion, Wein Bridge Oscillator, RC Phase Shift Oscillator,Square Wave Generator, Triangular Wave Generator.

UNIT IV [07 Hours]

Active filters:

Design of Butterworth n order filter – Low pass, High Pass, Band Pass, Band Stop filters, All Pass Filter, and Higher Order Filters using OP-Amp IC.

UNIT V [07 Hours]

Differential amplifiers:

DC and AC analysis, Constant Current Bias Circuits, Level Shifting Techniques,Cascaded Differential Amplifier stages.

UNIT VI [08 Hours]

Non-linear Applications:

Schmitt Trigger, Sample and Hold Circuit and Log/Antilog Amplifiers.Special FunctionIC's: IC 555 and its Applications, Phase Locked Loops IC 565, D/AConverter, A/D Converter and Recent Trends in Analog Circuits.

Suggested self-Readings:

Text Books

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age2003.
3. Ramakant A. Gayakwad, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.
4. Sergio Franco, "Design with Operational Amplifiers and Analog IntegratedCircuits", McGraw Hill.

Fourth Semester

Course: Analog Circuits Lab

Course Code: 24UEC401P

Teaching Scheme: L – T – P **Total Credits: 01**

0- 0 - 2

Scheme of Examination: ESE:25 Marks, **CE:**25 Marks

Course Objectives

1. To understand basic parameters of Operational Amplifier and applications.
2. To understand basic principles of Analog Integrated Circuits for Analog ICdesign.
3. To use op-amp to realize various circuits.
4. To Implement active filter and timer in the analog circuits.

Course outcomes:

Afer completion of this course students will be able to:

CO1: Design and analyze OP-Amp circuit configurations.

CO2: Analyze OP-Amp circuit parameters and Frequency response.

CO3: Design Linear and Non-Linear applications of OP-Amp.

CO4: Explain and design special function IC applications.

List of Experiments

1. To verify gain and frequency response of Inverting and Non- Inverting Amplifier using IC 741.
2. To verify OP-Amp parameters a) CMRR b) Slew Rate
3. Design and Verify OP-Amp application as Adder and Subtractor.
4. Design and simulate gain and frequency response of Integrator and Differentiator circuit using IC 741
5. Design and Simulate Second order Low Pass Filter/High Pass Filter. Alsoverify its frequency response characteristics.
6. Verify and simulate Schmitt Trigger circuit using IC 741.
7. Design and Verify Astable and Monostable Multivibrator using Timer IC555.
8. To construct RC phase shift oscillator and study its operation
9. To verify the operation of various types of Clipper and Clamper likepositive and negative IC 741.
10. To study and verify PLL using IC 565.
11. Verification of Digital to Analog Converter using R-2R Ladder network.
12. Mini Project

Fourth Semester

Course Title: Analog & Digital Communication

Course Code: 24UEC402T **Course Category: PCC**

Teaching Scheme: L – T – P **Total Credits: 04**

3 – 1 – 0

Scheme of Examination: ESE:60 Marks, **CE:** 40 Marks

Course Objectives: -

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

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

Course Outcomes:

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

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

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

CO3:Design digital communication systems by applying knowledge of the various modulation techniques.

CO4:Describe sampling theorem and pulse modulation techniques.

CO5:Identify Line Coding & channel coding techniques .

CO6: :Discuss different types of digital modulation techniques.

Course Content:

UNIT I [07 Hours]

Amplitude Modulation:

Introduction of amplitude modulation, Equation of AM, Generation of AM (DSBFC) and its spectrum, Modulation Index, Power relations applied to sinusoidal signals.

DSBSC – multiplier modulator, Nonlinear generation, switching modulator, Ring modulator & its spectrum, SSBSC, ISB & VSB Comparison, AM Broadcast technical standards.

UNIT II [07 Hours]

Angle Modulation:

Concept of Angle modulation: Types of Angle Modulation, frequency spectrum, Narrow band & wide band FM, Modulation index, Bandwidth. Bessel's Function and its mathematical analysis, Generation of FM (Direct & Indirect Method), Comparison of FM and PM.

UNIT III [07 Hours]

AM and FM Receivers:

Super heterodyne Receiver, Performance characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection.

AM Detection: Rectifier detection, Envelope detection ,FM Detection: Foster Seelay FM Detector & FM detection using PLL.

UNIT IV [08 Hours]

Pulse Modulation:

Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect.

Pulse modulation Techniques : PAM PWM & PPM. PCM – Generation & reconstruction, Bandwidth requirement of PCM, Introduction to Delta Modulation & Adaptive DM.

UNIT V [08 Hours]

Line coding & Channel Coding :

Classification of Line Codes, Unipolar-RZ, RZ, NRZ-I, NRZ-L, Polar-NRZ and RZ, Bipolar NRZ and RZ. Channel coding techniques: Review of channel coding, Linear block codes, Cyclic codes, Hamming Code, Convolutional codes and Decoding Techniques.

UNIT VI [08 Hours]

Digital Communication Systems:

Communication Channel Characteristics, Digital modulation techniques: ASK, FSK, PSK, QPSK, QAM, MSK, OFDM.

Suggested Self Readings:

Text Books

1. Kennedy & Devis : Electronic Communication Systems , Tata McGraw Hills Publication(Fourth Edition)
2. Dennis Roddy & Coolen - Electronic Communication, PHI (Fourth Edition)
3. B. P. Lathi: Modern Digital and Analog. Communication Systems: Oxford Press Publication (Third Edition)
4. John G Prokis, Digital communication 4 th edition Date:2005,TMG
5. Simon Haykin , Digital communication 3 rd edition August 2007,WEP

ReferenceBooks

1. Simon Haykin: Communication Systems, John Wiley & Sons, Fourth Edition
2. Taub & Schilling: Principles of Communication Systems, Tata McGraw-Hill
3. B.P. Lathi, Modern Digital & Analog Communication Systems,4th editionDate: 2009, Oxford Univ Pr Publication
4. Abhay Gandhi, Analog and Digital Communications: Theory and Lab Work;1st Edition, 2014; Cengage India.

Fourth Semester

Course Title: Analog & Digital Communication Lab

Course Code: 24UEC402P

Teaching Scheme: L – T – P **Total Credits:01**

0 - 0 -2

Scheme of Examination: ESE:25 Marks, **CE:25** Marks

Course objectives:

1. To perform practical based on analog and digital modulation techniques.
2. To study the analysis of AM and FM receivers.
3. To study ASK, FSK and PSK techniques.
4. To perform MATLAB based practical for different modulation techniques.

Course outcomes

On completion of this Lab students will be able to:

CO1:Demonstrate different modulation techniques used in Electroniccommunication system.

CO2:Use the modulation techniques and modern communication tools necessary for various engineering applications.

CO3:Evaluate fundamental communication system parameters, such as bandwidth power, signal to quantization noise ratio, data rate etc.

List of Experiments

1. To generate Amplitude Modulated wave using different techniques and plot its waveform.
2. To generate Frequency Modulated wave using different techniques andplot its waveform.
3. To generate Pulse Amplitude Modulation (PAM) and plot the waveforms. Observe the demodulated output.
4. To generate Pulse Width modulated signal and study PWM demodulation.
5. To generate Pulse Position modulated signal and study Pulse PositionDemodulation.
6. To generate DSB-SC signal using balanced modulator
7. To draw Spectrum Analysis of AM & FM signals
8. To observe the Input and Output waveforms of Digital Modulation Techniques ASK,FSK,PSK
9. To generate AM Modulated signal using simulation software.
10. To generate FM modulated signal using simulation software.
11. To generate PM modulated signal using simulation software.
12. To perform Pulse Code Modulation (PCM) using simulation software.

Fourth Semester

Course Name: Signals and Systems

Course Code: 24UEC403T

Teaching Scheme: L – T – P **Total Credits: 03**

3 - 0 - 0

Scheme of Examination: ESE:60 Marks, **CE**: 40 Marks

Course Objectives:

Objectives of this course are to prepare students:

1.To understand the basic definitions and classification of Signals and System and their operations.

2.To understand the concept of sampling and signal reconstruction.

3.To Learn concept of Linear Shift Invariant Systems and responses of thesystem for various inputs.

4.To learn system analysis using Fourier and Laplace Transforms.

Course Outcomes:

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

CO1:Classify different signals and systems and perform basic signal operations.

CO2:Explain the concept of sampling and reconstruction of analog signals.

CO3:Evaluate impulse response, step response, convolution, and characteristics of LSI systems.

CO4:Perform Fourier analysis and synthesis of continuous time signals and compare with DTFT.

CO5:Perform Laplace analysis of system using Laplace Transform.

CO6: Categorize and compare distortions in systems and perform noise analysis.

Course Contents:

UNIT I [08 Hours]

Introduction to signals and Systems:

Representation of signals, Signal classification, Types of signals, Operations on signals - Scaling, Shifting, Transformation of independent variables.

Classification of systems - Static and dynamic, Linear and non-linear, Time-variant and time invariant, Causal and non-causal, Stable and unstable.

UNIT II [07 Hours]

Sampling Theorem and its Implications:

Sampling theorem in time domain and Frequency domain, TDM and FDM concept,

Oversampling, Undersampling , Aliasing Effect and its Solution, Zero order hold sampling, first Order hold sampling, Natural Sampling, Flat Top Sampling, Quantization , Quantization Error.

UNIT III [07 Hours]

Linear shift Invariant Systems:

Impulse response and step response of systems, Convolution, System representation using difference and differential equations, Input Output behaviour of the system with periodic and aperiodic convergent inputs.

UNIT IV [10 Hours]

Fourier Analysis of Signals:

Introduction to Fourier series, Dirichlet's condition for convergence of Fourier Series, Continuous-time Fourier transform (CTFT), Magnitude and phase response, Properties of Fourier Transform, Parseval's theorem, Inverse Fourier transform, Discrete-time Fourier transform (DTFT), Comparison between CTFT and DTFT.

UNIT V [07 Hours]

System Analysis using Laplace transform:

Laplace Transform: Review of Laplace transforms, Inverse Laplace transform, Poles and Zeros of the system, Concept of region of convergence (ROC) for Laplace transforms, Properties of Laplace Transform, Relation between Laplace transform and Fourier Transform.

UNIT VI [06 Hours]

Ideal Distortionless channel, Types of distortions- Amplitude, Frequency, Phase, Noise, Signal to Noise ration, non linear behavior of signals, Noise Figure, Effects of frequency and phase mismatch.

Suggested Self Readings:

Text Books

1. Simon Haykin and Barry VanVeen, Signals and systems, 2007, second edition, Wiley, India
2. Alan. V. Oppenheim, Alan. S. Willsk , S. Hamid Nawab, Signals and systems, 2001, second edition- PHI learning Pvt. ltd.
3. A Nagoor kani ,Signals And Systems, Second reprint, 2010, Tata Mcgrawhill.

Reference Books

1. B. P. Lathi, Signal processing and linear systems, 2009, Oxford university press.
2. B.P.Lathi ,Modern Digital & Analog Communication Systems,4th edition, 2009,Oxford Univ Pr Publication

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Fourth Semester

Course Title: IoT Tools Lab

Course Code: 24UEC404P **Course Category: PCC**

Teaching Scheme: L – T – P **Total Credits: 01**

0 - 0 - 2

Scheme of Examination: ESE:25 Marks **CE:** 25 Marks

Prerequisites : Knowledge of fundamentals of Microprocessors, Digital Electronics, Programming Concept.

Course Objectives:

1. To study various types of Arduino boards with their features.
2. To study Arduino programming concepts and Arduino IDE.
3. To study interfacing of various devices like Sensors, display, switches, motors with Arduino.
4. To study analog to digital conversion features of Arduino.
5. To study interfacing of various wireless connectivity devices like Zigbee, Wi-Fi modules.

Course Outcomes:

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

CO1: Identify various Arduino Boards and their features and utility for various applications.

CO2: Design and implement interfacing of various devices with Arduino.

CO3: Understand to use the analog to digital conversion feature of Arduino and develop related applications.

CO4: Interface Wireless devices with Arduino.

Course Contents:

Experiments Based on Following Topics:

Basic Topics

Study of Arduino Boards, Pin description of Arduino board and Arduino IDE. Arduino IDE installation

Arduino Interfacing with LED, Seven Segment Displays, Push ButtonSwitches

Arduino Interfacing with LCD, OLED for image display.

Arduino Interfacing with various sensors like PIR, IR , Ultrasonic sensors etc. Arduino programming to generate PWM wave and to control speed/direction of DC motor, Brightness control of LED.

Analog to digital conversion using Arduino.

Arduino Interfacing with Zigbee, ESP 8266 wi-fi module.

Advanced topics

Realization of basic logic gates using Arduino. C programming using AVR- GCC compiler Assembly and C mix programming on Arduino.

(Any 8 experiments based on topics above can be conducted.Additionally two based on advanced topics.)

List of Experiments

1. Study of Arduino Board and installation of Arduino IDE.
2. Design a circuit to interface LEDs and generate a flashing pattern using Arduino.
3. Design a circuit to interface seven segment display and push button switches sw1 to sw7 to the Arduino and display the digit corresponding to pressed switch.
4. Design a circuit to interface LCD with Arduino and display a Welcome message.
5. Design a circuit to interface LCD with Arduino and create a rolling display.
6. Interface OLED with Arduino to display image on it.
7. Interface Arduino with sensors like motion sensors, Ultrasonic sensors, PIR sensors.
8. Write a program to generate PWM wave using Arduino to controlbrightness of LED.
9. Write a program to generate PWM wave using Arduino to controlspeed/direction of DC motor.
10. Interface Temperature /Humidity sensor with Arduino to read the analogvalues and print those values.
11. Write a program to read analog values of a sine wave from a functiongenerator and display those values on serial monitor.
12. Interface Zigbee module with Arduino to transmit the data and receiveand display data on serial monitor of receiver.
13. Interface ESP 8266 WiFi module to turn on and off LED through amobile/Laptop.
14. Write an assembly language program to verify the truth table of LogicalAND/OR gate.
15. Write an AVR GCC program to display a digit on LCD.
16. Write a mixed Assembly and C program to blink LED using Arduino.
17. Mini Project- Any application development using Arduino Board.

Suggested Self Readings:

Text Books

1. Arun Palanisamy, Fundamentals of Arduino, Xpress Publishing, First Edition
2. Aryan Kurkure, Learning Arduino in 2 months-Coding Made Easy, NotionPress

Reference Books/Link

1. **https://onlinecourses.swayam2.ac.in/aic20_sp04**
2. https://forum.arduino.cc/t/programming-xbee-to-transmit-and-receive- data/224613/15
3. https://www.arduino.cc

Fourth Semester

Course Title: [2]Object Oriented Programming Lab

Course Code: 24UCT407P **Course Category: MDM**

Teaching Scheme: L – T – P **Total Credits: 02**

0 – 1 – 2

Scheme of Examination: ESE: 25 Marks, **CE:**25 Marks

Course Objectives:

1.To understand the basic concepts of Object Oriented Programming.2.To implement the concepts of Inheritance in Problem solving.

3.To apply the concepts of Polymorphism and Interfaces. 4.To implement the concepts of Exception Handling

5.To design and implement program using file system.

Course Outcomes:

At the end of this course students will be able to

CO1: Demonstrate the basic concepts of Object Oriented Programming and design simple java programs.

CO2: Apply the knowledge of Inheritance in program development.

CO3: Develop programs using polymorphism and interfaces.

CO4: Implement various exceptions using concepts of exception handling.

Course Contents:

Basic Topics

1. Control Statements – If , else, nested if, if-else ladders, Switch, while, do-while, for, for-each,break, continue, Methods.
2. Class, Object, Object reference, Constructor, Constructor Overloading, Method Overloading,Recursion.
3. Inheritance and Polymorphism
4. Interfaces and Packages
5. Exception Handling and I/O Streams
6. GUI components in Java
7. Introduction to Database Connectivity

List of Experiments

1. Develop programs to demonstrate use different forms of if statements and its different forms.

2. Develop programs to demonstrate use of. Looping statement i.e. 'For','while', 'do-while'

[2] Using Java

3. Develop programs to demonstrate concept of Class and Object.
4. Develop programs for implementation of single and multilevelinheritance.
5. Write a program to implement the concept of overloading.
6. Write a program to implement the concept of overriding.
7. Develop a program to implement the try, catch and finally block.
8. Develop a program for implementation of File stream classes.
9. Develop a program to perform push and pop operation on stack andperform insert and delete operation on queue using array.
10. Develop a program to perform operation on linked list.
11. Develop a program to implement graphs in java.
12. Develop a program to implement spanning trees.

Suggested Self Readings:

Text Books

1. Herbert Scheldt, "Java the complete reference", McGraw Hill, Osborne, 7th Edition, 2011.
2. T. Budd, "Understanding Object- Oriented Programming with Java", Pearson Education,Updated Edition (New Java 2 Coverage), 1999.

Fourth Semester

Course Title: Introduction to Green Technology and Sustainable Development (MDM-II) | **Semester : IV**

Course Code : **24UCV404T** | **Course Category: MDM**

Teaching Scheme: L – T – P
2 – 0 – 0 | **Total Credits: 02**

Course Objectives:

1) To provide an idea on Green Technology with an approach towards the design, manufacturing and use of products to reduce or eliminate the chemical hazards intentionally
2) Students will learn the concept of sustainable development including different perspectives, consequences of societal resource use and strategies for changing this concept towards a sustainable direction

Course Outcomes:

After the completion of course students would be able to:

1) **Explore** the field of Green Technology and its approach towards the new discovery and innovation.
2) **Apply** the knowledge of Green technology to make Green industrial processes..
3) **Illustrate** the concept of sustainable development and its importance
4) **Describe & Implement** the Cleaner Production measures applicable to different industries and society.

Course Content:

UNIT I **[07 Hours]**

Principles of Green Technology and Green Engineering:

Green technology definition, uses and requirement, green processes and products to make them green safe and economically acceptable to the society, Concepts of green chemistry, Green nanotechnology and Process intensification

UNITII **[08 Hours]**

Green Industrial Processes:

Pollution statistics from various industries like polymer, textile, pharmaceutical, dyes, pesticides , electronics manufactures and pollution control measurements treatment. A greener approach towards all these industries.

UNITIII **[07 Hours]**

Meaning of Sustainable Development:

Understand the Sustainable Development, three principal dimensions: the ecological, the economic and the social dimension, use a systems perspective, to describe sustainability challenges and possibilities for major technical systems and for their transformation to meet sustainability requirements

UNITIV **[8 Hours]**

Concepts of Cleaner Technologies:

Cleaner Production (CP), Definition, methodology, Role of CP in Achieving Sustainability,

Benefits, Role of Industry, Government and Institutions, Environmental Management Hierarchy, Relation of CP and EMS. Concept of CDM, Environmental laws

Suggested Self Readings

Sr. No.	Suggested Text Books/Reference Books/ Web page (URL)/Research paper, etc.
1	Introduction to Green Chemistry, Matlack A.S. Publisher: Marcel Dekker, Newyork, 2001.
2	Green Chemistry: Theory and Practice, Anastas P.T. and Warner J.C. Oxford University Press,1998.
3	Pollution Prevention: Fundamentals and Practice, Bishop P. L. McGraw-Hill, Boston, 2000.
4	Cleaner Production Audit Environmental System Reviews, Modak P., Visvanathan C. andParasnis M. Asian Institute of Technology, Bangkok, 1995.
5	Handbook of Green Chemistry and Technology, Clark J.H. and Macquarrie D.J. Wiley-Blackwell Publishers, 2002
6	www.nptel.iitm.ac.in/courses/

Fourth Semester

Course Title: Mechatronics

Course Code: 24UOE429T **Course Category: OE**

Teaching Scheme: L – T – P **Total Credits: 02**

2 – 0 – 0

Scheme of Examination: ESE:30 Marks, **CE:** 20 Marks

Prerequisites: This course is designed to understand key elements of mechatronics systems.

Course Objectives:

1. To understand the working of mechatronics systems.
2. To acquire the insight to build the mechatronics systems.
3. To make understanding of various control systems.

Course Outcomes:

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

CO1: Identify various inputs and output devices in an automated system CO2: Understand and draw ladder diagrams,

CO3: Implement interfacing of input and output devices

CO4: Identify and describe actuating systems, microprocessors & microcontrollers.

Course Content:

Unit I [07 Hours]

Introduction of Mechatronics System:

Scope and elements of mechatronics, mechatronics design process, measurement system, requirements and types of control systems, feedback principle, Basic elements of feedback control systems, Classification of feedback control system.

Unit II [08 Hours]

System Interfacing and Data Acquisition:

DAQs: Data acquisition systems (DAQS), data loggers, Supervisory control and data acquisition (SCADA), Communication methods. Peripheral interface device.

(PIA), Analogue interfacing. Analogue to Digital and Digital to Analog Conversions, Variable frequency drives (VFD), Scalar and Vector drives, Stepper motor driverand controller.

Unit III [08 Hours]

Electrical Actuating Systems:

Mechanical switches and relays, solenoids, state switches solenoids, DC Servomotors, Stepper motor, Induction Motors, speed control, pulse four quadrant servo drives, Pulse width modulation (PWM) frequency drive, vector drive. Pneumatic & Hydraulic Actuating Systems: Pneumatic & Hydraulic Systems.

Unit IV [07 Hours]

PLC and SCADA:

Programmable Logic Controller: Introduction to PLCs, Basic structure of PLC, Principle of operation, input and output processing, PLC programming language, ladder diagram, ladder diagrams circuits, Introduction to SCADA: Functionality, applications, development, evaluation and benefits of SCADA.

Suggested Self Readings:

Text Books

1. Mechatronics - Integrated Mechanical Electronics System, K.P. Ramachandran, Wiley India Pvt. Ltd. New Delhi
2. Mechatronics & Microprocessors, K.P. Ramachandran, Wiley India Pvt.Ltd., New Delhi.
3. Mechatronics, Bolton W, Pearson Education, Second Edition, 1999.

Reference Books

1. Pneumatic Application, Wemer Deppert and Kurt Stoll, Kemprath Reihe, Vovel Verlag, Wurzburg, 1976.
2. Mechatronics, N. P. Mahalik, Mc Graw-Hill Education
3. Mechatronic Systems Fundamentals, Rolf Isermann, Springer, 2003.

Fourth Semester

Course Title: Internet of Things

Course Code: 24UOE430T **Course Category: OE**

Teaching Scheme: L – T – P **Total Credits: 02**

2- 0 - 0

Scheme of Examination: ESE:30 Marks**, CE:** 20 Marks

Course Objectives:

1. To understand basic concepts of Internet of things, architectures, Sensing ,Actuation.
2. To understand basic communication aspects of IoT like Communication protocols.
3. To understand basic concepts of IoT tools like raspberry Pi, Arduino and itsinterfacing.
4. To understand various applications and case studies of IoT.

Course Outcomes:

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

CO1: Define and state basic terminologies and concepts of IoT.

CO2: Classify various communication models and explain various communication protocols.

CO3: Classify various IoT tools and develop applications using these tools.

CO4: Explain various applications and case studies of IoT.

Course Contents:

Unit I [08 Hours]

Introduction to IoT:

IoT definition & Characteristics, Advantages and disadvantages, Applications, IoT functional blocks, sensing , actuation, IoT Architectures: Three Layer, Four Layer and Five Layer, IoT Vs M2M Communication, IoT Enabling Technologies concepts.

Unit II [07 Hours]

Communication Aspects of IoT:

IoT Communication Models (Request Response, Publish Subscribe, PushPull, Exclusive Pair) Application Layer Protocols: HTTP, MQTT, COAP, Transport Layer Protocols: TCP,UDP; Network Layer Protocols: IPv4, IPv6, 6LowPAN; Link Layer Protocols: Wi-Fi(802.11), Ethernet(802.3), WiMax(802.16),LR-WPAN(802.15.4) ,
LoRaWAN, Cellular(2G/3G/LTE).

Unit III [08 Hours]

IoT Tools:

Introduction to Raspberry Pi, Raspbian OS: Basic Features, Installation, Various Raspbian Commands, Introduction to Arduino, Arduino IDE, Introduction to Node MCU ESP 8266, ESP32 WiFi Modules.

Unit IV [07 Hours]

IoT Applications:

Introduction to Edge computing, Cloud computing and Fog computing.

Case Studies: Home Automation, Health Monitoring, Agriculture. Python Programming for IoT applications.

Suggested Self Readings:

Text Book

1. Satish Jain, Shashi Singh; IoT and its Applications; bpb publications
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things-A Hands on Approach;University Press
3. Dieter Uckleman, Mark Harrison et.al.; Architecting the Internet of Things; Springer Publications.

Reference Books/Links

1. https://nptel.ac.in/courses/106105166

Fourth Semester

Course Title: Industrial Applications of Raspberry Pi

Course Code: 24UOE431T **Course Category: OE**

Teaching Scheme: L – T – P **Total Credits: 02**

2- 0- 0

Scheme of Examination: ESE:30 Marks**, CE:** 20 Marks

Prerequisites : Knowledge of fundamentals of Microcontrollers.

Course Objectives:

1. To understand basics of Raspberry Pi and Raspbian OS.
2. To Understand basic python programming concepts for programming Raspberry Pi.
3. To study interfacing of various Hardware like sensors, actuators, camera with Raspberry Pi.
4. To understand industrial applications of Raspberry Pi.

Course Outcomes:

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

CO1:Classify various Raspberry Pi boards and state their configurations, pin descriptions.

CO2: Use various Raspbian OS commands and programming concepts of Python for Raspberry Pi.

CO3: Interface various sensors and actuators with Raspberry Pi and send data on cloud using Raspberry Pi.

CO4: Classify IoT, IIoT and Industry 4.0 and discuss applications of Raspberry Pi.

Course Contents:

Unit I [07 Hours

Getting Started with Raspberry Pi:

Various Raspberry Pi Boards and their configuration, Basic blocks of Raspberry Pi, Pin configuration of Raspberry Pi, Raspbian OS, Installation and Setup, Raspbian OS Commands.

Unit II [08 Hours]

Python Programming for Raspberry Pi:

Python programming for Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow, Python programming for data Communication.

Unit III [07 Hours]

Hardware Interfacing with Raspberry Pi:

Interfacing with LED, Raspberry Pi Camera interfacing and image capturing, Interfacing with Temperature and humidity sensor (DHT11 and DHT22), Interfacingwith RFID module, Relays, Sending Data using IOT.

Unit IV [08 Hours]

Industrial Applications:

Introduction to IIoT, Relation between IoT, IIoT and Industry 4.0.

Case Study: Smart Factories, Healthcare Service Industry, Transportation and Logistics, Mining, Firefighting and Disaster management, Milk Processing and Packaging industry.

Suggested Self Readings:

Text Books

1. Ioana Culic , Alexandru Radovici , Cristian Rusu; Commercial and Industrial Internet of Things Applications with the Raspberry Pi: Prototyping IoT Solutions; Apress Publications.
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things-A Hands on Approach;University Press

Reference Books/Links

1. https://nptel.ac.in/courses/106105166
2. https://onlinecourses.nptel.ac.in/noc20_cs69
3. https://freevideolectures.com/course/4231/nptel-introduction-industry-industrialinternetthings/59

Fourth Semester

Course Title: Professional communication

Course Code: 24UBS407T **Course Category: AEC**

Teaching Scheme: L – T – P **Total Credits: 02**

2 – 0 – 0

Scheme of Examination: ESE:30 Marks, **CE:** 20 Marks

Prerequisites : Basic knowledge of spoken and written English

Course Objectives: Students would be able to enhance their language skillsand be prepared for placements.

Course Outcomes:

On completion of the course, students will be able to-

CO1: Construct correct sentences for spoken and written English. CO2: Develop writing and speaking skills.

CO3: Demonstrate writing skills at work place .CO4: Prepare themselves for job placement.

Course Content:

UNIT I [07 Hours]

Grammar for Spoken English:

Tense, Active and Passive Voice, Negative, Interrogative and Negative-interrogative sentences, use of modal auxiliary verbs, reinforcement exercises

UNIT II [08 Hours]

Writing and Speaking skills:

Paragraph writing, Research papers writing, role play exercises for speaking (at shop, restaurant, bank, airport, office etc.), Public speaking, reinforcement exercises.

UNIT III [08 Hours]

Professional writing skills:

Business letters, email, minutes of meeting, notices, circulars, memos, blog writing, virtual message drafting, one page report writing.

UNIT IV [07 Hours]

Job placement techniques: Job application letter, Resume writing, Group discussion, types of interviews, interview techniques, telephonic interview etiquettes.

Suggested Self Readings:

Sr. No.	Text Books/Reference Books
1	Technical Communication by Meenakshi Raman and Sangeeta Sharma, OUP
2	Public Speaking and Influencing Men in Business by Dale Carnegie
3	Professional Communication Skills by Bhatia and Sheikh, S. ChandPublications
4	Communication Skills by Sanjeev Kumar and Pushpalata, OUP
5	Functional English for Technical Students by Dr. Pratibha Mahato and Dr.Dora Thompson, Himalaya Publishing House.
6	Communication Skills by Lalita Bisen, Bhumika Agrawal, N.Thejo Kalyani, Himalaya Publishing House.

Fourth Semester

Course Title: Environmental Science

Course Code: 24UBS410T **Course Category: VEC**

Teaching Scheme: L – T – P **Total Credits: 02**

2 – 0 – 0

Scheme of Examination: ESE:30 Marks, **CE:** 20 Marks

Prerequisites : Students are expected to know the fundamental principles of theoretical and experimental Basic Science of HSC level.

Course Objectives:

- A systematic study of human interaction with the environment in the interests of solving complex problems
- Study of physical and biological characters of the environment , also the social and cultural factors along with the impact of man on environment.
- Bring together the principles of various disciplines of Sciences, to solve contemporary environmental problems.

Course Outcomes:

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

CO1: Recognize the Multidisciplinary nature of environmental science and gain in- depth knowledge of natural processes that sustain life and govern economy.

CO2: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.

CO3: Acquire values and attitudes towards understanding complex environmental-economic-social challenges, and participating actively in solving current environmental problems and preventing the future ones.

CO4: Adopt sustainability as a practice in life, society and industry and know their roles and ethics, as citizens, and consumers in a complex, interconnected world.

Course Content:

UNIT I **[06 Hours]**

Environment as an multidisciplinary subject and Natural resources

Environment: Definition, Scope, basic terms, importance, need for public awareness. concept of sustainable development.

Natural resources and assosiated problems. Forest, water, mineral, food and land resources.

Role of individuals in conservation of natural resources. Eqitable use of resources for sustainable lifestyle. Environmental Application of remote sensing and GIS. Relevent case studies, laws and Legislation.

UNIT II [08 Hours]

Ecosystem and Biodiversity

Ecosystem: Concept, Structure and Functions, Energy Flow, Food Chain , Food web, and Ecological Pyramids;Grassland and pond Ecosystem. Ecological succsession. Biodiversity: Introduction, definition, Types (genetic, species & ecosystem). value of biodiversity, Biodiversity at Global, National and local Levels. Hot spots of biodiversity;Threats to biodiversity; conservation, In-situ and Ex-situ conservation; Relevent case studies, laws and Legislations.

UNIT III [08 Hours]

Environmental Pollution, hazards, Disaster management & EIA:

Pollution: Definition, causes, effects and control measures of Water , Air, solid, noise and nuclear pollution.

Environmental hazards & Disaster management:Definition, and typesof mitigation. Preparedness and awareness.

Environmental impact assessment(EIA); scope, importance and need.Role of IT in environment. Environmental Auditing; Relevent case studies, laws and Legislations.

UNIT IV [08 Hours]

Social Issues and Environment, Environmental conventions

Population explosion, Urban problems related to energy, resettlement and rehabilitation of people, their problems and concerns,family welfare programme, humen health, women and child welfare; environmental ethics & consumerism. Mass tourism and environment.Sustainable tourism. Stockholm convention, Kyoto Protocol, Montreal Protocol, COP (Conference of Parties), Ramsar Convention, Rio Summit, Convnetion on Biological Diversity; National Green Tribunal; Relevent case studies, laws and Legislations.

Textbooks:

1. Environmenta Studies by Anindita Basak: ISBN: 8188458-77-5
2. Environmenta Studies by Dr. Suresh K. Dhameja ISBN-978-81-317-2118-6

Reference books:

1. Environmental Studies Univ. Sci. PressISBN-978-81-318-0641-8

2.Environmenta Studie: ISBN: 8188458-77-5