MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
B.Tech. in Electronics and Communication Engineering

List of Open Electives Offered by Electronics and Communication Engineering Department to CSB, CSD and CSM branches under MR-21 Regulation

VI Semester Open Elective-I for CSB, CSM and CSD branches

EC631OE	Principles of Electronic Communications
EC632OE	Computer Organization and Architecture

VII Semester Open Elective-II for CSB, CSM and CSD branches

EC731OE	Data Communications and Networks
EC732OE	Digital Image Processing

VIII Semester Open Elective-III for CSB, CSM and CSD branches

EC831OE	Introduction to Embedded System Design
EC832OE	Introduction of Internet of Things (IoT)

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
(Open Elective-I)
(Common to CSB, CSM & CSD)

EC631OE: Principles of Electronic Communications

Course Objectives:

- Introduce the students to modulation and various analog and digital modulation schemes.
- They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Outcomes:

- Work on various types of modulations.
- Should be able to use these communication modules in implementation.
- Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.

Unit I: Introduction
Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels

Unit II: Simple description on Modulation
Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

Unit III: Telecommunication Systems, Networking and Local Area Networks
Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.
Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN

Unit IV: Satellite Communication, Optical Communication
Satellite Communication: Satellite Orbits, Satellite Communication Systems, Satellite Subsystems, Ground Stations Satellite Applications, Global Positioning systems.
Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

Unit V: Cellular and Mobile Communications, Wireless Technologies
Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.

Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Suggested Readings:

1. Louis E. Frenzel, Principles of Electronic Communication Systems, 3e, McGraw Hill publications, 2008.
2. Kennedy, Davis, Electronic Communications systems, Mc.Graw Hill Education, 4e, 1999.

Reference Books:

1. Theodore, S. Rappaport, Wireless Communications - Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Tomasi Wayne, Introduction to data communications and networking, Pearson Education, 2005.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
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EC632OE: Computer Organization and Architecture

Course Objectives:

- The purpose of the course is to introduce principles of computer organization and the basic architectural concepts.
- It begins with basic organization, introduces simple register transfer language to specify various computer operations, design and programming of a simple digital computer.
- Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors.

Course Outcomes:

- Understand the basics of instructions sets and their impact on processor design.
- Demonstrate an understanding of the design of the functional units of a digital computer system.
- Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
- Design a pipeline for consistent execution of instructions with minimum hazards.
- Recognize and manipulate representations of numbers stored in digital computers.

Unit I: Digital Computers, Basic Computer Organization and Design

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.
Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Unit II: Central Processing Unit

General Register Organization, Instruction codes, Computer Registers, Instruction cycle, Addressing Modes, Computer instructions: Data Transfer and Manipulation, Program Control.

Unit III: Data Representation, Computer Arithmetic

Data Representation: Data Types, Complements, Fixed Point Representation, Floating Point Representation.
Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating – Point Arithmetic Operations. Decimal Arithmetic Unit, Decimal Arithmetic Operations.

Unit IV: Input-Output Organization

Input-Output Organization: Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer: Programmed-controlled I/O, Interrupt-initiated I/O, Direct memory Access, Priority Interrupt.

Unit V: Memory Organization

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual memory.

Suggested Readings:

1. Moris Mano, Computer System Architecture, Pearson/PHI, Third Edition.

Reference Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, McGraw Hill, 5th Edition, 2014.
2. William Stallings, Computer Organization and Architecture, Pearson/PHI, Sixth Edition.
3. Andrew, S. Tanenbaum, Structured Computer Organization, PHI/Pearson, 4th Edition.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
(Open Elective-II)
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EC731OE: Data Communications and Networks

Course Objectives:

- To introduce the Fundamentals of data communication networks
- To demonstrate the Functions of various protocols of Data link layer.
- To demonstrate Functioning of various Routing protocols.
- To introduce the Functions of various Transport layer protocols.
- To understand the significance of application layer protocols.

Course Outcomes:

- Know the Categories and functions of various Data communication Networks
- Design and analyze various error detection techniques.
- Demonstrate the mechanism of routing the data in network layer
- Know the significance of various Flow control and Congestion control Mechanisms
- Know the Functioning of various Application layer Protocols.

Unit I: Introduction to Data Communications

Components, Data Representation, Data Flow, Networks, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet, Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs

Unit II: Data Link Layer

Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission, Parity Checks, Check summing Methods, Framing, Flow Control and Error Control protocols, Multiple Access Protocols, Random Access , ALOHA.

Unit III: The Network Layer

Introduction, Forwarding and Routing, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, The Internet Protocol(IP):Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing

Unit IV: Transport Layer

Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure.

Unit V: Application Layer

Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Web and HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works

Suggested Readings:

1. James, Kurose F., Keith W., Computer Networking A Top-Down Approach, Pearson, 6th Edition.
2. Forouzan, Behrouz A., Data Communications and Networking, McGraw-Hill Education, 4th Edition

Reference Books:

1. Trivedi Bhusan, Data communication and Networks, Oxford university press,2016.
2. Andrew S. Tanenbaum, Computer Networks, , Pearson Education, 4th Edition.
3. Shay, W.A., Understanding Communications and Networks, Cengage Learning, 3rd Edition

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
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EC732OE: Digital Image Processing

Course Objectives:

- To provide a approach towards image processing and introduction about 2D transforms
- To expertise about enhancement methods in time and frequency domain
- To expertise about segmentation and compression techniques
- To understand the Morphological operations on an image

Course Outcomes:

- Explore the fundamental relations between pixels and utility of 2-D transforms in image processer.
- Understand the enhancement, segmentation and restoration processes on an image.
- Implement the various Morphological operations on an image
- Understand the need of compression and evaluation of basic compression algorithms.

Unit I:

Digital Image Fundamentals & Image Transforms: Digital Image fundamentals, Sampling and quantization. Relationship between pixels, Image Transforms: 2-D FFT. Properties, Walsh transform, Hadamard Transform & Discrete Cosine Transform.

Unit II:

Image Enhancement (Spatial Domain): Introduction,Types of Point Processing, Histogram Manipulation, Local or Neighbourhood criterion, Median Filter, Spatial Domain High-Pass Filtering.
Image Enhancement (Frequency Domain): Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

Unit III:

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

Unit IV:

Image Segmentation: Detection of Discontinuities, Edge Linking and boundary detection, thresholding, Region oriented segmentation.
Morphological Image Processing: Dilation, Erosion, Opening and Closing, Hit or Miss Transformation.

Unit V:

Image Compression: Types of redundancies, Fidelity Criteria, Image Compression Models, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, JPEG 2000 Standards.

Suggested Readings:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 3rd Edition, Pearson, 2008.
2. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, TMH, 2010.

Reference Books:

1. ScotteUmbaugh, Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools , 2nd Ed, CRC Press, 2011.
2.Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, Digital Image Processing using MATLAB, 2nd Edition, TMH, 2010.
3. Somka, Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning (Indian edition) 2008.

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
(Open Elective-III)
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EC831OE: Introduction to Embedded System Design

Course Objectives:

- To provide an overview of principles of Embedded System.
- To provide an overview of components of Embedded System
- To provide a clear understanding of role of firmware, operating systems in correlation with hardware systems.

Course Outcomes:

- Expected to understand the selection procedure of processors in the embedded domain.
- Design procedure of embedded firm ware.
- Expected to visualize the role of real-time operating systems in embedded systems.
- Expected to evaluate the correlation between task synchronization and latency issues

Unit – I: Introduction to Embedded Systems

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit – II: Typical Embedded System

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators- Light Dependent Resistor, Thermistor, Photo Transistor, Light Emitting Diode, Relays, Stepper Motor. Communication Interfaces: SPI, I2C, UART, Onboard and External Communication Interfaces: WiFi, Bluetooth, ZigBee, USB

Unit – III: Other System Components of Embedded system :

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches: Super Loop Based Approach and OS based Approach, Development Languages: Assembly Language and High level Language

Unit – IV: RTOS Based Embedded System Design :

Operating System Basics, Types of Operating Systems-GPOS, RTOS, Tasks, Task States, Task Control Block, Process and Threads, Multiprocessing and Multitasking, Task Scheduling- Non-Preemptive Scheduling (FCFS, LCFS, SJF, Priority Based), Preemptive Scheduling(FCFS, LCFS, SJF, Priority Based, Round-Robin).

Unit – V: Task Communication :

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Communication/Synchronization Issues: Racing, Deadlock, Livelock, Starvation, Task Synchronization Techniques: Mutual exclusion through busy waiting/ Spin lock, Mutual exclusion through Sleep and Wakeup, Semaphores, Device Drivers, Methods to Choose an RTOS.

Suggested Readings :

1. Shibu K.V, “Introduction to Embedded Systems”, McGrawHill.
2. RajKamal, “Embedded Systems”,TMH.

Reference Books :

1.Frank Vahid, Tony Givargis, “Embedded Systems Design: A Unified Hardware / Software Introduction”, John & Wiley Publications, 2002.
2.Lyla B. Das, “Embedded Systems”,Pearson,2013.
3.David E. Simon, “An Embedded Software Primer”, Pearson Education

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
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EC832OE: Introduction to Internet of Things

Course Objectives:

- Understand the concepts of Internet of Things and able to build IoT applications
- Learn the programming and use of Arduino and Raspberry Pi boards.
- Known about data handling and analytics in SDN

Course Outcomes:

- Known basic protocols in sensor networks.
- Program and configure Arduino boards for various designs.
- Python programming and interfacing for Raspberry Pi.
- Design IoT applications in different domains.

Unit – I:
Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

Unit – II:
Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Unit – III:
Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi

Unit – IV:
Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics..

Unit – V:
Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT. Case Study: Agriculture, Healthcare, Activity Monitoring

Suggested Readings:

1. Madisetti, Vijay and Bahga, Arshdeep, Internet of Things (A Hands-on-Approach), VPT, 1st Edition, 2014.
2. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, 1st Edition, 2013.
3. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011.

Reference Books:

1. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks:Theory and Practice"
2. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013.