SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE (AUTONOMOUS)

(Affiliated to JNTUK, Kakinada), (Recognized by AICTE, New Delhi)
UG Programmes CE,CSE,ECE,EEE,IT & ME are Accredited by NBA
CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

Estd:1980

Regulation: R20			III / IV - B.Tech. I - Semester						
ELECTRONICS AND COMMUNICATION ENGINEERING									
SCHEME OF INSTRUCTION & EXAMINATION (With effect from 2020-21 admitted Batch onwards)									
Course Code	Course Name	Category	Cr	L	T	P	Int. Marks	Ext. Marks	Total Marks
B20EC3101	Internet of Things	PC	3	3	0	0	30	70	100
B20EC3102	Antennas & Wave Propagation	PC	3	3	0	0	30	70	100
B20EC3103	Digital Communication	PC	3	3	0	0	30	70	100
#PE-I	Professional Elective -I	PE	3	3	0	0	30	70	100
#OE-I	Open Elective-I	OE	3	3	0	0	30	70	100
B20EC3108	Digital Communication Lab	PC	1.5	0	0	3	15	35	50
B20EC3109	Internet of Things Lab	PC	1.5	0	0	3	15	35	50
B20HS3102	Soft Skills **(Skill Oriented Course)**	SOC	2	1	0	2	--	50	50
B20EC3110	Summer Internship	PR	1.5	--	--	--	--	50	50
	TOTAL		21.5	16	0	8	180	520	700

	Course Code	Course
#PE-I	B20EC3104	Data Communications & Computer Networks
	B20EC3105	Control systems
	B20EC3106	Electronic Measurements and Instrumentation
	B20EC3107	Digital System Design Using HDL
#OE-I	Student has to study one Open Elective offered by AIDS or CE or CSBS or CSE or EEE or IT or ME or S&H from the list enclosed.	

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3101	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3Hrs.**

INTERNET OF THINGS

(For ECE)

Course Objectives: Students should learn

1.	To make students familiar with the basic concepts of M2M &IoT architecture and Communication protocols.
2.	To introduce the Python Scripting Language with Raspberry PI platform, that is widely used in IoT applications.
3.	To introduce the implementation of web-based services on IoT devices.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Get familiarity with architecture and communication protocols of IoT.	K2
2.	Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules.	K3
3.	Explore and learn about Python with the help of Raspberry Pi for preparing projects designed for IoT.	K3
4.	Analyze data from physical devices through the cloud using data analytics.	K4

SYLLABUS

UNIT-I (09Hrs)	Embedded hardware units and Devices in a system, Embedded software in a system, Examples of embedded systems, embedded. Real world interfacing, Introduction to advanced architectures, , I/O types and examples, Serial Bus communication protocols, Parallel bus device protocols,
UNIT-II (09Hrs)	Internet enabled systems, Differences between Embedded systems and Internet Enabled systems, system-on-chip(SOC),ExemplaryDeviceforSoC:RaspberryPi, Node MCU(ESP8266) and IoT devices
UNIT-III (08Hrs)	IoT definition, Characteristics of IoT, Physical Design of IoT, Logical Design of IoT,IoTProtocols,M2M,Differences and Similarities between M2M and IOT,SDN and NFV for IoT.
UNIT-IV (08Hrs)	Basic building blocks of an IoT Device, Sensors like ultrasonic, IR sensor, temperature & humidity etc., communication modules like Bluetooth, zigbee, Wi-Fi& WSN, Lora WAN6LoWPAN

UNIT-V (10Hrs)	IOT Physical Servers, Cloud Offerings &Data Analytics for IOT Web Application Messaging Protocol (WAMP), Cloud based communication, Data Analytics, IoT Design Methodology with a use.

Text Books:

1.	Embedded System Architecture Programming and Design, RajKamal,2nd Edition, McGrawHill.
2.	Internet of Things : A Hands-On Approach, Arshdeep Bahga,VijayMadisett

Reference Books:

1.	Embedded Software Primer, David Simon, Pearson
2.	Internet of Things: Principles and Paradigms by Rajkumar Buyya, Amir Vahid Dastjerdi.

e-Resources:

1.	https://www.youtube.com/watch?v=kOjdExBUqAI
2.	https://www.codemag.com/article/1607071/Introduction-to-IoT-Using-the-Raspberry-Pi

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3102	PC	3	--	--	3	30	70	3hrs

ANTENNAS & WAVE PROPAGATION

(For ECE)

Course Objectives: Students should learn

1.	Understand the radiation mechanism of antennas and to learn about basic parameters like impedance, gain, directivity, bandwidth, effective length, beam width and radiation pattern etc.
2.	Derive fields and power radiated by elemental antenna, Half wave dipole, quarter wave monopole and values of their radiation resistance.
3.	Understand the necessity of antenna arrays and to learn about theory of uniform linear arrays, broad side and end fire arrays, non-uniform linear arrays like binomial arrays and pattern multiplication
4.	Acquire knowledge about practical HF, VHF, UHF and Microwave antennas and be able to Design practical antennas.
5.	Acquire knowledge about various antenna measurements and be able to conduct different types of antenna measurements.
6.	Gain knowledge about various types of radio wave propagation like Ground wave, Sky wave, Space wave and be able to design different types of communication links.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Understand Radiation mechanism and functions of antennas identify antenna parameters and derive expressions for antenna parameters.	K3
2.	Analyze and design Antenna arrays.	K4
3.	Analyze and design wire and aperture antennas for different applications.	K4
4.	Capable of performing various antenna measurements and come up with conclusions about antenna parameters and performance.	K4
5.	Identify characteristics of radio wave propagation and be able to design different types of communication links for different frequency bands.	K4

SYLLABUS

UNIT-I (09 Hrs)	**Fundamentals of Antennas & Radiation from Antennas:** Functions and properties of antennas, antenna parameters, basic antenna elements, radiation mechanism, radiating fields of alternating current element, radiated power and radiation resistance of current element, different types of current distribution on linear antennas, radiated fields, radiated power and radiation resistance of half-wave dipole and quarter – wave monopole, directional characteristics of dipole antennas.

UNIT-II **(09 Hrs)**	**Linear Arrays:** Uniform linear arrays, field strength of a uniform linear arrays, locations of principal maximum, nulls and secondary maxima, first side lobe level, analysis of broadside and end-fire arrays, Pattern multiplication, binomial arrays, effect of earth on vertical patterns, Antenna array synthesis – Fourier transform method.
UNIT-III **(08Hrs)**	**Practical Antennas :** Classification of antennas according to type of radiation and type of current distribution of antennas – Isotropic, Omnidirectional & directional antennas, standing wave and travelling wave antennas, Classification according to frequency of operation – LF, MF, HF, VHF & UHF. **HF,VHF & UHF Antennas :** V Antennas, Inverted V Antennas, Rhombic antennas, folded dipole, Yagi-Uda antenna, Log periodic antenna, Loop and Helical Antennas. **Microwave antennas:** Introduction, types of reflector antennas, corner reflector, parabolic reflector, feed systems for parabolic reflector, horn antennas, slot antennas and impedance of slot antennas, Babine's principle and micro strip antennas.
UNIT-IV **(08Hrs)**	**Antenna measurements:** Introduction, measurement ranges, antenna impedance measurements, antenna gain and directivity measurement, measurement of radiation pattern, beam width and SLL, Measurements of Polarization, Measurements of Phase, Measurements of Radiation Resistance
UNIT-V **(10Hrs)**	**Wave propagation :** Types of radio wave propagation, ground wave propagation and Maxwell's analysis of ground wave propagation, wave tilt of ground wave, structure of ionosphere, refractive index of ionosphere, mechanism of wave bending by ionosphere, critical frequency, MUF, Skip distance, fading and effect of earth's magnetic field on ionosphere propagation, faraday rotation, tropospheric (space wave) propagation, range of space wave propagation, effective earth radius, field strength of space wave.

Text Books:	
1.	EM waves and Radiating systems–by E.C.JORDAN and K.G.Balmain–PHI, New Delhi.
2.	Antenna theory-by C.A.Balanis, Johnwiley.
Reference Books:	
1.	Antennas and Wave Propagation–By J.D.Kraus, McGrawhill.
2.	Antennas and wave propagation–by G.S.NRaju,Pearsoneducation.
3.	Antenna and wave propagation–by K.D.Prasad
e-Resources:	
1.	https://www.youtube.com/watch?v=wx_tIvaajAI&list=PL3UZlxOnyu9CRoBsG5x-VqYeC69FmMZT

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3103	**PC**	**3**	**--**	**--**	**3**	**30**	**70**	**3Hrs**

DIGITAL COMMUNICATION

(For ECE)

Course Objectives: Students should learn

1.	To introduce the elementary concepts of digital communication systems.
2.	To get introduced with emphasis on different modulation techniques.
3.	Understand the effect of noise on signal transmission.
4.	To learn about optimum detection and probability of error.
5.	To compare the performance of two digital modulation techniques and introduce the elementary concept of spread spectrum modulation system.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Understand the basic concepts of sampling and digital communication systems.	K2
2.	Understand the concept of binary and M-array modulation techniques.	K2
3.	Apply the knowledge of signals & systems and evaluate the performance of various filters in the presence of noise.	K3
4.	Understand the concept of probability of error & apply the knowledge of basic digital modulation techniques to evaluate their optimal performance.	K3
5.	Analyze the error performance of two digital modulation techniques and understand the concept of spread spectrum communication system	K3

SYLLABUS

UNIT-I (12Hrs.)	**Digital Representation of Analog Signal:** Sampling, Digital representation of analog signal: Quantization of signals, Quantization error, Pulse Code Modulation, Companding, T1 Digital system, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation
UNIT-II (12 Hrs.)	**Digital Modulation and Transmission** Binary Phase-Shift Keying, Differential Phase-Shift Keying, Differentially Encoded PSK (DEPSK), Quadrature Phase-Shift Keying (QPSK), M-ary PSK, Binary Frequency Shift-Keying, Comparison of BFSK and BPSK, M-ary FSK, Minimum Shift Keying (MSK).
UNIT-III (8 Hrs.)	**Mathematical Representation of Noise:** Some Sources of Noise, Frequency-domain representation of Noise, Spectral Components of Noise, Response of a Narrowband Filter to Noise, Effect of a Filter on the Power Spectral

	Density of Noise, Linear Filtering ,Noise Bandwidth, Narrowband representation of noise.
UNIT-IV (8 Hrs.)	**Optimal Reception of Digital Signal:** A base band Signal Receiver, Probability of Error, Optimum Receiver for both Baseband and Pass band-Calculation of optimum filter Transfer function, Matched filter, Probability of Error of the Matched Filter, Correlator, Calculation of Probability error of PSK, FSK , QPSK and its Comparison.
UNIT-V (12 Hrs.)	**a) Noise in Pulse Code Modulation and Delta Modulation Systems.** PCM Transmission, Calculation of Signal-to-Noise Ratio in PCM, Delta Modulation (DM) Transmission, Calculation of Signal-to-Noise Ratio in DM, Comparison of PCM and DM. **b) Introduction to Spread Spectrum Modulation:** Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping Spread Spectrum, Generation & Characteristics of PN Sequence.

Text Books:

1.	Principles of Communication Systems by Herbert Taub, Donald LSchilling and Goutam Saha, 3rd edition, Tata McGraw- Hill Publications, 2008 NewDelhi.
2.	Digital Communications by Simon HaykinsJohnWiley,2005

Reference Books:

1.	Digital and Analog Communication Systems Sam Shanmugam, John Wiley,2005.
2.	Modern Analog and Digital Communications by B.P.Lathi, Oxford reprint, 3rd Edition, 2004.

e-Resources:

https://mrcet.com/downloads/digital_notes/ECE/III%20Year/DIGITAL%20COMMUNICATIONS.pdf

https://www.iare.ac.in/sites/default/files/iare-dc%20lecture%20notes%20final.pdf

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3104	PE	3	--	--	3	30	70	3Hrs.

DATA COMMUNICATIONS & COMPUTER NETWORKS

(For ECE)

Course Objectives: Students should learn

1.	To introduce the Fundamentals of data communication networks
2.	To familiarize with the fundamental concepts of computer networking and network engineering reference models.
3.	To introduce basic concepts of multiplexing techniques, switching techniques.
4.	To understand error control and flow control mechanisms.
5.	To familiarize with different multiple access protocols such as ALOHA, CSMA.
6	To familiarize algorithms. with different networking devices and congestion control
7.	To familiarize with TCP and UDP header formats.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Explain the overview of Data communication principles.	K2
2.	Explain the concepts of layered architecture of the OSI modeland TCP/IP model, and the concepts of switching and multiplexing techniques.	K2
3.	Analyze flow control, error control and access control issues.	K4
4.	Analyze the operation of different network devices, routing, congestion control algorithms, IP protocol and IP addressing.	K4
5.	Analyze the performance of transport layer and application layer protocols	K4

SYLLABUS

UNIT-I (12 Hrs)	**Data Communication Fundamentals**: Data Representation, Data Transmission, Modes of Data Transmission, Signal Encoding; Modems and Data Multiplexers: Introduction to Digital Modulation Methods, Uses of Computer Networks, Line Configuration, Topology, Transmission mode, Categories of Networks-LAN, MAN, WAN.
UNIT-II (12Hrs)	**Layered architecture:** Protocol Hierarchies, Design issues of layers, Connection Oriented and Connectionless services; Reference Models-The OSI Reference Model, The TCP/IP Reference Model, The B-ISDN ATM Reference Model. **Physical layer** Transmission Media, Multiplexing-Frequency Division Multiplexing, Time Division Multiplexing, Switching-Circuit Switching, packet switching techniques.

UNIT-III (9Hrs)	**Data link layer**
	Design issues of Data link layer, Error Detection and Correction techniques, Elementary Data link protocols, Sliding window protocols, HDLC, Medium access sublayer-The Channel allocation problem, Multiple Access Protocols-ALOHA, Carrier Sense Multiple Access protocols; IEEE standard for 802 LANs- 802.3,Wireless LANs- Wifi 802.11 architecture.
UNIT-IV (8 Hrs)	**NETWORK LAYER:** Virtual circuit and Datagram subnet, Network devices, Routing Algorithms-Distant vector routing algorithm, link state routing algorithm, Congestion Control algorithms- General principles of Congestion Control, Congestion prevention policies. The Leaky bucket algorithm and Token bucket algorithm, The Network Layer in the Internet- The IP Protocol, IP Addresses.
UNIT-V (7Hrs)	**TRANSPORT LAYER:** The Transport layer Service, Elements of Transportprotocols, The Internet Transport Protocols- UDP, TCP. **APPLICATION LAYER:** The Domain Name System, Electronic mail, The World Wide Web.

Text Books:	
1.	Data Communications and Networking by Behrouz A.Forouzan, 2nd edition, Tata McGraw Hill.
2.	Computer Networks — Andrew S Tanenbaum, 3rd Edition, PearsonEducation/PHI.
3.	Data Communications and Computer Networks by Prakash.C. Gupta, Prentice- Hall of India Pvt. Ltd
Reference Books and other learning resources:	
1.	An Engineering Approach to Computer Networks-S.Keshav, 2nd Edition, Pearson Education
2.	Understanding communications and Networks, 3rd Edition, W.A. Shay, Thomson
3.	https://www.youtube.com/channel/UCr0Ze4SR3MHXAgz1TvRYL7Q
4.	Demonstrations of network configurations, OSI and TCP/IP layered architecture using Cisco packet tracer simulation software.
e-Resources:	
https://www.youtube.com/channel/UCr0Ze4SR3MHXAgz1TvRYL7Q	
https://www.youtube.com/watch?v=VwN91x5i25g&list=PLBlnK6fEyqRgMCUAG0XRw78UA8qnv6jEx	

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3105	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

CONTROL SYSTEMS
(For ECE)

Course Objectives: Students will learn

1.	The modelling of linear systems using transfer functions and obtain transfer functions using block diagrams and signal flow graphs.
2.	The significance of time response and find it for system analysis in transient and steady state.
3.	The concept of stability and know different techniques of stability analysis.
4.	The concept of frequency domain analysis, Bode plots, Polar plots
5.	The concept of state space modeling and analysis.

Course Outcomes: Students will be able to

Sl.no	Outcome	Knowledge Level
1.	**Model** electrical and mechanical physical systems by **applying** laws of physics and **derive** transfer functions from block diagrams & Signal Flow Graphs.	K3, K4
2.	**Analyze** systems in time domain for transient and steady-state behavior.	K3, K4
3.	**Analyze** the stability of a system by RH criterion and Root locus.	K3, K4
4.	**Analyze** the behavior of system using frequency response plots.	K3, K4
5.	**Model** and **analyze** the LTI system using state space approach.	K3, K4

SYLLABUS

UNIT-I (10 Hrs)	**INTRODUCTION TO CONTROL SYSTEMS** Open loop and closed loop systems, Transfer Function models of linear Systems- Modelling of Electrical & mechanical Systems, Block Diagram representation of Control Systems – Block Diagram Reduction, Signal Flow Graph Representation of Control Systems, Mason's gain formula, Feedback Characteristics of Control Systems.
UNIT-II (10 Hrs)	**TIME DOMAIN ANALYSIS OF CONTROL SYSTEMS** Time Response of First and Second Order Systems with Standard Input Signals, Time Domain Specifications of Second Order Systems, Steady State Error, Steady State Error Constants-Basic Control Actions- Effects of Integral and Derivative Control actions.
UNIT-III (10 Hrs)	**STABILITY ANALYSIS OF CONTROL SYSTEMS** Concept of Stability, Routh-Hurwitz Criterion, Relative Stability Analysis, The Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus.
UNIT-IV (10 Hrs)	**FREQUENCY DOMAIN ANALYSIS OF CONTROL SYSTEMS** Frequency Response -Bode Plots- Log Magnitude versus Phase Plots, Polar Plots –

	Frequency Domain specifications -Correlation between Time and Frequency Responses, Stability in Frequency Domain- Nyquist Stability Criterion - Assessment of Relative Stability, Gain Margin and Phase Margin.
UNIT-V **(10 Hrs)**	**STATE SPACE ANALYSIS** Concept of state, State Variables and State Models, State space models for LTI electrical Systems, Phase variable form and diagonal canonical form, Conversion between Transfer Function models and State space Models, Solution to the State Equation, State Transition Matrix, Concept of Controllability and Observability.

Text Books:	
1.	I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International Publishers (6th Edition).
2.	Norman S.Nise, 'Control systems Engineering ', Wiley publications (7th Edition)
Reference Books:	
1.	Katsuhiko Ogata, "Modern Control Engineering" PHI (4th Edition).
2.	Richard C. Dorf and Robert H. Bishop, „Modern Control Systems", Addison-Wesley Publishers (8th Edition)

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3106	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs**

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

(For ECE)

Course Objectives: Students should learn

1.	Select the instrument to be used based on the requirements.
2.	Understand and analyze the different types of transducers.
3.	Understand the design of oscilloscopes for different applications.
4.	Understand the principle of operation and working of various types of bridges for measurement of parameters
5.	Understand and analyze different signal generators and analyzers.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Evaluate basics of measurement systems, principle of basic meter	K4
2.	Design different transducers for measurement of different parameters.	K3
3.	Examining a signal / waveform with different oscillators.	K3
4.	Use bridges of many types and measure appropriate parameters.	K3
5.	Evaluate how a signal can be generated using different types of meters.	K4

SYLLABUS

UNIT-I (10Hrs)	**Qualities of Measurements:** Introduction, Measurement standards, Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, expected value, Error, Sensitivity. Errors in Measurement, Types of static errors-Gross errors, systematic errors, Instrumental errors, Observational errors, Random errors, Sources of error, Statistical analysis, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error. DC Voltmeters, AC voltmeters, True RMS responding voltmeter, Electronic Multimeter.
UNIT-II (10Hrs)	**Transducers:** Active & passive transducers: Resistance, Capacitance, inductance; Resistive Transducer, Unbounded resistance wire Strain gauge, bonded resistance wire strain gauge, Semiconductor strain gauge, Linear Variable Differential Transducer, Piezo electric transducers, Resistance Thermometers, Thermocouples, Thermistors.
UNIT-III (10Hrs)	**Oscilloscopes:** CRT features, Block diagram of oscilloscope, vertical amplifier, horizontal deflection system, sweep, trigger pulse, delay line. Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, CRO probes.

UNIT- IV (8Hrs)	**Bridges:** Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance-Schearing Bridge. Wheatstone bridge. Wien Bridge, Errors and precautions in using bridges.
UNIT-V (10Hrs)	**Signal Generator:** Introduction, fixed frequency AF oscillator, variable frequency AF oscillator, Basic Standard signal generator, AF sine and square wave signal generators, Function Generators, Square pulse, Random noise, sweep, Arbitrary waveform. Introduction to Wave Analyzers, Harmonic Distortion Analyzers.

Text Books:	
1.	Electronic instrumentation, second edition - H.S.Kalsi, Tata McGraw Hill, 2004.
2.	Modern Electronic Instrumentation and Measurement Techniques–A.D. Helfrick and, D.W. Cooper, PHI, 5th Edition, 2002.
Reference Books:	
1.	Electronic Instrumentation & Measurements -DavidA.Bell,PHI,2ndEdition, 2003.
2.	Electronic Test Instruments, Analog and Digital Measurements-Robert A.Witte, Pearson Education, 2nd Ed.,2004.
e-Resources:	
1.	https://nptel.ac.in/courses/108/105/108105153/
2.	https://onlinecourses.nptel.ac.in/noc19_ee44/preview
3.	https://www.youtube.com/watch?v=LM66kmlP_74

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3107	**PE**	**3**	**--**	**--**	**3**	**30**	**70**	**3Hrs.**

DIGITAL SYSTEM DESIGN USING HDL

(For ECE)

Course Objectives: Students are expected to

1.	Learn the role of HDL in digital system design using VHDL and Verilog programming.
2.	Understand different levels of abstraction in both VHDL and Verilog HDL.
3.	Program both combinational and sequential logic circuits in both VHDL and Verilog HDL.
4.	Understand the testing of Combinational and sequential circuits

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Describe and test digital logic circuits in data flow description, structural description, behavioral description and advanced constructs using VHDL.	K3
2.	Describe and test digital logic circuits in data flow description, structural description, behavioral description and advanced constructs using Verilog.	K3
3.	Design complex Combinational and sequential designs using HDL	K4
4.	To Apply the overall knowledge of digital circuit design for testing of digital circuits.	K4

SYLLABUS

UNIT-I (8Hrs)	**Digital Logic Design using VHDL** Introduction, Designing with VHDL, entities, architecture, packages and configurations, types of models: dataflow, behavioral, structural, signals vs. variables, generics, data types, concurrent vs. sequential statements.
UNIT-II (12Hrs)	**Digital Logic Circuit Design Examples using VHDL** VHDL for Combinational Logic circuits: Adders-Half Adder, Full Adder Multiplexers, Decoders. VHDL for Sequential Logic circuits: Flip-flops, registers & counters, synchronous sequential circuits.
UNIT-III (8Hrs)	**Digital Logic Design using Verilog HDL** Introduction, Verilog Data types and Operators, Dataflow modelling, Verilog for Combinational circuits: Adders-Half Adder, Full Adder. Behavioural modelling: latches, Verilog for Sequential logic design: Flip-flops, synchronous counters,

	Structural Modelling: Ripple-Carry Adder.
UNIT-IV (12Hrs)	**Digital Logic Circuit Design Examples using Verilog HDL** Boolean-Equation-Based behavioural models of combinational logics, Multiplexers, Encoders and Decoders, Counters and Shift Registers.
UNIT-V (8Hrs)	**Testing of Digital Logic Circuit Design** Testing of logic circuits, fault model, complexity of a test set, path-sensitization, circuits with tree structure, random tests, built in self-test.

Text Books:	
1.	Stephen Brown & Zvonko Vranesic, "Fundamentals of Digital logic design with VHDL", Tata McGraw Hill, 2nd edition.
2.	Michael D. Ciletti, "Advanced digital design with the Verilog HDL", Eastern Economy Edition, PHI.
Reference Books:	
1.	Stephen Brown & Zvonko Vranesic, "Fundamentals of Digital logic with Verilog design", Tata McGraw Hill, 2nd edition.
2.	Bhaskar," VHDL Primer",3rd Edition, PHI Publications.
e-Resources:	
https://nptel.ac.in/courses/108/105/108105153/	
https://onlinecourses.nptel.ac.in/noc19_ee44/preview	
https://www.youtube.com/watch?v=LM66kmlP_74	

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3108	**PC**	--	--	**3**	**1.5**	**15**	**35**	**3hrs**

DIGITAL COMMUNICATION LAB

(For ECE)

Course Objectives: Students should learn

1.	The purpose of this course is to provide the student with a practical perspective of various digital communication modules.
2.	Simplify the practical illustrations of various Digital Modulation and demodulation techniques.
3.	This lab focuses on the fundamental concepts of Sampling, Pulse modulations, Digital modulation techniques.
4.	To be familiar with Spread spectrum modulation and demodulation techniques.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Design, implement and verify the theoretical concepts of sampling practically.	K4
2.	Analyze and implement analog to digital converters like PCM, DM.	K4
3.	Comprehend the design, application and practical implementation of various Digital Modulation techniques.	K5
4.	Analyze digital modulation techniques using MATLAB tools.	K4

SYLLABUS

Hardware

1	Verification of Sampling Theorem
2	Pulse Code Modulation
3	Differential Pulse Code Modulation.
4	Delta Modulation.
5	Frequency Shift Keying
6	Phase Shift Keying

MATLAB Simulation

7	Verification of Sampling Theorem
8	Quantization of Signals
9	Pulse Code Modulation
10	Companding
11.	Delta Modulation and Adaptive Delta Modulation
12	Digital modulation techniques
13	BPSK Data Transmission over AWGN Channel & BER Performance

14	Spread Spectrum Modulation & Demodulation
15	Generation of PN Sequences

Reference Books:	
1.	Lab Manual
2.	Principles of Communication Systems, H.Tauband D.L.Schilling, McGraw Hill,1971.
3.	Contemporary Communication Systems Using MATLAB, by Gerhard Bauch, JohnG Proakis, and Masoud Salehi
4.	Digital Communication Theory, techniques and applications, R.N.Mutagi.
e-Resources:	
1.	https://in.mathworks.com/matlabcentral/fileexchange/25293-matlab-for-digital-communication
2.	https://www.mathworks.com/products/communications.html

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3109	**PC**	**--**	**--**	**3**	**1.5**	**15**	**35**	**3hrs**

Internet Of Things Lab

(For ECE)

Course Objectives: Students should learn

1.	To design a IoT application prototypes with the knowledge of IoT.
2.	This lab course enables students to get practical experience in interfacing IoT Modules with cloud.
3.	Able to acquire knowledge on interfacing different sensors and communicationmodules with the System on Chip Modules. (Outcome)
4.	Able to connect SoC devices with the cloud for accessing and analyzing the data. (Outcome)

Course Outcomes: Students will be able to

S.No.	Outcome	Knowledge Level
1	Use wireless peripherals for exchange of data.	K3
2	Make use of Cloud platform to upload and analyze any sensor data	K3
3	Use of Devices, Gateways and Data Management in IoT.	K4
4	Use the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis.	K3

SYLLABUS

Develop a code and interface the following modules with ESP8266

PART-A

1	Led And Buzzer
2	Serial Communication With OLED
3	Soil And Moisture Sensor (Analog Input)
4	Magnetic Switch (Digital Input)

PART-B (cloud interfacing)

5	APDS 9960
6	BMP280
7	IR
8	MPU 6050
9	MAX30102

Reference Books:

1.	Lab manual

e-Resources:

1.	https://github.com/grietiotlab/gismo-vi

Code	Category	L	T	P	C	I.M	E.M	Exam
B20HS3102	SOC	1	--	2	2	--	50	3Hrs.

SOFT SKILLS

(Common to AIDS, CSBS, CSE, ECE, & IT)

Course Objectives:

1.	To familiarize students with soft skills and how they influence their professional growth.
2.	To build/refine the professional qualities/skills necessary for a productive career and to instill Confidence through attitude building.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1	Apply soft skills in the work place and build better personal and professional relationships making informed decisions.	K3
2	Participate in group discussions/group activities, exhibit team spirit, use language effectively according to the situation, respond to their interviewer/employer with a positive mind, make answers to the questions asked during their technical/personal interviews, exhibit skills required for the different kinds of interviews (stress, technical, HR) that they would face during the course of their recruitment process.	K3

SYLLABUS

1.	Introduction to Soft Skills, Significance of Inter & Intra-Personal Communication
2.	SWOT Analysis, Creativity & Problem Solving
3.	LSRW, JAM, Presentation Skills
4.	Building a positive attitude, Leadership & Team Work
5.	Goal Setting – Guidelines for Goal Setting
6.	Group Discussion: Essential guidelines
7.	Telephone Etiquette, Telephonic Interview
8.	Resume Preparation: Common resume blunders, tips for betterment, Resume Review
9.	Employability Skills: Emotional Intelligence, Report Writing, Social Consciousness and Social Entrepreneurship, Stress Management.
10.	Awareness about Industry, Companies, Importance of researching the prospective workplace, Knowing about Selection Process
11.	Interview Skills: Types of Interviews, Mock Interview, Do's and Don'ts of Interview.

Text Books:

1	Soft Skills & Employability Skills by Samina Pillai and Agna Fernandez, Cambridge University Press India Pvt. Ltd.
2	Soft Skills, by Dr. K. Alex, S. Chand & Company Ltd., New Delhi

	Reference Books:
1	The Art of Public Speaking by Dale Carnegie
2	The Leader in You by Dale Carnegie
3	Emotional Intelligence by Daniel Golman
4	Stay Hungry Stay Foolish by Rashmi Bansal
5	I have a Dream by Rashmi Bansal.
	Additional Materials
1	https://www.youtube.com/watch?v=LTnI7cmpDZI
2	https://www.youtube.com/watch?v=ic5O2sxhH9M
3	https://www.youtube.com/watch?v=4ZQkYSpmOdU
4	https://www.youtube.com/watch?v=d8p-5WcXoRs
5	https://www.youtube.com/watch?v=yZOar04g4zk&t=94s

SAGI RAMA KRISHNAM RAJU ENGINEERING COLLEGE
(AUTONOMOUS)
(Affiliated to JNTUK, Kakinada), (Recognized by AICTE, New Delhi)
UG Programmes CE,CSE,ECE,EEE,IT & ME are Accredited by NBA
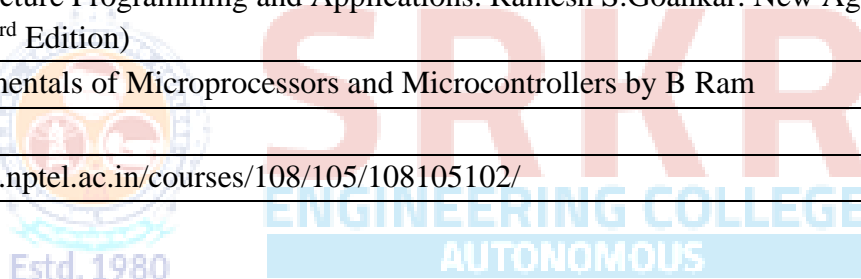CHINNA AMIRAM (P.O):: BHIMAVARAM :: W.G.Dt., A.P., INDIA :: PIN: 534 204

Estd:1980

Regulation: R20			III / IV - B.Tech. II - Semester						
ELECTRONICS AND COMMUNICATION ENGINEERING									
SCHEME OF INSTRUCTION & EXAMINATION (With effect from 2020-21 admitted Batch onwards)									
Course Code	Course Name	Category	Cr	L	T	P	Int. Marks	Ext. Marks	Total Marks
B20EC3201	Microprocessors & Microcontrollers	PC	3	3	0	0	30	70	100
B20EC3202	Digital Signal Processing	PC	3	3	0	0	30	70	100
B20EC3203	VLSI Design	PC	3	3	0	0	30	70	100
B20HS3202	Universal Human Values-2 : Understanding Harmony	HS	3	3	0	0	30	70	100
#OE-II	Open Elective-II	OE	3	3	0	0	30	70	100
B20EC3204	Microprocessors & Microcontrollers Lab	PC	1.5	0	0	3	15	35	50
B20EC3205	Digital Signal Processing Lab	PC	1.5	0	0	3	15	35	50
B20EC3206	VLSI Lab	PC	1.5	0	0	3	15	35	50
B20EC3207	Computer Networking LAB	SOC	2	1	0	2	--	50	50
B20MC3201	Employability Skills	MC	0	3	0	0	--	--	--
B20HS3204	*Gender Sensitization	HS	0	2	0	0	--	--	--
	TOTAL		21.5	21	0	11	195	505	700

#OE-II	Student has to study one Open Elective offered by AIDS or CE or CSBS or CSE or EEE or IT or ME or S&H from the list enclosed.

*Note: Gender Sensitization is a Self-Learning noncredit Audit Course

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3201	PC	3	--	--	3	30	70	3 Hrs

MICROPROCESSORS AND MICROCONTROLLERS

(For ECE)

Course Objectives: Students should learn

1.	To understand the architecture of 8085Microprocessor.
2.	To understand the architecture of 8086/8088 Microprocessor.
3.	To be familiar with 8086 assembly language programming.
4.	To understand the architecture of 8051 Microcontroller and
5.	To be familiar with assembly language programming.

Course Outcomes: the students will be able to

S.No	Outcome	Knowledge Level
1.	Illustrate architecture of the 8085 microprocessor	K3
2.	Illustrate architecture of the 8086 microprocessor.	K3
3.	Develop 8086 Assembly Language Programs.	K4
4.	Illustrate architecture of the 8051 Microcontroller and	K3
5.	Implement 8051 Assembly Language Programs.	K3

SYLLABUS

UNIT-I (12Hrs.)	**8085 Architecture:** Introduction to Intel 8 bit Microprocessors, Bus structure of 8085, internal architecture and functional description of INTEL 8085, flag register, Fetch cycle, memory Read /Write and I/O Read /Write Cycles with Timing Diagrams, Stack memory organization, Programming model of 8085 and function of each register, Addressing modes of 8085withexamples.
UNIT-II (08Hrs)	**8086/8088 Architecture:** Introduction to INTEL 16bit Microprocessors, Internal Architecture and Functional description of Intel8086/8088 microprocessors, and their comparisons. Memory segmentation and physical memory address generation, pipeline architecture and instruction queue. Register organization, Status flags and machine control Flags of 8086, Memory read/write and I/O read/Write Bus cycles with timing diagrams, 8086 memory Banks.
UNIT-III (09Hrs)	**8086Programming:** Introduction to 8086 Assembly language programming, programmable register array of 8086 and specific function of each register, Data addressing modes of 8086 with examples, fixed and variable I/O addressing using IN&OUT instructions. Stack memory operation using PUSH and POP instructions, Basic 8086 assembly language programs using data transfer instructions, ADD,SUB,MUL,DIV,DAA and DAS instructions.

UNIT-IV **(08Hrs)**	**Introduction to Microcontrollers (8051):** Microprocessors & Microcontrollers Comparison, Overview of 8051 Microcontroller, Internal Block Diagram of 8051, Pin Diagram of 8051, Memory Organization, Internal RAM Memory Structure, External Memory interfacing.
UNIT-V **(08Hrs)**	**Addressing Modes and Instruction Set:** Instruction syntax, Addressing modes with examples, Assembler directives, Stack memory operation using PUSH and POP instructions, PSW Flag Register, Classification of Instructions& basic 8051 Assembly Language Programs using Data Transfer and arithmetic Instructions.

Text Books:	
1.	Microprocessors: The 8086/8088, 80186/80286, 80386/80486 and the Pentium Family. Nilesh B. Bahadure, Phi Learning Pvt. Ltd., 2010
2.	The 8051 Microcontroller and Embedded Systems using assembly and C-Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.Mc Kinlay; PHI, 2013/Pearson ,2013
Reference Books:	
1	Architecture Programming and Applications. Ramesh S.Goankar. New Age International Pvt. Ltd., (3rd Edition)
2	Fundamentals of Microprocessors and Microcontrollers by B Ram
e-Resources:	
1.	archive.nptel.ac.in/courses/108/105/108105102/

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3202	PC	3	--	--	3	30	70	3 Hrs

DIGITAL SIGNAL PROCESSING
(For ECE)

Course Objectives:	
1.	This course introduces students to the basic concepts in digital signal processing and system design with emphasis on the digital filter design.
2.	To provide the student with an ability to compute Discrete Fourier Transform and efficient DFT computation of a time domain signal.
3.	To impart basic filter design concepts of IIR and FIR filters.
4.	To have an insight on various DSP applications and Multirate signal processingconcepts.

Course Outcomes: Students will be able to

S.No	Outcome	Knowledge Level
1.	Illustrate DT signals, systems and their significance and analyze DT-LTI systems using Z-Transform and realize system structures.	K3
2.	Analyze DT signals using DFT along with FFT algorithms	K4
3.	Design of IIR type of Digital filters as per the specifications	K3
4.	Design of FIR type of Digital filters as per the specifications	K3
5.	Discuss briefly about DSP applications and understand basic concepts of multi rate signal processing.	K2

SYLLABUS

UNIT-I (10Hrs)	**Discrete-Time Signals and Systems:** Introduction to Digital Signal Processing, Basic elements of a DSP system, Advantages of Digital SP over Analog SP, Discrete-time signals and systems, DT-LTI systems described by Linear constant–coefficient difference equations, Properties & Analysis of DT-LTI systems, Discrete linear convolution, Frequency domain representation of DT Signals and Systems, Review of the Z-transform, Properties, Inverse Z-transform, Analysis of DT LTI systems in Z-Domain, Unilateral Z-transform, Realization of Digital Filters, Direct-I, II, cascade and parallel forms.
UNIT-II (10Hrs)	**Discrete Fourier Transform (DFT) and Fast Fourier Transform Algorithms (FFT):** Frequency analysis of discrete time signals, DFS, DTFT, Properties of DTFT, DFT, Properties of DFT, Circular and linear convolution of sequences using DFT, Efficient computation of DFT, Radix–2 Decimation–in–Time(DIT) & decimation–in–Frequency (DIF) FFT Algorithms, Inverse DFT using FFT

UNIT-III (08Hrs)	**Design of IIR Digital Filters:** General considerations in Filter design, Analog filter approximations– Butterworth and Chebyshev, Frequency response specifications; Design of IIR digital filters from analog filters, Bilinear Transformation Method, Impulse Invariance Technique, and Low-pass filter Design examples.
UNIT-IV (08 Hrs)	**Design of FIR Digital Filters:** Characteristics of FIR Digital Filters, Design of Linear Phase FIR digital Filters using Windows, Effect of Window selection & filter length on filter frequency response, Design examples, Comparison of IIR and FIR Filters.
UNIT V (10Hrs)	**DSP Applications and Fundamentals of Multirate Digital Signal Processing:** Overview of DSP applications, DTMF signal detection, Spectral analysis of sinusoidal signals using FFT, Sub band coding of speech signals, Finite precision arithmetic effects.

Text Books:	
1.	Alan V. Oppenheim, Ronald W.Schafer,—Digital Signal Processing‖–PHIEd.,2006
2.	John G. Proakis, D.G.Manolakis, —Digital Signal Processing: Principles, Algorithms and Applications, 3rd Ed., PHI, 1996
Reference Books:	
1.	Digital Signal Processing: A Computer-based Approach by Sanjit K.Mitra, McGraw-Hill
2.	Essentials of Digital Signal Processing by B.Plathi, Roger A.Green, Cambridge University Press, 2014
e-Resources:	
1.	DSP –NPTEL Video course by Prof. S. C. Dutta Roy, IIT Delhi .https://nptel.ac.in/courses/117/102/117102060/
2.	https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/
3.	https://nptel.ac.in/courses/108/105/108105055/

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3203	PC	3	--	--	3	30	70	3hrs

VLSI Design

(For ECE)

Course Objectives: Students should learn

1.	To introduce various fabrication steps of MOS transistors and their electrical properties.
2.	To implement the stick diagrams and layouts using CMOS/Bi-CMOS design rules.
3.	To explain MOS technology interconnection as circuits, scaling models, static and dynamic designs.
4.	To introduce the concepts of FPGA and testing methods of digital circuits.

Course Outcomes: The students will be able to

S.No	Outcome	Knowledge Level
1.	Analyze the Electrical properties and Fabrication processes of MOS circuits.	K4
2.	Design the layouts of various MOS circuits by applying the concept of design rules.	K3
3.	Interpret the basic MOS circuit concepts, static and dynamic CMOS logic designs and the impact of scaling on MOS circuits.	K2
4.	Analyze various testing methods of digital circuits and the basic concepts of FPGA.	K4

SYLLABUS

UNIT-I (09Hrs)	**Introduction** : Introduction to IC Technology, Fabrication process: NMOS,PMOS and CMOS. Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans conductance, Output Conductance and Figure of Merit. NMOS Inverter, Pull-up to Pull down Ratio for NMOS inverter driven by another NMOS Inverter, and through one or more pass transistors, Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Comparison between CMOS and Bi-CMOS technology.
UNIT-II (09Hrs)	**MOS and Bi-CMOS Circuit Design Processes**: MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2µm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter.
UNIT-III (08Hrs)	**Basic Circuit Concepts**: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Choice of

	layers.
	Scaling of MOS Circuits: Scaling models, Scaling factors for device parameters, Limitations of Scaling on substrate doping, Miniaturization, Interconnect and contact Resistance, Sub-threshold currents and current density.
UNIT IV (08Hrs)	**CMOS Combinational and Sequential logic circuit design:** **Static CMOS Design:** Complementary CMOS and its static properties, Ratioed logic, Pass Transistor logic-Design of logic gates. **Dynamic CMOS Design:** Basic principles, Issues in dynamic logic- charge leakage, charge sharing, Static latches and registers- Latches versus registers, The bi stability principle, SR-Flip flops, Multiplexer based latch, Master-slave-edge triggered register.
UNITV (10Hrs)	**FPGA Design:** FPGA design flow, Basic FPGA architecture, FPGATechnologies, Introduction to FPGA Families: Xilinx XC4000 **Test and Testability**: Design for Testability-Path sensitization, Scan Design Techniques-Scan path, Level sensitive scan design (LSSD), Boundary scan test (BST) and Built-In-Self Test.

Text Books:	
1.	Essentials of VLSI Circuits and Systems By Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India PrivateLimited, 2005 Edition.
2.	Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and orivoje Nikolic,2nd edition, 2016
Reference Books:	
1.	FPGA Based System Design‖- Wayne Wolf, Pearson Education, 2004, Technology and Engineering
2.	CMOS Digital Integrated Circuits Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, Tata McGraw Hill Education,2003.
e-Resources:	
1.	https://www.engineersgarage.com/vlsi-technology-an-overview/
2.	https://www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.htm
3.	https://www.powershow.com/viewfl/e5a26-ZDc1Z/Lecture_4_Design_Rules_Layout_and_Stick_Diagram_powerpoint_ppt_presentation

Code	Category	L	T	P	C	I.M	E.M	Exam
B20HS3202	**HS**	**3**	**--**	**--**	**3**	**30**	**70**	**3 Hrs.**

UNIVERSAL HUMAN VALUES-2 : UNDERSTANDING HARMONY

(Common to CE, ECE, & EEE)

Course Objectives: The objectives of this course are to make the student aware of

1	Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3	Strengthening of self-reflection.
4	Development of commitment and courage to act.

Course Outcomes:

S.No	Outcome	Knowledge Level
1	Students are expected to become more aware of themselves, and their surroundings (family, society, nature)	K2
2	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.	K2
3	They would have better critical ability.	K2
4	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).	K2
5	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	K3

SYLLABUS

UNIT-I (10 Hrs)	**Course Introduction -** Need, Basic Guidelines, Content and Process for Value Education Purpose and motivation for the course, recapitulation from Universal Human Values-I Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
UNIT-II (8Hrs)	**Understanding Harmony in the Human Being -** Harmony in Myself! Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

	Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail; Programs to ensure Sanyam and Health.
UNIT-III (8Hrs)	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship Understanding the meaning of Trust; Difference between intention and competence Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
UNIT-IV (8Hrs)	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** Understanding the harmony in the Nature Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self regulation in nature Understanding Existence as Co-existence of mutually interacting units in all pervasive space Holistic perception of harmony at all levels of existence.
UNIT-V (8Hrs)	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** Natural acceptance of human values Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

Text Books	
1	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books:	
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

3	The Story of Stuff (Book).
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher
6	Slow is Beautiful - Cecile Andrews
7	Economy of Permanence - J C Kumarappa
8	Bharat Mein Angreji Raj – Pandit Sunderlal
9	Rediscovering India - by Dharampal
10	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11	India Wins Freedom - Maulana Abdul Kalam Azad
12	Vivekananda - Romain Rolland (English)

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3204	**PC**	--	--	**3**	**1.5**	**15**	**35**	**3hrs**

MICROPROCESSORS AND MICROCONTROLLERS LAB

(For ECE)

Course Objectives:

1.	To Introduce ALP concepts, features and Coding.
2.	Get familiarized with 8085,8086 and 8051 instructions.
3.	Developing Assembly Language Programs using the instruction sets of microprocessors (8085,8086) and 8051 Microcontroller
4.	The accompanying lab is designed to provide practical hands-on experience with Microprocessor hardware kits and software applications

Course Outcomes: the students will be able to:

S.No	Outcome	Knowledge Level
1.	Develop 8085 assembly language programs on data transfer, arithmetic and logical operations	K4
2.	Develop 8086 assembly language programs using data transfer, arithmetic and logical instructions	K4
3.	Develop 8051 assembly language programs on data transfer, arithmetic and logical operations	K4

SYLLABUS

Experiments Based On 8085:

1	a) Assume that a byte of data is stored at memory location 'X'. Write an ALP which tests bit5 of this data. Write 'FF' in the location 'X+1' if the bit 5 is '1' or Write '00' if bit 5 is '0'. b) For data value in the location 'X' compute the number of logic 1's and store the result in the location 'Y+1'.
2	Write an ALP to transfer a block of data from one memory location to another memory location
3	Two 16 bit numbers are stored at memory locations 'X' and 'X+2'.Write an ALP to add these numbers **without using DAD** instruction and store the result from location Y onwards
4	Two 8 bit numbers 34H and 43H are stored in locations 'X' and 'X+1' compute the product of these two numbers using **repetitive addition method**.
5	The number of the bytes of a block of data is in location 'X' and data starts from location 'X+1'onwards. By defining **a stack pointer**, write an ALP to arrange this sequence of data in reverse order. Keep the reverse sequence from 'Y' onwards
	Experiments Based On 8086:
6	Write an 8086 µP ALP to perform Addition/Subtraction operation of two-32 bit numbers

7	Write an 8086 µP ALP to perform Multiplication/Division of two 16 bit unsigned numbers
8	Write an 8086 µP ALP to find the factorial of a given number less than 9.
9	Write an 8086 µP ALP to convert 8 bit BCD number into Binary or Binary number into BCD
10	Write an 8086 µP ALP to add two packed BCD numbers
11	Write an 8086 µP Assembly Program to find the largest/smallest element in given array
12	Sort the block of data in ascending order by using bubble sorting technique. Assume the number of bytes of a block of data is at location 'X' and data starts from location 'X+1'onwards
	Experiments Based On 8051:
13	Write an 8051 µC ALPs on basic Data transfer instructions
14	Write an 8051 µC ALPs on basic Arithmetic instructions
15	Write an 8051 µC ALP to compute the number of logic 0's in a given byte
16	Write an 8051 µC Assembly Program to find the largest element in given array
17	Write an 8051 µC Assembly Program to find the sum of first 10 natural numbers
18	Write an 8051 µC Assembly Program to find Average of N-bytes

Reference Books:	
1.	Microprocessors: The 8086/8088, 80186/80286, 80386/80486 and the Pentium Family. Nilesh B. Bahadure, Phi Learning Pvt. Ltd., 2010
2.	The 8051 Microcontroller and Embedded Systems using assembly and C-Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.Mc Kinlay; PHI, 2013/Pearson ,2013
3.	Lab Manual
e-Resources:	
1.	www.sim8085.com

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3205	**PC**	--	--	**3**	**1.5**	**15**	**35**	**3 Hrs**

DIGITAL SIGNAL PROCESSING LAB

(For ECE)

Course Objectives: Students should learn

1.	To implement Convolution and Transform techniques on a given sequence
2.	To analyze frequency response of Discrete Time Signals and Systems
3.	To design different Digital filters
4.	To implement basic Image Processing techniques

Course Outcomes: students will be able to

S.No	Outcome	Knowledge Level
1.	Make use of the MATLAB simulation tool for performing variousoperations on discrete signals.	K4
2.	Make use of the MATLAB simulation tool to verify different DSP algorithms.	K4
3.	Make use of the MATLAB simulation tool to perform various operations on an Image	K4

SYLLABUS

1	Verification of Sampling Theorem
2	Generation of Discrete Time (DT) Sequences and Signals
3	Linear Convolution & Circular Convolution
4	Frequency Domain Analysis of DT Signals & Systems using DTFT
5	LTI System Simulation
6	Design and Verification of IIR Digital Filters
7	Design and Verification of FIR Digital Filters using Windows
8	Spectrum Analysis using Fast Fourier Transform (FFT)
9	Multirate Up sampling & Down sampling
10	Intensity transformations & Histogram processing of an image
11	Filtering images in spatial and frequency domain
12	Computation of N-point DFT of a given sequence using DSP processor
13	Computation of FFT of a given sequence using DSP processor

Reference Books:

1.	DSP using MATLAB by John G.Proakis
2.	Sanjit K.Mitra, "Digital Signal Processing: A Computer Based Approach", Tata McGraw Hill.

3.	Digital Image Processing by Gonzalez and Woods
4.	Lab manual
e-Resources:	
1.	https://www.mathworks.com/academia/books/digital-image-processing-gonzalez.html
2.	http://vlabs.iitkgp.ernet.in/dsp/index.html

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3206	**PC**	--	--	**3**	**1.5**	**15**	**35**	**3hrs**

VLSI LAB

(For ECE)

Course Objectives: Students should learn

1.	To learn Verilog /VHDL Source coding, perform simulation and analyze the results using necessary Synthesizer.
2.	To provide knowledge in designing the schematic diagrams and layouts of various combinationaland sequential circuits using CMOS 130nm Technology with necessary EDA tools (Mentor Graphics/Cadence Tools).

Course Outcomes: students will be able to

S.No	Outcome	Knowledge Level
1.	Analyse and program synthesizable codes in Verilog/VHDL.	K4
2.	Design schematics and layouts using CMOS logic and verify their functionality including parasitics using Cadence/Mentor Graphics CAD tools.	K4

SYLLABUS

PART-A (Any Seven Experiments)

Note: Develop Verilog/VHDL Source code, perform simulation using relevant simulator and analyze the obtained simulation results using necessary Synthesizer.

1	Realization of Logic gates
2	4-bitripplecarryandcarrylookaheadadderusingbehavioral, dataflow and structural modeling
3	Multiplexers (16:1, 4:1,2:1mux)
4	3:8 decoderrealizationthrough2:4 decoder
5	8:3Encoders
6	Flip-Flops
7	Synchronous and Asynchronous Counters

PART-B (Any Five Experiments)

Back-end Level Design and Implementation using EDA tools

1.	Universal gates
2.	An Inverter
3.	Full Adder
4.	Full Subtractor
5.	D-Latch
6.	2x4Decoder

EDA Tools/Hardware Required:

1.	EDA Tool that supports FPGA programming including Xilinx Vivado.

2.	MentorGraphicsSoftware/Cadence/Synopsys/TannerorEquivalentIndustryStandard/CAD Tool.
3.	Desktop computer with appropriate Operating System that supports the EDA tools.
Web Links:	
1.	https://courses.engr.illinois.edu/ece110/sp2021/content/courseNotes/files/?logicAndCMOS
2.	http://ece-research.unm.edu/jimp/vlsiII/labs/layout_lecture.html

Code	Category	L	T	P	C	I.M	E.M	Exam
B20EC3207	**SOC**	**1**	**--**	**2**	**2**	**--**	**50**	**3hrs**

COMPUTER NETWORKING LAB

(For ECE)

Course Objectives:

1	To demonstrate the practical implementation of TCP-IP, OSI models and IP addressing scheme
2	To provide practical skills in configuration and troubleshooting of different network devices and networks in a simulation environment.

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

S.No	Outcome	Knowledge Level
1	Create IP addressing schemes and verify network connectivity between devices.	K4
2	Configure an internetwork of routers, switches and end devices and troubleshoot the connectivity issues.	K4

SYLLABUS

1	Investigation of TCP-IP and OSI Models in Action
2	Study and implementation of IP Addressing scheme.
3	Performing an Initial Switch Configuration
4	Configuring and Troubleshooting a LAN Network (Switched Network)
5	Performing an Initial Router Configuration
6	Configuring and Troubleshooting a WAN Network
7	Configuration of routing protocols on a router
8	Analysis of Network traffic using Wireshark software

Resources

1.	Cisco Packet Tracer Simulation software
2.	Wireshark software

Web Links:

1.	https://www.youtube.com/watch?v=frUQMHXhnvs&t=580s
2.	https://www.packettracernetwork.com/

Code	Category	L	T	P	C	I.M	E.M	Exam
B20MC3201	**MC**	**3**	**--**	**--**	**--**	**--**	**--**	**3 Hrs.**

EMPLOYABILITY SKILLS
(Common to AIDS, CSBS, CSE, ECE & IT)
Part-A: Verbal Ability

Course Objectives:

1.	To introduce concepts required in framing grammatically correct sentences and identifying errors While using Standard English.
2.	To familiarize the learner with high frequency words as they would be used in their professional career.
3.	To inculcate logical thinking in order to frame and use data as per the requirement
4.	To acquaint the learner of making a coherent and cohesive sentences and paragraphs for composing a written discourse.
5.	To familiarize students with soft skills and how it influences their professional grow.

Course Outcomes: The students will be able to

S.No	Outcome	Knowledge Level
1	Detect grammatical errors in the text/sentences and rectify them while answering their competitive/company specific tests and frame grammatically Correct sentences while writing.	K3
2	Answer questions on synonyms, antonyms and other vocabulary-based Exercises while attempting CAT, GRE, GATE and other related tests.	K3
3	Use their logical thinking ability and solve questions related to analogy, Syllogisms, and other reasoning-based exercises.	K3
4	Choose the appropriate word/s/phrases suitable to the given context in order to make the sentence/paragraph coherent.	K3

SYLLABUS

UNIT-I	Spotting Errors, Sentence Improvement

UNIT-II	Synonyms, Antonyms, Frequently Confused Words, Foreign Phrases, Idioms and Phrasal Verbs, Collocations.

UNIT-III	Foreign Phrases, Idioms and Phrasal Verbs, Collocations, Analogies, Odd One Out

UNIT-IV	Sentence completion, Sentence Equivalence, Close Test

UNIT-V	Reading Comprehension, Para Jumbles

Text Books:

1.	Oxford Learners,, Grammar–Finder by John Eastwood, Oxford Publication.
2.	RS Agarwal books on objective English and verbal reasoning

3.	English Vocabulary in Use-Advanced, Cambridge University Press
4.	Collocations In Use, Cambridge University Press
5.	Soft Skills & Employability Skills by Samina Pillai and Agna Fernandez, Cambridge University Press India Pvt .Ltd.
6.	Soft Skills, by Dr.K.Alex, S. Chand & Company Ltd., New Delhi

Reference Books:

1.	English Grammar in Use by Raymond Murphy, CUP
2.	Websites: Indiabix,800score, official CAT, GRE and GMAT sites
3.	Material from IMS, Career Launcher and Time institutes for competitive exams
4.	The Art of Public Speaking by Dale Carnegie
5.	The Leader in You by Dale Carnegie
6.	Emotional Intelligence by Daniel Golman
7.	Stay Hungry Stay Foolish by Rashmi Bansal
8.	I have a Dream by Rashmi Bansal.

Part-B: Quantitative Aptitude-I

Course Objectives:

1.	To familiarize students with basic problems on numbers and ratios problems.
2.	To enrich the skills of solving problems on time, work, speed, distance and also Measurement of units.
3.	To enable the students to work efficiently on percentage values related to shares, profit and Loss problems.
4.	To inculcate logical thinking by exposing the students to reasoning related questions.
5.	To inculcate logical thinking by exposing the students to reasoning related questions.

Course Outcomes:

S.No.	Course Outcome	Knowledge Level
1.	The students will be able to perform well in calculating on number problems and various units of ratio concepts	K3
2.	The students will be able to solve problems on time and distance and units related solutions	K3
3.	The students will become adept in solving problems related to profit and loss, in specific, quantitative ability	K3
4.	The students will present themselves well in the recruitment process using analytical and logical skills which he or she developed during the course as they are very important for any person to be placed in the industry	K3
5.	The students will earn to apply Logical thinking to the problems of Syllogisms and be able to effectively attempt competitive examinations like CAT, GRE, GATE for further studies	K3

	SYLLABUS
UNIT-I	Numbers, LCM and HCF, Chain Rule, Ratio and Proportion Importance of different types of numbers and uses of them: Divisibility tests, finding remainders in various cases, Problems related to numbers, Methods to find LCM, Methods to find HCF, applications of LCM, HCF. Importance of chain rule, Problems on chain rule, Introducing the concept of ratio in three Different methods, Problems related to Ratio and Proportion
UNIT-II	Time and work, Time and Distance Problems on manpower and time related to work, Problems on alternate days, Problems on hours of working related to clock, Problems on pipes and cistern, Problems on combination of the some or all the above, Introduction of time and distance, Problems on average speed, Problems on Relative speed, Problems on trains, Problems on boats and streams, Problems on circular tracks, Problems on polygonal tracks, Problems on races.
UNIT-III	Percentages, Profit Loss and Discount, Simple interest, Compound Interest, Partnerships, shares and dividends. Problems on percentages-Understanding of cost price, selling price, marked price, discount, percentage of profit, percentage of loss, percentage of discount, Problems on cost price, selling price, market price, discount. Introduction of simple interest, Introduction of compound interest, Relation between simple interest and compound interest, Introduction of partnership, Sleeping partner concept and problems, Problems on shares and dividends, and stocks.
UNIT-IV	Introduction, number series, number analogy, classification, Letter series, ranking, directions Problems of how to find the next number in the series, Finding the missing number and related sums, Analogy, Sums related to number analogy, Ranking of alphabet, Sums related to Classification, Sums related to letter series, Relation between number series and letter series, Usage of directions north, south, east, west, Problems related to directions north, south, east, west.
UNIT-V	Data sufficiency, Syllogisms Easy sums to understand data sufficiency, Frequent mistakes while doing data sufficiency, Syllogisms Problems.

Text Books:	
1.	Quantitative aptitude by RS Agarwal
2.	Verbal and nonverbal reasoning by RS Agarwal
3.	Puzzles to puzzle you by shakunatala devi.
References:	
1.	Barrons by Sharon Welner Green and IraK Wolf (Galgotia Publications pvt. Ltd.)
2.	Websites: m4maths, Indiabix, 800score, official CAT, GRE and GMAT sites
3.	Material from IMS, Career Launcher and Time,, institutes for competitive exams
4.	Books for CAT by Arun sharma.
5.	Elementary and Higher algebra by HS Hall and SR Knight.

Websites:	
1.	www.m4maths.com
2.	www.Indiabix.com
3.	www.800score.com
4.	Official GRE site
5.	Official GMAT site

Code	Category	L	T	P	C	I.M	E.M	Exam
B20HS3204	**HS**	**2**	**--**	**--**	**--**	**--**	**--**	**--**

GENDER SENSITIZATION
(Common to ALL Branches)

Course Objectives:

1.	To develop students' sensibility with regard to issues of gender in contemporary India.
2.	To provide a critical perspective on the socialization of men and women.
3.	To introduce students to information about some key biological aspects of genders.
4.	To help students reflect critically on gender violence and workplace security.
5.	To expose students to more egalitarian interactions between men and women.

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

S.No	Outcome	Knowledge Level
1.	Understand the important issues relating to gender in contemporary India.	K2
2.	Get sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender.	K2
3.	Attain a finer grasp of how gender discrimination works in our society and how to counter it.	K2
4.	Acquire insight into the gendered division of labour and its relation to politics and economics.	K2
5.	Develop a sense of appreciation for both men and women in all walks of life.	K3

SYLLABUS

UNIT-I	**Understanding Gender and Related Concepts - Gender in Everyday Life** Introduction: Conceptual Connotation – Sex and Gender – Basic Gender Concepts - Gendered Socialization – Gender Stereotypes –Exploring Attitudes towards Gender – Gender Roles & Relationships - Myths – Gender in Indian society – Early days – Later Vedic Period –Medieval and British Period – Independent India.
UNIT-II	**Introduction to Gender Justice- Notion and Significance** Division and Valuation of Work – Housework- The Invisible Work - "My Mother doesn't work," - Offences against Women –Fact and Fiction - Status of Women in Society – Gender and Human Rights - Gender Equality – Gender Justice – Notion and Significance
UNIT-III	**International and Constitutional Perspectives on Gender Equality** The International Bill of Rights, 1979 –Declaration on the Elimination of Violence against women 1993 –The Rights of Women –Beijing Platform for Action 1995 – Constitutional Guarantees – Fundamental Rights – Equality.
UNIT-IV	**Gender and Culture** Gender and Film - Gender and Electronic Media – Gender and Advertisement –

	Gender and Popular Literature – Gender Issues - Gender-Sensitive Behaviour – Gender being Together as Equals.
UNIT-V	**Gender Violence- Within and Beyond** Violence – Gender Violence – Types of Gender Violence –Gender Violence in Indian Perspective – -Women Specific Legislations for the Elimination of Violence Within and Beyond.

Reference Books:

1.	"Towards A World Of Equals: A Bilingual Textbook on Gender" by A. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas, and Susie Tharu, Published by Telugu Akademi (2015).
2.	Ferber, Holcomb & Wentling, Sex, Gender & Sexuality: The New Basics, Oxford Univ. Press 2008.
3.	Flavia Agnes, Sudhir Chandra, Monmayee Basu, Women and Law in India, Oxford Univ. Press 2004.
4.	Mamta Rao, Law Relating to Women and Children, Eastern Book Co, Lucknow.
5.	K.I. Vibhute, Criminal Law, Lexis Nexis, 12th Edn.
6.	N. Prabha Unnithan (ed.), Crime & Justice in India, Sage Pub., 2013.
7.	Ritu Gupta, Sexual Harassment at Workplace, Lexis Nexis, 2013.
8.	IGNOU: Gender Sensitization: Society, Culture and Change (2019) BGSE001, New Delhi IGNOU.

Web links:

1.	https://nptel.ac.in/courses/110105080
2.	https://www.youtube.com/watch?v=2Xfp2eiTte0
3.	https://www.youtube.com/watch?v=-FCEBe5VNcA&t=41s
4.	https://www.youtube.com/watch?v=7n9IOH0NvyY
5.	https://www.youtube.com/watch?v=dpC2jGqu4G0
6.	https://www.youtube.com/watch?v=kcW4ABcY3zI&t=99s
7.	https://www.youtube.com/watch?v=dlXw1PbnWKM
8.	https://www.youtube.com/watch?v=9bayaZ18_po
9.	https://www.youtube.com/watch?v=ZbLq23cGFV4&t=1662s
10.	https://www.youtube.com/watch?v=61aYvb0Vo68
11.	https://www.youtube.com/watch?v=728H4Khf7Gk&t=1793s
12.	https://www.youtube.com/watch?v=y2Yk-rSZ7PI
13.	https://www.youtube.com/watch?v=wSqFvcjDpos
14.	https://www.youtube.com/watch?v=AljDd7nj9wE
15.	https://www.youtube.com/watch?v=MKPM0f2fOjM