DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

LIST OF COURSES OFFERED FOR MINOR PROGRAM (R20)

Course code	Course Title	Contact hours/week				Credits
		L	T	P	Total	
20ECM1	Analog And Digital Electronics	3	1	0	4	4
20ECM2	Principles Of Communication Systems	3	1	0	4	4
20ECM3	Microprocessors	3	1	0	4	4
20ECM4	Signal Processing Applications	3	1	0	4	4
20ECM5	Fundamentals of VLSI	3	1	0	4	4
20ECM6	Advanced Communications	3	1	0	4	4

Minor Programme

B.Tech. (IV Sem.) **ANALOG AND DIGITAL ELECTRONICS**

L	T	P	Cr.
3	1	0	4

Pre-requisites: Engineering Physics.

Course Educational Objective: This course focuses on operation and characteristics of Diodes, Transistors, &its applications and concepts of number system, logic gates, combinational logic circuits, sequential logic circuits, & its applications.

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

CO1: Describe the operation and characteristics of Diodes and transistors.

CO2:Apply the knowledge of characteristics for deciding the best diode and transistor for given applications.

CO3: Understand the concepts of number systems, Boolean algebra, combinational and sequential logic circuits.

CO4: Solve the given problems using combinational, sequential logic circuits and ASMs.

UNIT – I

PN Junction Diode: Operation of PN junction Diode, Zener Diode, LED, Photo diode, Solar cell and its Volt- Ampere Characteristics.Applications: Full wave rectifier, Clipper, Clamper.

UNIT – II

Transistor:BJT Operation and characteristics, MOSFET Operation and characteristics, Applications of transistor as an Amplifier, Analog to Digital and Digital to Analog Converters.

UNIT – III

Number Systemsand Boolean expressions: Binary Number systems, Hexadecimal Number systems, 1's and 2's complement of binary numbers, Binary codes –BCD, Error detecting and correcting codes – Hamming code.

Minimization of Boolean expressions, logic gates, realization of Boolean functions using logic gates

UNIT – IV

Combinational Logic Circuits: Design procedure, Adders and Subtractors, BCD adder, Magnitude Comparator, Decoder, Encoder, Multiplexer, Demultiplexer, and Applications.

UNIT – V

Sequential Logic Circuits: Flip flops-SR, JK, T, D – Characteristic and excitation tables, Counters-Synchronous, Implementation of 4-bit Counters.

Introduction to Mealy and Moore machines, Algorithmic State Machines: System design procedure and Memories.

TEXT BOOKS

1. Jacob Millman, Christos C Halkias, Electronic Devices and Circuits, Fourth reprint, Tata McGraw Hill, Publishers, New Delhi, 2011.
2. Morris Mano, "Digital Design", PHI Publishers, 4th Edition.

REFERENCE

1. Donald A.Neamen, Electronic Circuit Analysis and Design, Second Edition, Tata McGraw HillPublishers, 2014.
2. Charles H. Roth, "Fundamentals of Logic Design", Cengage learning Publishers.

Minor Programme

B.Tech. (Sem.) **PRINCIPLES OF COMMUNICATION SYSTEMS**

L	T	P	Cr.
3	1	0	4

Pre-requisites: Knowledge on Signals

Course Educational Objective: This course covers fundamental concepts of analog and digital communication systems which are essential for the understanding of advanced courses in digital or wireless communication systems.

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

CO1	Understand the fundamental concepts of various analog and digital modulation schemes.
CO2	Differentiate various analog and digital transmission schemes for transmission and reception.
CO3	Interpret different types of AM and FM transmitters & Receivers in communication system.
CO4	Apply the concepts of analog and digital modulation techniques for signal transmission.

UNIT-I

Introduction to Communication System: Elements of Communication System, Need for Modulation, Classification of Modulation.

Amplitude Modulation: Time and Frequency Domain Representation of AM, Switching Modulator, and Envelope detector.

Double Side band Suppressed Carrier Modulation: Time and Frequency domain representation, Ring Modulator, Coherent Detection of DSBSC wave.

Single Side band Modulation: Generation of SSBSC: Filter Method & Phase-shift Method, Coherent detection of SSB wave.

UNIT-II

Angle Modulation: definition, Types of Angle Modulation, Frequency modulation, Phase modulation, Narrow Band and Wide band FM.

Generation of FM waves: Indirect FM, Direct FM. **Demodulation of FM wave:**Simple slope detector, Balanced Slope detector, Foster Seeley Discriminator.

UNIT-III

Radio Transmitters: Classification of Transmitters, AM Transmitter: Low level and high level, FM transmitters: Reactance tube and Armstrong Method.

Radio Receivers:

Tuned Radio Frequency receiver, Need for heterodyning, AM Super Heterodyne Receiver, Frequency Changing and Tracking, Concept of Intermediate Frequency, FM receiver. **Noise:** Definition, Classification of Noise, internal noise and external noise.

UNIT-IV

Pulse Analog Modulation: Sampling theorem, Pulse Amplitude Modulation, Generation of and demodulation of PAM wave, Pulse Width Modulation: Generation and demodulation of PWM waves, Pulse Position Modulation: generation and demodulation of PPM.

UNIT-V

Digital Modulation Techniques: Introduction to Digital Modulation, Delta Modulation Adaptive Delta Modulation, Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Binary Phase Shift Keying, Comparison of various digital modulation techniques.

TEXT BOOKS:

1. Simon Haykin, *"Communication Systems"*, John Wiley & Sons, 2nd Edition, 1983.
2. Taub and Schilling, "*Principles of Communication Systems*", TMH Publications, 3rd Edition.

REFERENCE BOOKS:

1. George Kennedy,Davis, *"Electronic Communication Systems"*, Tata McGraw Hill Education, 4th edition, 1999
2. Sanjay Sharma, *"Analog and Digital Communication Systems",*S.K.Katariya& Sons,2nd Edition, 2007

B.Tech. (Sem.) **Minor Programme** **MICROPROCESSORS**

L	T	P	Cr.
3	1	0	4

Pre requisite: Digital Circuits, Computer organization

Course Educational Objective:
In this course student will learn about the register organization and architecture of 8086 Microprocessor, programming using assembler language, interfacing the memory chips, various Peripherals with 8086 Microprocessor, concepts of Interrupts and Serial Communication using 8086 processor.

Course Outcomes: (COs): At the end of the course, students are able to:

CO 1 Understand the architecture of 8086 and peripheral devices like DMA, PPI, PIC& USART.
CO 2 Apply 8086 instructions for microprocessor based applications.
CO 3 Analyze the operation and programming of peripheral devices like DMA, PPI, PIC& USART.
CO 4 Design of 8086 based system by interfacing memory, peripherals and I/O devices.

UNIT – I: Introduction to 8086 Microprocessor
Introduction to 8086 Microprocessors, Pin configuration of 8086, Architecture of 8086, Register organization of 8086, Special functions of general purpose registers, 8086 Flag register and function of 8086 Flags.

UNIT – II: 8086 Memory and I/O Interfacing
Minimum mode and maximum mode of operation with read and write timing diagrams, Memory organization of 8086, Memory mapped I/O and I/O mapped I/O. Interfacing circuits of memory devices like RAM and EPROMs to 8086.

UNIT – III: Programming using 8086 Instructions
Instruction set of 8086, Addressing modes of 8086, Assembler directives, simple assembler language programs involving logical, branch and call instructions, sorting, evaluation of arithmetic expressions, string manipulation, procedures and macros.

UNIT – IV: Peripherals – I
Need for DMA, Block diagram of 8257-DMA Controller, data transfer methods using DMA controller, Interfacing 8257 with 8086, Programming using 8257. Interrupt structure of 8086, Interrupt Vector table, Interrupt service routines, Introduction to DOS and BIOS interrupts, 8259 Programmable Interrupt Controller block diagram and its operation to provide service to an interrupt, ICWs & OCWs of 8259 and Programming using 8259 to interface with 8086.

UNIT – V: Peripherals – II
8255 PPI block diagram – various modes of operation and interfacing to 8086, Interfacing of Seven segment Displays with 8086 using 8255, Interfacing of Stepper Motor to 8086, Interfacing DAC of types 0800 & AD7523 with 8086 to generate waveforms like Saw tooth, Triangle and Square waves, Interfacing ADC 0808 with microprocessor. Serial data transfer schemes, RS-232C cable pin configuration, 8251 USART architecture and interfacing with 8086 to transfer and receive data.

TEXT BOOKS:

T1 A. K. Ray and K. M. Bhurchandi, "Advanced Microprocessor And Peripherals", 3rd Edition TMH Publishers.
T2 Douglas V. Hall, "Micro Processors & Interfacing", TMH,2007.

REFERENCE BOOKS:

R1 J. K. Uffenbeck, "The 8088 and 8086 Micro Processors", PHI, 4th Edition, 2003.

R2 Microcomputer systems-The 8086 / 8088 Family – Y.C. Liu and G. A. Gibson, 2E PHI -2003

R3 The Intel Microprocessor, Architecture, Programming and Interfacing-Barry B. Brey, 6e, Pearson Education / PHI, 2003

Minor Programme

B.Tech. (Sem.) **SIGNAL PROCESSING APPLICATIONS**

L	T	P	Cr.
3	1	0	4

Pre-requisites: Vectors, Scalars, Approximation of a vector by another vector, Differentiation and Integration of signals

Course Educational Objectives: This course describe signals mathematically and how to perform mathematical operations on signals, represents the signals in both time and frequency domains, provides the concepts of sampling, represents the signals in both time and frequency domains, the signal approximation using orthogonal functions and Fourier Analysis and analyzing systems with Z Transform its properties. This course provides fundamental knowledge needed in the processing of 1D, 2D and 3D signals.

Course Outcomes (COs): At the end of this course, student will be able to

CO1: Understand the concepts of Signalanalysis, Approximation and response of Linear Time Invariant systems.
CO2: Interpret the characteristics of speech signal.
CO3: Apply the filtering fundamentals for image processing.
CO4: Analyze the 3D motion models for processing of Video signals.

UNIT-I

Signal Analysis: Concept of Signal, Elementary continuous and discrete time signals, Classification of Signals; Operations on Signals. Classification of Systems, Response of Linear Time Invariant systems.

Signal Approximation: Approximation of a Signal by another signal-Mean square error, Condition for orthogonal signals, and Approximation of a Signal by a set of mutually orthogonal signals-Evaluation of Mean square error, Representation of periodic and non periodic continuous time using Fourier series and Fourier Transform.

UNIT-II

Discrete Fourier Transform: DFT, Computation of DFT, Computation of IDFT, Properties of DFT (Proofs not expected).

Z-Transform: Z-Transform of Causal, Anti-Causal and Non-Causal sequence; Region of Convergence and Properties, Properties of Z-Transform (Proofs not expected).

UNIT-III

Speech Signal analysis

Introduction to speech signal, Digital model for speech signals, Short time energy and average magnitude, short time average zero crossing rate, speech vs silence discrimination using energy and zero crossing, Pitch period estimation using Parallel Processing approach, Short time auto correlation and average magnitude function.

UNIT-IV

Image Enhancement:

Digital Image, Fundamental Steps and Components of an Image Processing System, Sampling and Quantization, Representation of Digital Images, Spatial and intensity Resolution, Histogram processing, Spatial filtering - Smoothing and sharpening filters.

UNIT-V

Video Processing:

Analog Video, Digital Video, Time varying Image formation models: Three dimensional Motion models, Geometric and Photometric Image Formation, Sampling of Video Signals, Filtering operations

TEXT BOOKS:

1. A V Oppenheim, A S Wilsky and IT Young, "Signals and Systems", PHI learning, 2nd Edition,2018.
2. Alan V Oppenheim, Ronald W. Schafer, "Digital Signal Processing", PHI learning, 1st edition, 2010.

REFERENCE BOOKS:

1. L.R.Rabiner,R.W.Schafer,"Digital Processing of Speech Signals", Pearson Education,1993
2. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition. Prentice Hall, 2007
3. A.M.Tekalp, "Digital Video Processing", Prentice Hall, 2nd Edition, 2003.

B.Tech. (Sem.)	Minor Programme FUNDAMENTALS OF VLSI	L	T	P	Cr.
		3	1	0	4

Pre-requisites: Analog and Digital Electronics.

Course Educational Objective: This course provides the knowledge on IC Fabrication Technologies and gives a complete idea about combinational and sequential sub system CMOS circuit designs used in VLSI Design.

Course Outcomes: At the end of the course, the student will be able to
CO1: **Remember** IC fabrication process and properties of MOSFET.
CO2: **Apply**the layoutdesign rules for NMOS andCMOS circuits.
CO3: **Apply** the concepts of logic gates and combinational circuits used in ICs.
CO4: **Design**the sub system using combinational and sequential circuits.

UNIT – I: Introduction to MOS Technology
Introduction to Integrated Circuit (IC) Technology, The IC Era, Metal-Oxide-Semiconductor (MOS) and related VLSI Technology, Basic MOS Transistors, Enhancement mode Transistor action, Depletion mode Transistor action, NMOS Fabrication, CMOS Fabrication: The p-well process, The n-well process.

UNIT – II: Basic Electrical Properties of MOS Circuits
Drain to Source Current I_{ds} versus Voltage V_{ds} Relationships: The Non-saturated Region, The saturated Region, Aspects of MOS Transistor Threshold Voltage V_t, MOS Transistor Transconductance g_m and Output conductance g_{ds}, MOS Transistor Figure of Merit ω_0, The Pass Transistor, The NMOS Inverter, The CMOS Inverter.

UNIT – III: MOS Circuit Design Processes
MOS Layers, Stick Diagrams: NMOS Design style, CMOS Design style, Design Rules and Layout: Lambda-based Design Rules, Contact Cuts, Double Metal MOS Process Rules, CMOS Lambda-based Design Rules, General Observations on the Design Rules, Layout Diagrams.

UNIT – IV: Subsystem Design – I
Architectural Issues, Switch Logic: Pass Transistors and Transmission Gates, Gate Logic: The Inverter, Two-input NMOS and CMOS NAND Gates, Two-input NMOS and CMOS NOR Gates, Other forms of CMOS Logic, Structured Design Examples: Parity Generator, Bus Arbitration Logic for n-line Bus, Multiplexers, General Logic Function Block, Four-line Gray code to Binary code Converter, The Programmable Logic Array (PLA).

UNIT – V: Subsystem Design – II
Clocked Sequential Circuits: Two-phase clocking, Charge storage, Dynamic Register Element, Dynamic Shift Register, Other System Considerations: Bipolar Drivers for Bus Lines, Basic Arrangements for Bus lines, The pre-charged Bus Concept, Power Dissipation for CMOS Circuits, Current Limitations for V_{DD} and GND (V_{SS}) Rails, Further Aspects of V_{DD} and V_{SS} Rail Distribution, General Considerations: Some problems, Illustration of Design Processes: The General Arrangement of a 4-bit Arithmetic Processor, The Design of a 4-bit Shifter..

TEXT BOOK
1. Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design" PHI Publishers, 3rd Edition..

REFERENCE

1. Wayne Wolf, Modern VLSI Design (3/e), Pearson Education Publishers.
2. Neil. H. E. Weste and KamaranEshraghian, Principles of CMOS VLSI Design (2/e), Pearson Education Publishers, 3rdEdition.
3. John .P. Uyemura, Introduction to VLSI Circuits and Systems, JohnWiley Publishers.

Minor Programme

B.Tech. (Sem.) **ADVANCED COMMUNICATIONS**

L	T	P	Cr.
3	1	0	4

Pre-Requisites: Principles of communication systems

Course Educational Objective: This course provides the knowledge on various concepts of communication system like optical, satellite, wireless and mobile communications. It also gives the complete information regarding existing and emerging wireless communication technologies.

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

CO1	**Understand** different concepts of wired and wireless communication systems.
CO2	**Differentiate** the various wireless communication Technologies.
CO3	**Interpret** different concepts of recent trends in communication.
CO4	**Apply** basic concepts of Optical and wireless communication in real- time applications

UNIT-I

Introduction to Wireless Communication System: Evolution of mobile communications, Mobile Radio System around the world, Types of Wireless communication System, Comparison of Common wireless system, Trend in Cellular radio and personal communication. Wireless Local Loop(WLL),Wireless Local Area network(WLAN), Bluetooth and Personal Area Networks. Microwave frequency ranges and applications, Basic Radar System and its Applications.

UNIT – II

Mobile Communications: Introduction to Cellular Systems: Basic cellular system, Operation of cellular systems-How a cellular telephone call is made, Operational channels, Performance criteria, Uniqueness of mobile radio environment, Frequency reuse, Handoff, concept of Digital cellular system, Digital Cellular Systems: 2G Systems-Global System for Mobile,3G Systems ,Introduction to 4G & 5G technologies.

UNIT – III

Optical Communications: Introduction-general optical fiber communication system- basic optical laws and definitions. Fiber optic cables, classification of optical fiber-single mode fiber-graded index fiber. Optical Sources: direct and indirect band gaps, LED: LED structures, surface emitting, Edge emitting LED -LASER diodes-operating principles. Optical Detectors: PIN photo detector-Avalanche photo diodes- comparisons of photo detectors.

UNIT – IV

Satellite Communication: Need of satellite communication, Definition of a satellite and orbit, Frequency allocations for satellite services, General structure of satellite communication system, Different types of orbits, Merits and demerits of satellite communication, Kepler‟s three laws of planetary motion. Satellite Applications: GPS (Global Positioning System) architecture and location principle, Direct Broadcast Satellite (DBS/DTH)

UNIT – V

Multiple Access Techniques: Introduction, Comparisons of multiple Access Strategies TDMA, FDMA CDMA, FDM.

Recent Trends: Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software Defined Radio, UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.

TEXT BOOKS:

1. Theodore S. Rappaport ,"Wireless Communications", Pearson Education, 2nd Edition, 2002.
2. GredKeiser,"Optical Fiber Communication, McGraw Hill Education (India) Private Limited. Fourth Edition, 2008.
3. Timothy Pratt, Charles Bostian, Jeremy Allnutt , "Satellite communications", John Wiley & Sons,2nd edition, 2003.
4. William C.Y. Lee,"Mobile Cellular Telecommunications", Tata McGraw Hill, 2nd Edition, 2006.

REFERENCES:

1. Rajpandya, Mobile and personal Communication system and services, Wiley–Blackwell, 1999.
2. C.K.Toh ,Adhoc Mobile Wireless network: Protocols and Systems, Pearson, 1st edition,2001.