NATIONAL INSTITUTE OF TECHNOLOGY WARANGAL



Minor in

Electronics and Communication Engineering

(for B.Tech. students other than EEE and CSE)

(w.e.f. 2021-22)

Department of

Electronics and Communication Engineering

SCHEME OF INSTRUCTION

S.No	Course Code	Course Title	L	T	P	Credits	Sem
1	EC131	Basic Electronic Engineering	3	0	0	3	2 - 1
2	EC281	Digital Electronics	3	0	0	3	2 - 2
3	ECM01	IC Applications	3	0	0	3	3 - 1
4	EC395	Communication Systems	3	0	0	3	3 - 2
5	EC445	Microprocessors and Microcontrollers	3	0	0	3	4 - 1
6	EC317	Internet of Things	3	0	0	3	4 - 2
		Total				18	

Course Code : EC131	Basic Electronic Engineering	Credits 3-0-0 : 3

Pre requisites: NIL

Course Outcomes: After the completion of the course the student will be able to:

CO1	Comprehend the characteristics of semiconductor devices, and operational amplifiers
CO2	Understand the principles of working of amplifiers
CO3	Understand and design of simple combinational and basics of sequential logic circuits
CO4	Understand the principles of electronic measuring instruments and Transducers
CO5	Understand the basic principles of electronic communication

Mapping of course outcomes with program outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3											1	1
CO2	2	3											1	1
CO3	2		3										1	1
CO4	2			3									1	1
CO5	2				2	2							1	1

Detailed Syllabus:

Electronics Systems: Introduction to electronics, review of p-n junction operation, diode applications, Zener diode as regulator.

Transistor and applications: Introduction to transistors, BJT Characteristics, biasing and applications, simple RC coupled amplifier and frequency response. FET and MOSFET characteristics and applications.

Feedback in Electronic Systems: open loop and closed loop systems, Negative and positive Feedback, merits and demerits, Principles of LC and RC oscillators.

Integrated Circuits: Operational amplifiers – characteristics and linear applications

Digital Circuits: Number systems and logic gates, Combinational Logic circuits, Flip-Flops, counters and shift registers, data converters, Analog to Digital and Digital to Analog converters (ADC/DAC's), Introduction to microprocessors and microcontrollers.

Laboratory measuring instruments: principles of digital multi-meters, Cathode ray oscilloscopes (CRO's).

Electronics Instrumentation: Measurement, Sensors, principles of LVDT, strain guage and thermocouples. Introduction to data acquisition system.

Principles of Communication: Need for Modulation, Definitions of various Modulation and Demodulation techniques, AM radio transmitter and receiver, brief understanding of FM and mobile communications.

Text books:

1. Bhargava N. N., D C Kulshreshtha and S C Gupta, Basic Electronics & Linear Circuits, 2nd Edition, Tata McGraw Hill, 2013.
2. Malvino and Brown, "Digital Computer electronics" Mcgraw Hill, 3rd Edition.
3. Keneddy and Davis, "Electronic Communication Systems" Mcgraw Hill, 4th Edition.
4. Helfrick and Cooper, " Modern Electronic Instrumentation and Measurement Techniques" PHI, 2011

References:

1. Salivahanan, N Suresh Kumar Electronic Devices and circuits, 3rd Edition, McGraw Hill publications.
2. Neil Storey, Electronics A Systems Approach, 4th Edition, Pearson Education Publishing Company Pvt Ltd.

Online Resources:

1. https://nptel.ac.in/courses/117/103/117103063/
2. https://nptel.ac.in/courses/117/107/117107095/

Course Code: EC281	Digital Electronics	Credits 3-0-0 : 3

Pre-requisites: EC131 - Basic Electronic Engineering

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

CO1	Design combinational and sequential digital circuits to meet a given specification and be able to represent logic functions in multiple forms-understanding the advantages and disadvantages of each.
CO2	Understand how CMOS transistors can be used to realize digital logic circuits and understand basic characteristics of logic gates (such as power, noise margins, timing, tri-state circuitry, etc.).
CO3	Understandnumericalandcharacterrepresentationsindigitallogicincluding ASCII, sign magnitude, 2's complement, and floating point and the corresponding design of arithmetic circuitry.
CO4	Understand the importance and need for verification and testing of digital logic circuits.
CO5	Understand the principle of operation and design of a wide range of electronic circuits such as computer RAM and ROM.
CO6	Understand how convert signals from analog to digital and digital to analog.

Detailed syllabus:

Number system and codes: Analog versus digital, merits of digital system, number systems, base conversions, complements of numbers, weighted and unweighted codes, and error detecting and correcting codes.

Switching algebra and switching functions: Boolean algebra, postulates, theorems and switching algebra, completely and incompletely specified switching functions, minimization of Boolean functions using Karnaugh map and Quine McCluskey methods.

Logic Families: Characteristic parameters, Transistor-Transistor logic, TTL subfamilies, CMOS logic family, Implementation of Boolean function using CMOS logic, various logic gate ICs.

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, IC Versions of Combinational logic circuits.

Sequential Logic: Review of Flip-Flops, Finite State model of sequential Circuits, modulus counter, shift registers, IC Version of sequential logic circuits. Semiconductor Memories: RAM, ROM (Cell Structures and Organization on Chip)

Data Conversion Circuits: D/A converter specifications, A/D converter specifications, D/A converters such as DAC 0808, DAC 1408/1508, Integrated circuit A/D Converters ADC 0808, ICL 7106/7107.

Reading:

1. Linear Integrated Circuits, S Salivahanan, TATA MC GrawHill.
2. Jain R.P, “Modern Digital Electronics”, Third edition, Tata Mc GrawHill,2003
3. Floyd T.L., “Digital Fundamentals ", Prentice Hall, 9 th Edition, 2006
4. Anil K. Mani: Digital Electronics-Principles and Integrated Circuits, Wiley-India, 2007.
5. Herbert Taub, Schilling: Digital Integrated Electronics, TATA MC Graw Hill, 2008.

Course Code: ECM01	IC Applications	Credits : 3-0-0 : 3

Pre-requisites: None

Course Outcomes: After the completion of the course the student will be able to:

CO1	Design op-amp circuits to perform arithmetic operations.
CO2	Analyze and design linear and non-linear applications using op-amps.
CO3	Analyze and design oscillators and filters using functional ICs.
CO4	Choose appropriate A/D and D/A converters for signal processing applications.

Detailed Syllabus:

INTRODUCTION TO OP-AMPS: ideal Characteristics, Pin configuration of 741 op-amp. Bias, offsets and drift, bandwidth and slew rate. Offset and Frequency compensation. Exercise problems. Practical op amps, Basic building blocks: Current sources and active loads

LINEAR AND NON-LINEAR APPLICATIONS OF OP-AMPS: Inverting and non-inverting amplifiers and their analysis, Applications: inverting and non- inverting summers, difference amplifier, differentiator and integrator, Voltage to current converter, Exercise problems. Instrumentation amplifier, Log and antilog amplifiers. Precision rectifier, Non-linear function generator, solving differential equations using analog computing blocks. Analog IC Multipliers and applications Comparators, regenerative comparators, input - output Characteristics, Astable and Monostable multi vibrator, Triangular wave- generators, RC-phase shift oscillator, and Wein's bridge oscillator

ACTIVE FILTERS: Low pass, High pass, Band pass and Band Reject filters, Butterworth, Chebychev filters, Different first and second order filter Topologies, Frequency Transformation.

TIMERS & PHASE LOCKED LOOPS: 555 Timer functional diagram, monostable and astable operation, applications. PLL- basic block diagram and operation, capture range and lock range; applications of PLL IC 565, AM detection, FM detection and FSK demodulation. VCO IC 566.

IC VOLTAGE REGULATORS: Series op amp regulator, three terminal IC voltage regulator exercise problems. IC 723 general purpose regulator, Switching Regulator.

DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS: Weighted resistor DAC, R-2R and inverted R-2R DAC. IC DAC-08. Counter type ADC, successive approximation ADC, Flash ADC, dual slope ADC, 1-bit converters, sigma-Delta ADC. DAC and ADC Specifications, Specifications of AD 574 (12 bit ADC).

Readings:

1. G B Clayton, Operational Amplifiers, 5th Edition, Elsevier science, 2003
2. Sergio Franco, Design With Operational Amplifier And Analog Integrated Circuits, 4th Edition, TMH, 2011.
3. Roy Choudary D. and Shail B. Jain, Linear Integrated circuits, 4th Edition, New Age International Publishers, 2010
4. Ramakant A.Gayakward, Op-Amps and Linear Integrated Circuits, 4th Edition, PHI, 2010.

Course Code : EC395	COMMUNICATION SYSTEMS	Credits 3–0–0 : 3

Pre-requisites: None

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

CO1	Understand different modulation and demodulation schemes for analog communication
CO2	Design analog communication systems to meet desired application requirements
CO3	Evaluate fundamental communication system parameters, such as bandwidth, power, signal to quantization noise ratio etc.
CO4	Elucidate design trade-offs and performance of communications systems.

Detailed syllabus:

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

Noise Analysis: External Noise, Internal Noise, White Noise, Narrow Band Noise, Representation of Narrow Band noise in phase and Quadrature Components, Noise Figure, Noise Bandwidth, Noise Temperature.

Amplitude (Linear) Modulation: Linear Modulation Schemes, Generation of AM, Envelope Detector, DSB-SC Product Modulator, Switching Modulator, Ring Modulator, Coherent Detection, Costas receiver, SSB Signal Representation, Filtering Method, Phase Shift Method, Coherent Demodulation, VSB Modulator and Demodulator, Carrier Acquisition using Squaring Loop and Costas Loop, Receiver Model, SNR, Noise in SSB and DSB receivers using coherent detection, Noise in AM Receiver using Envelope detection, Threshold Effect.

Angle (Exponential) Modulation: Types of Angle Modulation, Relation between FM and PM, Narrow Band FM, Wideband FM, Transmission Bandwidth of FM Signals, Generation of FM using Direct and Indirect methods, FM Demodulation using Slope Circuit, Frequency Discriminator, Interference in Angle Modulation, Noise in FM Receiver, FM Threshold Effect, Pre-emphasis and De-emphasis in FM, Model of PLL for FM Demodulation.

Pulse Modulation: Sampling Process, PAM, PWM, PPM, Quantization, PCM, TDM, Digital Multiplexer Hierarchy, DM, DSM, Linear Prediction, DPCM, ADPCM, Noise in PCM System, Companding, Comparison of the Noise Performance of AM,FM,PCM and DM.

Information Theory: Uncertainty, Information, Entropy, Source Coding Theorem, Data Compaction, Mutual information, Channel Capacity, BSC Channel, Information Capacity Theorem, Bandwidth - Power Tradeoff, Huffman Coding.

Reading:

1. S. Haykin, Communication Systems, Fourth Edition, John Wiley & Sons, Singapore, 2001.
2. B.P. Lathi, Modern Digital & Analog Communication Systems, 3rd Edn, Oxford University Press, Chennai, 1998.
3. Leon W.Couch II., Digital and Analog Communication Systems, Sixth Edition, Pearson Education inc., New Delhi, 2001.
4. A Bruce Carlson, PB Crilly, JC Rutledge, Communication Systems, Fourth Edition, MGH, New York, 2002.

Course Code : EC445	Microprocessors and Microcontrollers	Credits 3-0-0 : 3

Pre-requisites: Digital Electronics

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

CO1	Understand the architecture and instruction set of 8086 microprocessor and 8051 microcontroller
CO2	Design and develop various interfacing circuits with 8086 using 8255.
CO3	Understand the concepts of interrupt mechanism and serial communication.
CO4	Develop various applications by interfacing various modules to 8051.

Detailed syllabus:

Introduction to Microprocessor Architecture Introduction and evolution of Microprocessors– Architecture of 8086–Register Organization of 8086–Memory organization of 8086– General bus operation of 8086–Introduction to 80286–80386 and 80486 and Pentium.

Minimum and Maximum Mode Operations Instruction set, Addressing modes– Minimum and Maximum mode operations of 8086–8086 Control signal interfacing–Read and write cycle timing diagrams.

I/O Interface 8255 PPI: Architecture of 8255–Modes of operation– Interfacing I/O devices to 8086 using 8255–Interfacing A to D converters– Interfacing D to A converters– Stepper motor interfacing– Static memory interfacing with 8086–DMA controller (8257)–Architecture–Interfacing 8257 DMA controller– Programmable Interrupt Controller (8259)–Command words and operating modes of 8259– Interfacing of 8259–Keyboard/display controller (8279)–Architecture–Modes of operation–Command words of 8279– Interfacing of 8279

Introduction to 8051 Micro Controller : Overview of 8051 Micro Controller– Architecture–Register set–I/O ports and Memory Organization– Interrupts–Timers and Counters–Serial Communication.

Interfacing and Applications of 8051: LEDs and push buttons Interfacing, Relays and Latch connections, Keyboard interfacing, seven segment display interfacing, A/D and D/A converter interfacing.

Learning Resources:

1. **Prescribed Text Books**

1. D. V. Hall. Microprocessors and Interfacing, TMGH.2’1 edition 2006.
2. Kenneth. J. Ayala. The 8051 microcontroller 3rd Edition, Cengage learning, 2010.

2. **Reference Text Books**

1. Barry B. Brey, “The Intel Microprocessors”, PHI, 7th Edition 2006
2. Muhammad Ali Mazid, Janice Gillispie Mazid and Rolin D Mckinaly,” The 8051 microcontroller and Embedded systems”,Pearson, 2nd Edition.

3. Liu and GA Gibson," Microcomputer system 8086/8088 Family Architecture, Programming and Design", PHI 2nd Edition
4. Ajay. V. Deshmukh, "Microcontrollers and applications", TMGH 2005

3. Digital Learning Materials:

1. Microcomputers: Design and applications, IIT, Delhi, Prof. Anshul Kumar, No. of Lectures: 37
2. Microprocessors and applications, IIT, Madras, Prof. S.Srinivasan, No. of Lectures: 34.

Course Code : EC317	Internet of Things	Credits 3-0-0 : 3

Pre-requisites: None

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

CO1	Understand IOT design requirements
CO2	Compare various technologies and protocols
CO3	Study Cloud storage and intelligent analytics
CO4	Analyze security requirements along with threat model
CO5	Design and experiment various applications

Detailed 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

Text Books:

1. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley 2013
2. Naveen Balani, “Enterprise IoT”, CreateSpace Independent Publishing Platform 2016
3. NAYAN B. RUPARELIA, “Cloud Computing”, MIT Press 2016