CURRICULUM & SYLLABI
B.Tech. ELECTRONICS AND COMMUNICATION ENGINEERING

Effective from AY: 2024-25

NATIONAL INSTITUTE OF TECHNOLOGY WARANGAL
WARANGAL, TELANGANA

Credit Structure

Minor: ECE

S.No	Code	Course Title	L-T-P	Credits	Sem
1	EC1M01	Digital Electronics	3-0-0	3	3
2	EC1M02	Principles of Communication Systems	3-0-0	3	4
3	EC1M03	Sensors and Instrumentation	3-0-0	3	5
4	EC1M04	Introduction to Internet of Things	3-0-0	3	6
5	EC1M05	Fundamentals of Image Processing	3-0-0	3	7
		Total Credits		**15**	

SYLLABI

Minor: **Electronics and Communication Engineering**

EC1M01 **3-0-0: 3**

Digital Electronics

Pre-Requisites: **None**

Course Outcomes:

CO-1	Design combinational and sequential digital circuits, represent logic functions in multiple forms understanding the advantages and disadvantages of each.
CO-2	Understanding of CMOS transistors to realize digital logic circuits, understand basic characteristics of logic gates.
CO-3	Understand the principle of operation and design of a wide range of electronic circuits and memories RAM and ROM.
CO-4	Understand how to convert signals from analog to digital and digital to analog.

Course Articulation Matrix:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	3	2	-	2	-	-	-	-	-	-	1	2	1
CO-2	2	3	2	-	2	-	-	-	-	-	-	1	2	1
CO-3	2	2	2	-	2	-	-	-	-	-	-	1	2	1
CO-4	2	2	2	-	2	-	-	-	-	-	-	1	2	1

1 - Slightly; **2 - Moderately;** **3 - Substantially**

Syllabus:

Number system and codes: Analog versus digital, merits of digital system, number systems, base conversions, complements of numbers, weighted and non-weighted codes, error detecting and correcting codes. Boolean algebra, postulates and switching algebra, completely and incompletely specified switching functions, minimization of Boolean functions using Karnaugh map and Quine Mc-Cluskey methods- their limitations.

Logic Families: Introduction to Logic Gates- AND, OR, Ex-OR, NAND, NOR, Characteristic parameters, TTL logic, CMOS logic families, Implementation of Basic gates using TTL & CMOS logic.

Combinational Logic: Principles and practices, Logic design of combinational circuits code conversion, parity generation and checking, multiplexers, de-multiplexers, encoders, decoders, buffers, tri-state buffers.

Sequential Logic: Study of Flip-Flops (SR, JK, T, D, MS), FSM's, Counter, Universal shift registers, Full adders. RAM, ROM (Cell Structures and Organization on Chip)

Data Conversion & Study of IC's: Concepts of D/A conversion, A/D conversion using the basic circuits. Study of Basic Gate IC's –AND, NAND, OR, NOR, NOT, Ex-OR, Building Block IC's – MUX, Decoder, Adder, Flip-Flops (SR, JK, T, D, Master-Slave).

Learning Resources:

Text Books:

1. S Salivahanan, Linear Integrated CircuitsTATA MC GrawHill.
2. Jain R.P, “Modern Digital Electronics”, Tata Mc GrawHill,2003, Third edition.
3. Floyd T.L., “Digital Fundamentals ", Prentice Hall, 2006, 9 th Edition.

Reference Books:

1. Anil K. Mani: Digital Electronics-Principles and Integrated Circuits, Wiley-India, 2007.
2. Herbert Taub, Schilling: Digital Integrated Electronics, TATA MC Graw Hill, 2008.

Other suggested Readings:

1. https://archive.nptel.ac.in/courses/108/105/108105132/

EC1M02 **3-0-0(3)**

Principles of Communication Systems

Pre-Requisites: None

Course Outcomes:

CO-1	Understand different modulation and demodulation schemes for analog communication
CO-2	Design analog communication systems to meet desired application requirements
CO-3	Evaluate fundamental communication system parameters, such as bandwidth, power, signal to quantization noise ratio etc.
CO-4	Elucidate design trade-offs and performance of communications systems.

Course Articulation Matrix:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3	PSO-4
CO-1	2	2	-	-	2	-	-	-	1	-	-	2	1	1	2	2
CO-2	-	-	-	-	2	-	-	-	-	-	-	-	1	1	-	-
CO-3	-	1	2	2	3	-	-	-	1	-	-	1	1	1	-	1
CO-4	-	1	-	-	3	-	-	-	1	-	-	1	1	1	-	1

1 - Slightly; 2 - Moderately; 3 - Substantially

Syllabus:

Signal Analysis: Communication Process, Sources of Information, Communication Channels, Modulation Process, Types of Communication, Random Process, Gaussian Process, Correlation Function, Power Spectral Density.

Noise Analysis: External Noise, Internal Noise, White Noise, Narrow Band Noise, Noise Figure, Noise Bandwidth, Noise Temperature.

Amplitude (Linear) Modulation: Linear Modulation Schemes, Generation of AM, Envelope Detector, Coherent Detection.

Angle (Exponential) Modulation: Types of Angle Modulation, Relation between FM and PM, Narrow Band FM, Wideband FM, Principles of FM Demodulation.

Pulse Modulation: Sampling Process, PAM, PWM, PPM, Quantization, PCM, TDM, Digital Multiplexer Hierarchy.

Information Theory: Uncertainty, Information, Entropy, Source Coding Theorem, Data Compaction, Mutual information, Channel Capacity, Information Capacity Theorem .

Learning Resources:

Text Books:

1. S. Haykin, Communication Systems, Fourth Edition, John Wiley & Sons, Singapore, 2001.
2. B.P. Lathi, Modern Digital & Analog Communication Systems, Oxford University Press, Chennai, 1998, 3rd Edn.

Reference Books:

1. Leon W.Couch II., Digital and Analog Communication Systems, Pearson Education inc., New Delhi, 2001, Sixth Edition.
2. A Bruce Carlson, PB Crilly, JC Rutledge, Communication Systems, MGH, New York, 2002, Fourth Edition.

Other suggested Readings:

1. https://archive.nptel.ac.in/courses/108/104/108104091/

EC1M03 **3-0-0 : (3)**

Sensors and Instrumentation

Pre-Requisites: **None**

Course Outcomes:

CO-1	Understand the working of different sensors and transducers
CO-2	Understand various measurements using the sensors
CO-3	Understand the components of a virtual instrumentation systems
CO-4	Explore different data acquisition methods

Course Articulation Matrix:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	2	-	-	-	-	-	-	-	-	-	2	2
CO-2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO-3	2	2	-	-	-	-	-	-	-	-	-	1	2	2
CO-4	1	3	-	-	-	-	-	-	-	-	-	-	2	2

1 - Slightly; **2 - Moderately;** **3 - Substantially**

Syllabus:

Sensors & Transducer: Definition, Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.

Measurements: Principles of Measurement: Static Characteristics, Error in Measurement, Types of Static Error Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor. Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors.

Virtual Instrumentation: Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs, Structures: Case, Sequence & Formula nodes, need of software-based instruments for industrial automation.

Data Acquisition Methods: Basic block diagram, Analog and Digital IO, Counters, Timers, Types of ADC: successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type. HVAC and BAC Protocols.

Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control, Actuators.

Learning Resources:

Text Books:

1. DVS Murthy, Transducers and Instrumentation, PHI, 20132nd Edition.
2. D Patranabis, Sensors and Transducers, PHI, 2013, 2nd Edition.

3. S. Gupta, J.P. Gupta, PC interfacing for Data Acquisition & Process Control, Instrument Society of America, 1994, 2nd edition .
4. Gary Johnson / Lab VIEW Graphical Programing / McGraw Hill 1997, II Edition.

Reference Books:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 2012, 4th Edition.
2. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001.
3. Hermann K.P. Neubert, “Instrument Transducers” 2012, Oxford University Press, 2012, 2nd Edition.

EC1M04 **3-0-0 : (3)**

Introduction to Internet of Things

Pre-Requisites: **None**

Course Outcomes:

CO-1	Understand IOT design requirements
CO-2	Compare various technologies and protocols
CO-3	Study Cloud storage and intelligent analytics
CO-4	Design and experiment various applications

Course Articulation Matrix:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	-	1	-	2	-	-	-	-	-	-	1	2	2
CO-2	-	3	1	-	1	-	-	-	-	-	-	1	2	2
CO-3	-	-	1	-	1	-	-	3	-	-	-	1	2	2
CO-4	-	-	3	-	1	-	3	-	-	-	-	1	2	2

1 - Slightly; **2 - Moderately;** **3 - Substantially**

Syllabus:

Architectures: IoT and the connected world, Architecture of IoT, Security issues, Opportunities for IoT, Relevance of Internet to network of Things, network management, security, mobility and longevity, desirable features of a distributed architecture for a system of things

Technologies: Wireless protocols, Connectivity options, Low-power design, range extension techniques, data-intensive IoT, MAC and routing aspects.

Data storage and analysis: Managing high rate sensor data, Processing data streams, Data consistency in an intermittently connected or disconnected environment, Identifying outliers and anomalies

Security in IOT: Threat models, Defensive strategies and examples.

Cloud Computing: Introduction, Types of Cloud Computing, Cloud Computing: A Paradigm Shift, Price and Value Models, Security and Governance, IAAS AND PAAS, SAAS, AWS, Azure, IBM Watson

Applications of IoT

Learning Resources:

Text Books:

1. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley 2013.
2. Naveen Balani, “Enterprise IoT”, CreateSpace Independent Publishing Platform 2016.

Reference Books:

1. Nayan B. Ruparelia, “Cloud Computing”, MIT Press 2016.

EC1M05 **3-0-0 (3)**

Fundamentals of Image Processing

Pre-Requisites: None

Course Outcomes:

CO-1	Understand different components of image processing system with examples
CO-2	Ability to describe various enhancement techniques using various processing methods
CO-3	Illustrate the concept of image transforms and compression
CO-4	Demonstrate various edge detection, segmentation and classification techniques on a given image
CO-5	Illustrate the various schemes for image representation and recognition with examples

Course Articulation Matrix:

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	3	-	3	2	-	-	-	-	-	-	-	2	2
CO-2	3	3	3	2	2	2	-	-	-	-	-	-	2	2
CO-3	3	3	3	3	3	-	-	-	-	-	-	-	2	2
CO-4	2	3	2	2	2	2	-	-	-	-	-	-	2	2
CO-5	2	3	3	3	3	2	-	-	-	-	-	-	2	2

1 - Slightly; 2 - Moderately; 3 - Substantially

Syllabus:

INTRODUCTION: Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System. Digital Image Fundamentals: Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels.

IMAGE ENHANCEMENT: Spatial Domain: Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, smoothing spatial Filters, Sharpening spatial Filters. Image Enhancement in the Frequency Domain: Introduction to 2D-Fourier Transform and the Frequency Domain, Smoothing frequency-domain Filters, Sharpening Frequency-domain Filters, Homomorphic Filtering,

IMAGE TRANSFORMS AND COMPRESSION: Properties of DCT, DWT, Fundamentals – Image Compression models – Error Free Compression – Lossy compression– Image Compression standards

IMAGE SEGMENTATION:AND MACHINE LEARNING FOR CLASSIFICATION: Detection of discontinuities- Edge detection Edge Linking and Boundary detection – Thresholding Region based segmentation, feature extraction, Machine learning for classification Methods commonly used for Computer vision, including k nearest neighbors, Logistic regression, SoftMax Regression and Support Vector Machines.

IMAGE REPRESENTATION AND RECOGNITION: Boundary representation – Chain Code – Polygonal approximation, signature, boundary segments – Boundary description – Shape number – Fourier

Descriptor, moments- Regional Descriptors –Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching

Learning Resources:

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. Prentice Hall India/Pearson Education. 2017. 4th edition.
2. A.K.Jain, Fundamentals of Digital Image Processing. Prentice Hall India.

Other Suggested Readings:

1. William K Pratt, Digital Image Processing by 2001, John Wiley & Sons, Inc
2. Sonka, Image Processing, Analysis and Machine Vision. Cengage Publications.