Central University of Jammu
Rahya-Suchani (Bagla) District Samba – 181143, Jammu (J&K)
Department of Electronics and Communication Engineering

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Course Syllabus (Semester-V) Electronics and Communication Engineering-Avionics

Central University of Jammu

Rahya-Suchani (Bagla) District Samba – 181143, Jammu (J&K)

Department of Electronics and Communication Engineering

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Internet of Things

Course Code: BEECA3C001

Course Title: Internet of Things

Semester: V

Credits: 03

Rationale

To provide the comprehensive overview of IoT fundamentals, communication protocols, device integration, advanced concepts, and practical applications, equipping students with the knowledge and skills needed to excel in the rapidly evolving field of IoT.

Course Outlines

Contents	No. of Lectures
Unit - I Introduction to IoT: Sensing, Actuation, Basics of Networking. Basics of Networking, IoT Layered Architecture, Channel Modeling	**08**
Unit - II Communication Protocols, MQTT, HART, CoAP , HMM, Sensor Networks, Real Time Deployment of IoT Network, WSN, UAV, FANET	**08**
Unit -III Machine-to-Machine Communications, WoT, Bluetooth, ZigBee Network, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi	**08**
Unit - IV Introduction to SDN: SDN for IoT, Cloud Computing, Fog Computing: Smart Cities and Smart Homes	**08**
Unit - V Connected Vehicles, VANET, Industrial IoT: Part I, Case Study: Agriculture, Healthcare, Activity Monitoring	**08**

Course Outcomes

Upon successful completion of this course, candidates will be able to:

- Understand the vision of IoT from a global context.
- Understand the application of IoT and determine the market perspective of IoT.
- Use of Devices, Gateways and Data Management in IoT.
- Building state of the art architecture in IoT.
- Application of IoT in Industrial and Commercial Building Automation and Real World Design

Constraints.

Text Books

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)

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Internet of Things Lab

Course Code: BEECA3C001P

Course Title: Internet of Things Lab

Semester: V

Credits: 01

Course Outlines

- To study and Install IDE of Arduino and different types of Arduino
- Write Program for RGB LED using Arduino
- Write a program for integration DHT sensor using Arduino Mega Board
- Write a program for integrating Motor based Actuator (Servo Motor) in Arduino
- Study and Configure Raspberry Pi
- Study and WAP for Arithmetic operation in python
- Study and WAP for looping statement in python
- WAP for LED blink using Raspberry Pi
- Configure Pi Camera and make a program for clicking still image in Python
- Write a Python program for showing temperature and humidity using DHT11 sensor using Raspberrypi
- Study the Temperature sensor and Write Program for monitor temperature using Arduino
- Study and Implement RFID, NFC using Arduino
- Study and Implement MQTT Protocol using Arduino
- Study and Implement Zigbee Protocol using Raspberry Pi
- Mini Project on IoT

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Network Analysis and Synthesis

Course Code: BEECA3C002

Course Title: Network Analysis and Synthesis

Semester: V

Credits: 04

Rationale

The subject deals with the various methods of analysis of electrical circuits under transient and steady state conditions. It enables to understand the concept of Laplace and Fourier transform and transform circuits using Thevenin's and Norton's theorem.

Course Outlines

Contents	**No. of Lectures**
Unit - I Basic Concepts: Active and passive elements, Concept of ideal and practical sources, Ohm's law, Source transformation, Kirchoff's laws, Analysis of networks by Mesh and Node voltage methods with independent and dependent sources. Graph Theory: Graph of network, Tree, Incidence matrix, Cut-sets, f-circuits analysis and f-cut set analysis, Duality, Methods of obtaining dual network.	**08**
Unit - II Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem and Tellegen's theorem. Analysis of networks with and without dependent AC and DC sources.	**08**
Unit -III Two Port networks: Definition, Open circuit impedance, Short circuit admittance, Hybrid and Transmission parameters and their evaluation for simple circuits, Relationships between parameter sets. Image impedance, Image transfer function.	**08**
Unit - IV Network Synthesis: Hurwitz polynomial, Positive real functions, reactive networks. Separation property for reactive networks. The four-reactance function forms, Specification for reactance function. Foster form of reactance networks. Cauer form of reactance networks. Synthesis of R-L and R-C networks in Foster and Cauer forms.	**08**
Unit - V Transient Analysis using Laplace Transformation: Laplace transformation, Laplace transformation of impulse, step, ramp, sinusoidal signals and shifted functions. Initial and Final value theorems. Special signal waveforms with Laplace transform and applications to circuit operations.	**08**

Course Outcomes

Upon successful completion of this course, candidates will be able to:

- Understand the concept of different network theorems.
- Analyze different type of electric circuit in transient time domain.
- Understand network functions in S plane.
- Study and analyze the two-port network with different parameters and their interconnection. Analyze their application to different network.
- Understand Laplace Transformation and its applications.

Text Books

1. "Network Analysis", Valkenburg, PHI Pbs.
2. "Circuit theory", Kurikose-PHI Pbs.

Reference Books

1. Introduction to Network Synthesis", Valkenburg, PHI Pbs.
2. Sudhakar, A. Shyammohan, "Circuits and Network", Third Edition, 2006,Tata McGraw Hill.
3. Kelkar, Pandit, "Linear Network Theory", Pratibha Publication.

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Electromagnetic Field Theory

Course Code: BEECA3C003

Course Title: Electromagnetic Field Theory

Semester: V

Credits: 04

Rationale

The course enables to understand the basic knowledge of Electromagnetic field theory that allows the student to have a solid theoretical foundation for future applications. Also students able to identify, formulate and solve the electromagnetic fields and waves propagation based problems, further it provide the students with a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies

Course Outlines

Contents	No.ofLectures
Unit-I **VECTOR ANALYSIS**: General Treatment on Cartesian, cylindrical, spherical co-ordinate systems with reference to vectors, operation of gradient, divergence, curl, Laplacian., Gauss's Divergence theorem, Stoke's theorem.	**10**
Unit-II **ELECTROSTATICS**: Review of electric field quantities and their definitions. Gauss's flux theorem, Poisson's Equation and Laplace Equation, uniqueness theorem, Green's theorem, Coulomb's law, dipole moment. Electrostatic Field in Dielectric: Polarization, electric flux density, boundary conditions, capacitor and capacitance, electrostatic shielding, energy stored in electric fields.	**10**
Unit-III **MAGNETOSTATICS**: Magnetic flux and flux density, static currents in conducting media, Ampere's law, Biot-Savart law, boundary between magnetic media, forces between currents, magnetic potentials, magnetic torque and moment, Dipole, Energy stored in magnetic field. Faraday's law of induction (transformer and motion), Inductor and Inductances (self and mutual).	**10**
Unit-IV **ELECTROMAGNETIC WAVES**: Faraday's low, Maxwell's equations - Equation of continuity - Displacement current - Maxwell's equation in point and integral forms,Time-varying potentials, wave equations, plane waves in Lossy Dielectrics, Free space & Good conductors, Skin effect, Poynting vector and Theorem, Reflection of plane waves, SWR.	**10**

Unit-V TRANSMISSION LINES: Line equations, input impedance, Stub Matching, SWR and power, smith chart, some applications of Transmission lines. Electromagnetic Wave in Conductors, Rectangular and Circular Wave Guide, Cutoff and guided wavelength, Wave and Characteristic impedance, Dominant Mode, TE and TM Modes.	**10**

Course Outcomes

Uponsuccessfulcompletionofthiscourse,candidateswillbeable to:

- Describe various theorems related to vector analysis Scheme
- Differentiate different types of coordinate systems and use them for solving the problems of electromagnetic field theory
- Explain concepts, theories and laws of electrostatics, magnetics, electromagnetics, electromagnetic wave propagation and transmission lines
- Apply theories and laws of electrostatics, magnetics and electromagnetics to solve electrical engineering problems
- Deduce the electromagnetic wave propagation from Maxwell's equations

Books Recommended:

1. W. H. Hayt, J. A. Buck, and M. Jaleel Akhtar, "Engineering Electromagnetics", 8th Edition, McGraw Hill Publication.
2. David J. Griffiths, Introduction to Electrodynamics, 4th Edition, PHI, 2013.
3. S. P. Seth, Elements of Electromagnetic Fields, Dhanpat Rai & Co., 4th Edition, 2012.
4. C. L. Wadhwa, Engineering Electromagnetics, New Age International Publishers, 3rd Edition, 2012. 5. Fawwaz T. Ulaby, Electromagnetics for engineers, Pearson education, first Indian reprint, 2005.
5. Elements of Electromagnetic by Mathew N.O. Sadiku, Oxford University Press.

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Material Science and Metallurgy

Course Code: BEECA3C004

Course Title: Material Science and Metallurgy

Semester: V

Credits: 03

Rationale

To provide a focused exploration of materials science and engineering, covering key concepts such as crystal structure, defects, alloying, and solidification principles. It emphasizes the correlation between material structure and properties, encompassing mechanical, electrical, thermal, and optical characteristics. It provides the understanding of material design and application in diverse industries.

Course Outlines

Contents	No. of Lectures
Unit - I Selection of materials – structure of solids, crystal structure – defects in crystals, free energy concept – alloying	**08**
Unit - II principles of solidification – phase diagrams – concept of heat treatment – properties of materials, mechanical, electrical, thermal and optical properties	**08**
Unit -III Testing of materials – semiconductor materials – ceramics, synthesis and processing –	**08**
Unit - IV polymers, classification, mechanism of formation, structure property relations, characterization	**08**
Unit - V Composites-classification, factors influencing properties, processing.	**08**

Course Outcomes

Upon successful completion of this course, candidates will be able to:

- Understand material structure and properties.
- Apply solidification principles effectively.
- Optimize material performance with heat treatment.
- Evaluate material properties for applications.
- Synthesize and characterize diverse materials accurately.

Text Books

1. Callister Jr.,W. D., Materials Science and Engineering: An Introduction, 7th ed., John Wiley

(2007).
2. Raghavan V., Physical Metallurgy: Principles and Practice, 3rd ed., PHI Learning (2015).

Reference Books

1. Billmeyer, F. W., Textbook of Polymer Science, 3rd ed., Wiley India (1984).
2. Askeland, D. R. and Phule, P. P., The Science and Engineering of Materials, 4th ed., ThompsonEngineering (2006).

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Computer Networks & Data Communication

Course Code: BEECA3C005

Course Title: Computer Networks & Data Communication

Semester: V

Credits: 03

Rationale

The students will be familiar with the basic concepts and layered models of Computer Networks and Data Communication. Also, students will be able to understand the design and performance issues of the networking systems.

Course Outlines

Contents	No. of Lectures
Unit - I Introduction to Computer Networks: History, Uses of Computer Networks, Network Architecture, Topologies, Reference Model (ISO-OSI, TCP/IP-Overview), Circuit Switching and Packet Switching, Modulation, Data Encoding, Network Standardization, Inter-networking, Physical Layer. Transmission Media, Transmission Media Connectors and Cables (RJ11, RJ45, 8P8C, Cat5, Cat6, UTP, Coax, 10baseT, etc).	**08**
Unit - II Data Link Layer, Design Issues, Frame, Error Detection and Correction, Flow Control, Elementary Data Link Protocols, Character-Oriented and Bit-Oriented Protocols, Sliding Window Protocols. Channel Allocation Methods: TDM, FDM, ALOHA, Hidden/Exposed Terminals, CSMA (CA, CD), Ethernet, Token Bus, Token Ring, ARQ Protocols, IEEE 802.11, IEEE 802.15.1, IEEE 802.15.4**.**	**08**
Unit -III Network Layer, Store and Forward Packet Switching, Connectionless and Connection-oriented services, Virtual Circuit. Routing Algorithms, Shortest Path, Flooding, Link State, Distant Vector, Hierarchical, Broadcast and Multicast Routing. OSPF, BGP, Congestion, Congestion Control Algorithms.	**08**
Unit - IV TCP/TP Protocol, IP Addresses, Classes of IP Addresses, Subnets, IPv6, Network Layer in the Internet, Internet Control Protocols, ARP, RARP, BOOTP, DHCP, Transport Layer, Protocol Stack, TCP and UDP, Transport Services Primitives, Transmission Policy, Congestion Control, Timer Management, Wireless TCP and UDP.	**08**
Unit - V Application layer, Name service (DNS), Domain Hierarchy, Name servers, Name resolutions, Traditional applications, Telnet, FTP, SMTP, MIME, World	**08**

wide web-HTTP, HTTP Methods. Basics of Cryptography and Network Security: Introduction to cryptography, Classical Cryptosystem, Block Cipher.	

Course Outcomes

Upon successful completion of this course, candidates will be able to:

- Understand the basic taxonomy and terminology of the computer networks and data communication.
- Understand the architecture and principles of today's computer networks.
- Understand the protocols and their functionalities.
- Understand the various network algorithms and architectures.
- Become familiar with different transmission medias and explore the basic knowledge of cryptography and network security.

Text Books

1. Andrew S. Tanenbaum, "Computer Networks", 5 e, 2013, Pearson Education Asia.
2. Behrouz A. Forouzan, "Data Communications and Networking", 4e, 2004, Tata McGraw Hills.
3. William Stallings. "Data and Computer Communication", 7e, 2016, Pearson Education Asia.
4. Prakash C. Gupta, “Data Communications and Computer Networks”, PHI

Reference Books

1. Michael A. Miller, "Data and Network Communications", 2e, Delmar Thomson Learning.
2. James F. Kurose and Keith W. Ross, "Computer Networking", 3e, Pearson Education.
3. William A. Shay, “Understanding Data Communications and Networks”, 2e, Thomson Asia Pvt.Ltd.
4. Black U. PHI “Computer Networks-Protocols, Standards and Interfaces”
5. Stallings W., “PHI Computer Communication Networks,”
6. Computer Networking: A Top - Down Approach, by Ames Kurose, Keith Ross.
7. Computer Networks: A Systems Approach Book by Bruce S. Davie and Larry L. Peterson
8. TCP/IP Tutorial and Technical Overview, (IBM Redbook) - Download From http://www.redbooks.ibm.com/abstracts/gg243376.html
9. TCP/IP Guide, Charles M. Kozierok, Available Online - http://www.tcpipguide.com/
10. Request for Comments (RFC) - IETF - http://www.ietf.org/rfc.html

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Digital Signal Processing

Course Code: BEECA2C006

Course Title: Digital Signal Processing

Semester: V

Credits: 03

Rationale

To provide the understanding of digital signal processing systems, discrete Fourier transform, fast Fourier transform, short time Fourier transform, digital filter design, and power spectral estimation.

Course Outlines

Contents	No. of Lectures
Unit - I Signal, System, and Signal Processing, Classification of signals, Analysis of Discrete LTI Systems. Convolution Sum and Linear Constant Coefficients Difference Equations, Correlation of Discrete Time Systems	**08**
Unit - II Discrete Fourier Transform (DFT) , FFT Algorithms, Applications of FFT Algorithm, Introduction of short time Fourier transform (STFT) and its applications	**08**
Unit -III Structures for the Realization of FIR and IIR Digital Filters, Quantization of Filter Coefficients, and Round off effects in Digital Filters	**08**
Unit - IV Design IIR Filter using Approximation of Derivative, Impulse Invariance, Bilinear Transformation Method, Frequency transformation based Filter Design, Design of FIR filters	**08**
Unit - V Estimation of spectra from finite duration observations of signals, Non-Parametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum Variance Spectral Estimation	**08**

Course Outcomes

Upon successful completion of this course, candidates will be able to:

- Analyze the response of discrete-time systems
- Analyze discrete-time signals and systems using DFT and FFT
- Apply FFT and STFT for feature extraction of signals
- Design and implement digital finite impulse response (FIR) and infinite impulse response (IIR) filters

- Understand the power spectrum estimation, and able to apply in different application of the digital signal processing

Text Books

1. J.G. Proakis, and D.G. Manolakis, " Digital Signal Processing", 4th Edition, Pearson, 2007.
2. M.H.Hayes, "Digital signal processing", Schum's outlines, Tata McGraw Hill, 2007

Reference Books

1. A.V.Oppenheim, R. W. Schafer, and J. R. Buck, "Discrete-time signal processing", Pearson, 2004.
2. Andreas Antoniou, "Digital Signal Processing : Signals, Systems and Filters", Tata McGraw Hill, 2006

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Digital Signal Processing Lab

Course Code: BEECA2C006P

Course Title: Digital Signal Processing Lab

Semester: V

Credits: 01

Course Outlines

- Getting familiar with MATLAB Programming
- To perform signal generations and manipulations
- To perform the convolution and correlation.
- To perform the circular or periodic convolution.
- To perform the long data filtering using overlap save and overlap add method
- To perform the discrete Fourier transform of the discrete time signals.
- To analyze the spectral parameters of the window functions.
- To perform the short time Fourier transforms (STFT) of non-stationary signals.
- To Design low pass and high pass FIR filters using window method
- To design band pass and band stop FIR filters using window method
- To perform the non-parametric power spectral estimation
- To perform the parametric power spectral estimation