V Semester

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	ET501T	Microprocessor and Microcontroller	3	-	-	3	30	70	100
2	ET501P	Microprocessor and Microcontroller lab	-	-	2	1	25	25	50
3	ET502T	Analog Circuit design	3			3	30	70	100
4	ET502P	Analog Circuit design lab	-	-	2	1	25	25	50
5	ET503T	Analog and Digital Communication	3	-	-	3	30	70	100
6	ET503P	Analog and Digital Communication lab	-	-	2	1	25	25	50
	ET504T	Program Elective – I	3			3	30	70	100
7	ET505T	Open Elective - I	3	-	-	3	30	70	100
8	H 104	Foundational Humanities Elective	2	-	-	-	Audit		
9	AS502T	English for Engineers	2	-	-	2	15	35	50
10	ET506P	Technical Skill Development-II	-	-	2	1	50	-	50
11	ET507T	Career Development – III	2	-	-	0	Audit		
Total			**21**	**-**	**8**	**21**	**290**	**460**	**750**

***** Career Development (Interpersonal Skills and Aptitude)

ET505T	**Open Elective – I**		**Foundational Humanities Elective**
ET505T	Industrial applications of microcontroller	H-103	Development of Societies
ET504T	**Program Elective I**	H-104	Philosophy
ET504T(i)	Antenna and Wave Propagation		
ET504T(ii)	Internet of Things		

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET501T	Microprocessor and Microcontroller	3	-	0	3	30	70	100

Course Objectives	Course Outcomes
1. To study fundamentals of microprocessor and microcontroller systems. 2. To study architecture of microprocessor & to understand the concept of memory organization, stack memory, Assembly language programming. 3. To study different interrupt techniques. 4. To study interfacing of microprocessor & microcontroller with different peripheral devices.	After completion of the course students are able to, 1. Explain internal architecture, Memory organization, Instruction set of 8086/8088 microprocessors, Pentium and different peripheral devices. 2. Develop program and interfacing of 8086 with different peripheral devices 3. Design Interfacing of 8086 with Timer, USART peripheral devices, the concept of 8087 Numeric-coprocessor & its use in practical application. 4. Explain the concept of internal architecture, Memory organization and Instruction set of 8051microcontroller. 5. Develop assembly language program and embedded c program for 8051 microcontroller with Illustrate the Interfacing of 8051 with different peripheral devices.

UNIT- I:	**[10 Hrs]**
Intel 8086/8088 microprocessor & Programming: 8086/8088 microprocessor: Pin diagram, Architecture, features and operating modes, Clock generator 8284, memory organization & interfacing, Addressing modes, complete instruction set, Pentium: Architecture, North Bridge, South Bridge, DRAM.-Added	
Unit –II:-	**[10 Hrs]**
8086 & Peripheral Interfacing: 8086 & Peripheral Interfacing: Assembly language programming of 8086, Interrupt structure, I/O interfacing, interfacing of peripherals like 8255 PPI, multiplexed 7-seg display & matrix keyboard interface using 8255, Programmable interval timer/counter 8254; Architecture, working modes, interfacing. Serial communication, Classification & transmission formats. USART 8251, Pins & block diagram, interfacing with 8086 & programming. 8087 Numeric co-processor; Architecture, interfacing with 8086, instruction set.	
Unit –III:-	**[9 Hrs]**
8051 microcontrollers: Introduction to 8051 microcontrollers; Pin diagram, architecture, features & operation, Ports, memory organization, SFR's, Flags, Counters/Timers, Serial ports. Interfacing of external RAM & ROM with 8051. 8051 Interrupt structure, Interrupt vector table with priorities, enabling & disabling of interrupts	
UNIT- IV:	**[9 Hrs]**
8051 microcontroller & programming: Instruction set of 8051; data transfer, logical, arithmetic & branching instructions, Addressing modes, Assembly language programming examples, introduction to Embedded C, programming examples	
Unit -V:	**[10 Hrs]**
8051 Timers, Serial and interfacing: Counter/Timer programming in various modes. Serial communication, Operating modes, serial port control register, Baud rates. I/O expansion using 8255, Interfacing keyboard, LED display, ADC & DAC interface, stepper motor interface, Embedded C programming examples	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Programming & Interfacing of 8086/8088	D.V. Hall		TMH.
2	The 8051 Microcontroller and Embedded system	M.A. Mazidi & J.G. Mazidi	3 rd Indian reprint	Pearson Education
3	Advanced Microprocessor and peripherals	by K. M. Bhurchandi and A. K. Ray		
4	The Intel Microprocessor 8086 & 80486 Pentium and Pentium Pro. Architecture Programming and Interfacing	Brey.		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Intel Reference Manuals, Microprocessors & Microcontrollers:			Intel
2	Microcontrollers,	Peatman		Mc Graw Hill
3	Microprocessors & Microcomputers based system design	Md. Rafiquzzaman		

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET501P	Microprocessor and Microcontroller Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
1. To perform a practical on microprocessor and microcontroller based system. 2. To study assembly language programming skills. 3. Interface different peripherals with microprocessor and microcontroller with its use.	After completion of the course students are able to, **1.** Outline the procedure for execution Programs on 8086,8051 trainers. 2. Demonstrate the concept of Assembly languages structure and programming skills 3. Develop interfacing of various peripherals with 8086 and 8051 4. Simulate the programs on different software platforms 5. Design and develop the Mini project based on real life problems

Expt. No.	Title of the experiment
1	Study of 8086 microprocessor.
2	Write and execute 8086 assembly Language Programs to multiply two 16 bit numbers.
3	Write and execute 8086 assembly Language Programs to divide 16 bit number by 8 bit number.
4	Write and execute 8086 assembly Language Programs to search a look-up table for a byte (make use of XLAT)
5	Write and execute 8086 assembly Language Programs to compare two strings (use String instructions)
6	Write and execute 8086 assembly Language Programs to arrange the data bytes in ascending/descending order.
7	Write and execute 8086 assembly Language Programs to generate Fibonacci series and store it from memory location 0050H.
8	Write and execute 8051 assembly language program to find smallest byte in a string of bytes.
9	Write and execute 8051 assembly language program to exchange two data strings.
10	Write and execute 8051 assembly language program to generate square wave of 1 KHz (and any other frequency) on one of the pin of output port.
11	Interface 8255 with 8086 microprocessor and write a program to glow the alternate LED's.

12	Interface 8255 with 8086 microprocessor and write a program to rotate the stepper motor.
13	Interface 8253 with 8086 microprocessor and write a program to generate square waveform.
14	Interface of ADC using 8255 with 8086 and write a program to convert analog signal input into its equivalent digital value and store it in memory locations.
15	Write a separate program for addition, subtraction, multiplication and division of 8-bit numbers on using Kiel and on 8051 Micro-controller Trainer .
16	Implement the interfacing of LED's with 8051 micro-controller and WAP to blinking the LED.
17	Implement the interfacing of 7 segment display with 8051 micro-controller and WAP to display 0 to9 digit continuously.
18	Implement the interfacing of stepper motor with 8051 micro-controller and WAP to rotate it.
19	Mini-project

Text Books

S.N	Title	Authors	Edition	Publisher
1	Programming & Interfacing of 8086/8088	D.V. Hall,		TMH.
2	The 8051 Microcontroller and Embedded system	M.A. Mazidi & J.G. Mazidi	3 rd Indian reprint	Pearson Education
3	Advanced Microprocessor and peripherals	by K. M. Bhurchandi and A. K. Ray		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Intel Reference Manuals, Microprocessors & Microcontrollers:			Intel
2	Microcontrollers,	Peatman		Mc Graw Hill
3	Microprocessors & Microcomputers based system design	Md. Rafiquzzaman		

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET502T	Analog Circuit Design	3	-	0	3	30	70	100

Course Objectives	Course Outcomes
1. To study the basic characteristic, construction, open loop & close loop operations of Op-Amp. 2. To study linear and non linear applications of Op-Amp. 3. To study the design of Electronic Circuits for Oscillator, Multivibrator and Active Filters	After completion of the course students are able to, 1. To explain the basic differential amplifier using transistor, ideal op amp and basic feedback configurations. 2. To demonstrate and evaluate practical integrator, differentiator circuits, instrumentation amplifier, logarithmic & anti logarithmic amplifier circuits. 3. To explain & evaluate practical Schmitt trigger, comparator, Clipper, clamper, precision rectifier circuits, Design of phase locked loop, Astable , nonstable, circuits using an opamp IC and timer. 4. To explain & design Hartley,Colpitts, Crystal oscillators using transistors ,Quadrature,RC phase shift & Wein bridge oscillators using op-amp along with diode function generator circuit and opamp. 5. To Analyze design active Butterworth filters up to 6^{th} order

UNIT- I: OP-Amp Fundamentals	**[10 Hrs]**
Block diagram of OP-Amp (Basic Building Blocks), Basic differential Amplifier using transistor and its operation, current mirror circuit, OP-Amp parameters, characteristic and Definition, Ideal OP-Amp, Equivalent circuit, Voltage Transfer curve, concepts of virtual short and ground. Inverting and Non-inverting configurations and design.	
Unit –II:- OP-Amp Linear Applications	**[10 Hrs]**
Voltage follower, Summing amplifier, scaling and averaging amplifier, Bridge Amplifiers using opamp, Instrumentation amplifier and applications, Integrator and differentiators (Practical considerations and design), Peak detector, Log and antilog amplifiers using OP-Amp, V to I and I to V converter circuit.	
Unit –III:- OP-Amp Non-Linear Applications	**[10 Hrs]**
Comparators, Schmitt trigger, Comparator IC such as LM 339, Clipper and Clamper, PLL, Multivibrators:, Astable & Monostable multivibrator circuits using IC 555, Sample/Hold circuits,D/A (R/R) & A/D conversion circuits (Successive Approximation Method), design of ADC using 0804 ICs.	
UNIT- IV: Design power supply and Oscillators	**[11 Hrs]**
Design of linear and switching power supplies:- Design of opmap based series voltage regulator, Design of Buck and boost switched mode power supply, Design of high efficiency SMPS using soft switching technique.Design of sinusoidal oscillators OPAMP based Wein Bridge ,Phase Shift oscillators, Transistorized Hartley, Colpitts oscillator, and Crystal oscillators, Evaluation of figure of merit for all above oscillator circuits. Design of function generator using an opamp.	

Unit -V: Design of Active Filters	**[7 Hrs]**
Advantages of active filters, Design of Butterworth Active Filter(upto 6^{th} order) , Design of Active filter of LPF, HPF, BPF and switched capacitor filter. Design of relay driver circuit using transistor and op-amp, Design of IGMF filters	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Operational Amplifier and Applications	R. Gayakwad.	3	PHI
2	. Electronic Devices and Circuits	David Bell	5	Oxford Higher Education
3	Designing with Op-Amps	Franco		McGraw Hill

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Linear Integrated Circuits Mannal I, II, and III			National Semiconductor
2	Linear Applications Handbook			National Semiconductors
3	Operational Amplifier	Dailey		McGraw Hill
	Operational Amplifier Design and Applications	Tobey, Graemme, Huelsman	1	McGraw Hill.

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET502P	Analog Circuit Design lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
1. To study and verify the basic characteristic of Op-Amp. 2. To verify linear and non linear applications of Op-Amp.	After completion of the course students are able to, 1. To explain the basic differential amplifier using transistor, ideal op amp and basic feedback configurations. 2. To demonstrate and evaluate practical integrator, differentiator circuits, instrumentation amplifier, logarithmic & anti logarithmic amplifier circuits. 3. To explain & evaluate practical practical applications . 4. To explain & design Hartley, Colpitts, Crystal oscillators 5. To Analyze design active Butterworth filters up to 6^{th} order

Expt. No.	Title of the experiment
1	Study & Perform OPAMP as An Inverting Amplifier Using Bread board & Kit
2	Study & Perform OPAMP as Non Inverting Amplifier Using Bread board & Kit
3	Study & Perform Adder & Avarager(Inverting Type) On Breadboard
4	To Design the Differential Amplifier using transistor on Multisim
5	study & Perform Adder/Subtractor Circuit On Breadboard
6	Study & Perform Integrator & Differentor on Breadboard
7	To Design the Operation of Astable Multivibrator using IC 555 & calculate Duty Cycle.
8	To Design the Operation of Monostable Multivibrator using IC 555 & calculate Duty Cycle.
9	Study & Perform Transistor series Voltage Regulator on Kit
10	Study & Perform Band Pass Filter design on Breadboard.
11	Study & Perform OPAMP as An Inverting Amplifier Using Bread board & Kit

Text Books

S.N	Title	Authors	Edition	Publisher
1	Operational Amplifier and Applications	R. Gayakwad.	3	PHI
2	Electronic Devices and Circuits	David Bell	5	Oxford Higher Education

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Linear Integrated Circuits Mannal I, II, and III			National Semiconductor
2	Linear Applications Handbook			National Semiconductors
3	Operational Amplifier	Dailey		McGraw Hill
	Operational Amplifier Design and Applications	Tobey, Graemme, Huelsman	1	McGraw Hill.

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET503T	Analog and Digital Communication	3	-	0	3	30	70	100

Course Objectives	Course Outcomes
1. To study basic components of digital communication systems. **2.** To understand the designing aspects of optimum receivers for digital modulation techniques. 3. To study the analysis of error performance of digital modulation techniques. **4.** To study the designing of digital communication systems under given power, spectral and error performance constraint.	After completion of the course students are able to, 1. Explain the working principles of basic building blocks of analog communication system. 2. Explain the working principles of basic building blocks of a digital communication system. 3. Demonstrate and elaborate the concept of source and waveform coding techniques 4. Illustrate digital modulation techniques. 5. Demonstrate and elaborate the concept of channel coding and decoding techniques, Model and construct digital communication systems using appropriate mathematical techniques and describe spread spectrum analysis.

UNIT- I:	**[10 Hrs]**
Base band & Carrier communication, Introduction of modulation, Equation of modulation, Generation of AM (DSBFC) and its spectrum, Modulation Index, Power relations applied to sinusoidal signals, Comparison of AM, FM and PM, Pulse Analog modulation: PAM PWM & PPM.	
Unit –II:-	**[10 Hrs]**
Model of digital communication system, Gram Schmitt Orthogonalization procedure, signal space concept, Geometric interpretation of signals. PCM – Generation & reconstruction, Bandwidth requirement of PCM, Differential PCM, Delta Modulation & Adaptive DM. (Only Block diagram treatment).	
Unit –III:-	**[10 Hrs]**
Source coding Theorem, Shannon Fano Coding, Huffman coding-Z encoding algorithm, Rate distortion theory for optimum quantization, scalar & vector quantization. Waveform coding methods: ADPCM, Adaptive Sub-Band & Transform coding, LP & CELP coding.	
UNIT- IV:	**[8 Hrs]**
Coherent Binary: QPSK, MSK, Gaussian MSK, DPSK, Memory less modulation methods, linear modulation with Memory, nonlinear modulation methods with memory: CPFSK, CPM.Binary: QPSK, MSK, Gaussian MSK, DPSK, CPFSK, CPM.	
Unit -V:	**[10 Hrs]**
Introduction to Galois field, Construction of Galois field GF (2 m) & its basic properties. Types of error control: Forward error correction (FEC), Automatic repeat request system (ARQ). Convolution encoding and decoding distance properties, Viterbi algorithm and Fano algorithm. Spread - Spectrum methods: - Study of PN sequences, direct sequence methods, Frequency hop methods, slow and fast frequency hop.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Digital communication	Simon Haykin		WEP
2	Error Control Coding 1. “	Shu Lin & Daniel J.Costello		TMH
3	Digital Communication	J.S.Chitode		
4	Electronic Communication Systems	Kennedy & Devis	Fourth Edition	Tata McGraw Hills Publication
5	Modern Digital and Analog. Communication Systems”	B. P. Lathi	Third Edition	Oxford Press Publication

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Communication Systems	Simon Haykin	Fourth Edition	John Wiley & Sons
2	Principles of Communication Systems	Taub & Schilling		Tata McGraw-Hill
3	Digital and Analog Communication Systems	Leon W.Couch, II	Seventh Edition	Pearson Education

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET503P	Analog and Digital Communication lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
1. To study the concept of communication based on RF-AF in digital domain. 2. To study the role of sampling factor for analyzes the digital communication systems 3. To study & Design the digital communication systems. 4. To study line coding and its application.	After completion of the course students are able to, 1. Test the concept of the analog communication-based systems and techniques 2. Examine and analyze the digital communication-based circuit design 3. Design and conduct experiments for testing digital communication circuits and systems. 4. Analyze the different coding technique for design and modeling of digital communication. 5. Formulate and solve digital communication circuits and systems problems.

Expt. No.	Title of the experiment
1	To generate Amplitude Modulated wave using different techniques and plot its waveform.
2	To generate Frequency Modulated wave using different techniques and plot its waveform.
3	To study generation of SSB-SC using balanced modulator
4	To study generation of DSB-SC signal.
5	To Study and perform Error Detection and Correction codes.
6	To study the performance of adaptive Delta modulator/Demodulator circuits.
7	To study and observe the effect of signal Distortion using EYE-Diagram.
8	To Study and perform generation & reception of BPSK & perform its spectral analysis.
9	To Study and perform generation & reception of FSK & perform its spectral analysis.
10	To Study and perform generation & reception of QPSK & perform its spectral analysis.
11	To Study and perform generation & reception of MSK & perform its spectral analysis.
12	To Study and perform generation & reception of DPSK & perform its spectral analysis.
13	Write and execute Scilab/Matlab code for generation of BPSK / Prepare Simulink Model for BPSK.
14	Write and execute Scilab/Matlab code for generation of FSK / Prepare Simulink Model for FSK.
15	Write and execute Scilab/Matlab code for generation of QPSK / Prepare Simulink Model for QPSK

Test Books:

S.N	Title	Authors	Edition	Publisher
1	Digital communication	Simon Haykin		WEP
2	Error Control Coding	Shu Lin & Daniel J.Costello		TMH
3	Digital Communication	J.S.Chitode		
4	Electronic Communication Systems	Kennedy & Devis	Fourth Edition	Tata McGraw Hills Publication
5	Modern Digital and Analog. Communication Systems"	B. P. Lathi	Third Edition	Oxford Press Publication

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Communication Systems	Simon Haykin	Fourth Edition	John Wiley & Sons
2	Principles of Communication Systems	Taub & Schilling		Tata McGraw-Hill
3	Digital and Analog Communication Systems	Leon W.Couch, II	Seventh Edition	Pearson Education

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET504T(i)	Antenna and Wave Propagation	3	-	0	3	30	70	100

Course Objectives	Course Outcomes
1. To acquaint students with various basics of waveguides, transmission line characteristics, radiating elements, antennas, their principle of operation, analysis and their applications. 2. The student will able to understand the features of Antenna array, Micro-strip antenna and reflector antenna.	After completion of the course students are able to, 1. Examine transmission line characteristics. 2. Design & analyze the wired antenna parameters. 3. Design and characterize antenna arrays. 4. Analyze and design Micro-strip Antennae. 5. Illustrate the operation of aperture and reflector antennae.

UNIT- I: Transmission lines	**[8 Hrs]**
Transmission line equations and their solution. Transmission line parameters, characteristic impedance, propagation constant, attenuation constant and phase constant, waveform distortion, distortion less transmission lines, reflection coefficient and VSWR. Equivalent circuits of transmission lines, open and short circuited lines, smith chart, stub matching.	
Unit –II:- Linear wire antennas	**[8 Hrs]**
Retarted Potential, Infinitesimal dipole, its radiation field, radiation resistance, near field, far field directivity, finite length dipole, half wave length dipole, Monopole and their application, folded dipole. Introduction to loop Antenna & its applications.	
Unit –III:- Antenna Array	**[8 Hrs]**
Array of two isotropic point sources, non – isotropic sources, principle of pattern multiplication, linear arrays of n elements, broadside, End fire, radiation Pattern, directivity, Beam width and null directions, array factor, Antenna analysis using **Binomial Array** & Dolph-Tschebyscheff. Log-periodic and Yagi-Uda antennas.	
UNIT- IV: Microstrip antennas	**[6 Hrs]**
Radiation Mechanism of Microstrip antenna, feeding methods, methods of analysis, Circularly Polarized Patch antenna, Rectangular & circular patch, Circular polarization and feed network.	
Unit -V: Reflector antennas	**[6 Hrs]**
Simple reflectors, the design of a shaped Cylindrical reflector, Radiation patterns of Reflector Antennas, Dual shaped Reflector Systems, Plane reflector, Corner reflector, parabolic reflector, horn antenna, aperture antenna.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Antenna Theory analysis and design	Costantine A. Balanis		John Wiley ublication
2	Antenna and Wave propagation	K.D. Prasad		Satya Prakashan
3	Electromagnetic	Jordan Balmann,		Prentice Hall of India publication
4	Antenna Theory and Design	Robert S. Elliott		Wiley Student Edition
5	Electromagnetic Waves	R. K. Shevgaonkar		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Antenna & Wave Propagation	Sisir K Das		Mc Graw Hill
2	Antenna and wave Propagation	Harish A. R		Oxford University Press
3	Antennas and Radio Propagation,	R.E. Collins,		Mc Graw -Hill

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET504T(ii)	**Internet of Things**	**3**	**-**	**-**	**3**	**30**	**70**	**100**

Course Objectives	Course Outcomes
1. To acquaint students with basic concept of IOT 2. The student will able to design and develop Arduino and Raspberry PI based system for IoT application	After completion of the course students are able to, 1. Explain the fundamental concepts of IoT, explore the different components of IoT and Analyze Communication Protocols, Sensor Networks and Machine-to-Machine Communications 2. Analyze Communication Protocols, Sensor Networks and Machine-to-Machine Communications 3. Demonstrate use the of Arduino and Raspberry Pi Platform for IoT application 4. Implement concepts of IoT for Sensor-Cloud, Fog Computing, Smart Cities and Smart Homes 5. Explore used cases and case studies how IoT is impacting the industries 6. Work with Sensors

UNIT- I: Introduction to IoT	**[7 Hrs]**
Introduction to IoT, evolution of IoT, Platforms, Basics of Networking: XMPP protocol, MQTT protocol, CoAP protocol and AMQP protocol., Communication Protocols: ZigBee, 6 LoWPAN, Bluetooth NFC and RFID, Sensor Networks, Machine-to-Machine Communications	
Unit –II:- Introduction to Arduino Programming	**[8 Hrs]**
Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Introduction to Python programming	
Unit –III:- Raspbery- pi , SDN for IoT & Data Handling	**[8 Hrs]**
Introduction to Raspberry Pi Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT, Data Handling and Analytics	
UNIT- IV: Cloud Computing	**[7 Hrs]**
Cloud Computing, Sensor-Cloud. Fog Computing, Smart Cities and Smart Homes	
Unit -V: Industrial IoT & Case Study:	**[6 Hrs]**
Connected Vehicles, Smart Grid, Industrial IoT Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring	

Text Books

S.N	Title	Authors	Edition	Publisher
1	The Internet of Things: Enabling Technologies, Platforms, and Use Cases	Pethuru Raj and Anupama C. Raman	1	CRC Press
2	Internet of Things: A Hands-on Approach	Arshdeep Bahga and Vijay Madisetti	1	Universities Press)

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Internet of Things	Prof. Sudip Misra,| IIT Kharagpur		https://swayam.gov.in/nd1_noc19_cs65/preview

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ET505T	Industrial Applications of Microcontrollers	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
1. The students' knowledge should get updated with the latest industrial trends in technology 2. The student can creatively use the capabilities of modern microcontrollers & latest technical advancements.	After completion of the course students are able to, 1. Explain the architecture of modern microcontrollers 2. Develop a circuit consisting of external elements connected to microcontroller I/O ports 3. Design the application by using embedded peripherals 4. Compare and choose the proper communication interface for the application to be designed 5. Outline the automation system for an application consisting of external elements

UNIT- I: Architecture and basic characteristics of microcontrollers	**[7 Hrs]**
: Selection of microcontrollers, Architecture & Characteristics of Arduino, Introduction to ESP 32 & ARM based Microcontrollers. setting up the Arduino board, creating sketches, using Libraries, using example codes, Debugging Using the Serial Monitor & ICE (In-Circuit Emulator)	
Unit –II:- Input-output ports & Interface	**[8 Hrs]**
Architecture of the universal I/O ports subsystem (PIO) used in microcontrollers. Analog Inputs- Thermocouple, Strainguage, Microcontroller pin configuration programming. A/D converter (ADC) & D/A Converters(DAC) used in microcontrollers. Sensors: Temperature sensors, Humidity sensors, Proximity sensors, Ultrasonic sensor, Accelerometer, and gyro Case study of all faults diagnostic system for industrial encoders	
Unit –III:- Memory System ,Clock generator and timers/counters:	**[8 Hrs]**
Flash memory subsystem, EEPROM. Interrupts system, Architecture of timers/counters subsystem (TC) used in microcontrollers, Use of the TC subsystem to generate square waveforms of given parameters and measure frequency, duty factor, and time shift of waveforms. Pulse width Modulation (PWM). TC subsystem interrupts. **Case study of Power Harmonic Analyzer**	
UNIT- IV: Communication Interfaces:	**[8 Hrs]**
USART, I2C (TWI) and SPI standards, The architecture of USART, TWI and SPI controllers used in microcontrollers, Registers and software handling of above interfaces for Arduino, Handling of the interrupts generated by USART, TWI and SPI controllers. USB to TTL converter module.Examples on I2C(Interfacing RTC), SPI(Serial Eprom) Case study of Electronic Chlorophyll Reader	
Unit -V: Industrial Automation	**[6 Hrs]**
Basic block diagram, PLC & SCADA, Concepts of DCS, Process Boiler Automation, Machine control Automation, PLC and Microcontroller based instrumentation Systems, HMI display with touch screen, Modbus, PROFINET. Arduino Libraries for implementing MQTT & REST protocols for IoT.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Arduino Cookbook	Michael Margolis	1	O'Reilly Media
2	Microcontrollers, Architecture, Programming, Interfacing and System Design	Rajkamal	1	Pearson
3	Industrial Automation Using PLC SCADA & DCS PLC and SCADA Book	Rajesh Mehra, Vikrant Vij	2	Paperback Bunko
4	Arduino for Beginners: Essential Skills Every Maker Needs	John Baichtal,	1	Pearson

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Microcontrollers datasheets and user's manual			https://www.farnell.com/datasheets/1682209.pdf
2	UNO R3 Arduino Documentation			https://docs.arduino.cc/hardware/uno-rev3
3	Audrino			https://www.ti.com/microcontrollers-mcus-processors/processors/digital-signal-processors/overview.html