Koneru Lakshmaiah Education Foundation

(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

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Department of Electronics and Communication

Program: B. Tech

Academic Year: 2024-2025

Y24 MAPPING OF COURSE OUTCOMES

S No	Course Code	Course Title	CO NO	Description of the Course Outcome
1	24EC2228F	Biomedical Electronics & IOT For Healthcare	1	Analyze the human bio-electric and Nonelectrical signal characteristics and understand the functionality of each body parts.
			2	Apply the Knowledge of Medical Instruments in clinical and ambulance to assist the
			3	Apply the knowledge of various Bio-sensors for healthcare using Nextgen Internet of Things Technology.
			4	Analyze the various applications of IoMT in real world.
			5	Design the IoT based Health monitoring and Elderly Assist modules.
2	24EC2236F	Electronic Circuits For Medical Instrumentation	1	Identifying sources of bioelectric phenomena in nerves, muscles and examine the general properties of physiological systems, including nonlinearity and non-stationarity.
			2	Demonstrate amplifiers and find random noise related factors which is to be useful measures of a signal conditioning systems.
			3	Interpret aliasing and the sampling theorem, Analog-to-digital and digital-to-analog converters.
			4	Illustrate several circuits and systems applied in medical instrumentation.
			5	Experimental design, simulate and analyze bio signal characteristics using MATLAB/Multisim/COMSOL.
3	24BMI3101R	Biomedical Signal And Image Processing	1	Demonstrate the basic concepts related to Biomedical signals and images.
			2	Classify the Bio medical signal processing methods to eliminate the artefacts arise in biomedical signals.
			3	Explain the Biomedical imaging and enhancement techniques.
			4	Apply advanced signal processing approaches for biomedical signals and images.
			5	Analyze and Implement appropriate signal/Image processing algorithms for practical problems involving biomedical signals and systems Using MATLAB.

4	24BMI3202	Advanced Biomedical Signal And Image Processing	1	Summarize the basic concepts of digital signal processing techniques and identify the nature of Biomedical signals.
			2	Apply the Filtering Techniques.
			3	Analyze the various Techniques for Detection of Events and Biosignals.
			4	Analyze several circuits and systems for the application in medical instrumentation.
5	24BMI3303R	Materials For Bio-Medical Applications	1	Summarize the characteristics of biomaterials.
			2	Apply surface modification for biomedical applications.
			3	Apply Biocompatibility Testing and Response of Biomaterial to Human Body.
			4	Analyse Bio-implants & Surgical Aids for biomedical applications.
			5	Design and evaluate a solution based on nanomaterial technology for a given need in the field of healthcare and biomedical Engineering using COMSOL/OFDTD.
6	24BMI3404	Nanotechnology And Nanosensors	1	Summarize the basic concepts of Nanosensors
			2	Interpret the fabrication, characterization of nanosensors
			3	Apply nanomaterials to manipulate nanosensors
			4	Apply quantum dots in Sensing and Imaging Application.
7	24BMI3505	Biosensing And Bioelectronics	1	Summarize the working principles of biosensors
			2	Interpret characterization of optical and electrochemical sensors
			3	Apply the response of biosensors
			4	Analyse selective biomedical devices for future applications
			5	Design and interfacing of Biological Systems with electronic systems, non-conventional bioelectronic devices using SPICE/OFDTD/COMSOL
8	24EC2105	Signals & Communication Systems	1	Understand the basic Continuous Time Signals and Systems
			2	Solve the frequency domain challenges and applications to systems.
			3	Interpret the principles of linear and angle modulation and demodulation techniques.
			4	Analyze the analog transmitters and receivers in the presence of noise
9	24EC2208	Digital Communications	1	Understand the pulse modulation techniques.
			2	Interpret the transmission through band limited signals.
			3	Analyze the Digital Transmission via Carrier Modulation
			4	Analyze the Spread Spectrum Modulation
			5	Analyze the non linear equilizers and modulation BER errors due to channel.
10	24EC2226F	Wireless Communication	1	Understand working of cellular mobile communication and methods to imrove channel capacity and reduce interference
			2	Explore and study different fading mechanisms in mobile communication
			3	Apply the concepts of equalization and diversity techniques to mitigate fading in wireless channels

			4	Interpret the concepts of Wireless Architecture and Standards
			5	Analyze Spectrum bands of wireless technologies, verification of different types of fading and study various communication protocols
11	24EC2234F	Radio Wave Propagation	1	Explore different frequency bands used in wireless communication and study Propagation Mechanisms.
			2	Analyze Mobile Radio channel characterization with focus on signal variations.
			3	Interpret tropospheric effects and ionospheric effects on radio wave propogations
			4	Analyze wave Propagations in Underwater by analyzing acoustic waves.
			5	Analyze various Spectrum bands of wireless communication and study different types of fading with various communication protocols
12	24WLT3101	4G Wireless Technologies And Cellular Communication	1	Interpret the Spreading Sequences and Multiuser systems and systems for packet evolution
			2	Demonstrate the Multi carrier modulations using OFDM
			3	Extrapolate the MIMO systems and its eigenmode channels
			4	Analyse the Ultra-Wide Band technologies and challenges
			5	Determine the multicarrier systems and multi antenna systems
13	24WLT3202	Modern Satellite Communication Systems	1	Interpret the concepts of satellite orbits, orbital mechanics and frequency allocations to enable Earth space communications.
			2	Interpret the subsystems that enable control of orbit and attitude in satellites.
			3	Analyze the atmospheric impairments and mitigation techniques to enable earth-space communication.
			4	Analyze satellites application in enabling the 5G ecosystem.
			5	Analyze the mission requirements and simulate complex ground, sea, air, and space platform analyses in an integrated environment.
14	24WLT3303	5G NR Wireless Technologies	1	Interpreting the 5G's architectural framework, quality of service, security, and call flow process as per 3GPP standards, and unlock the potential of its use cases, deployment, and operational scenarios.
			2	Interpret the Multi-RAT Dual Connectivity (MR-DC) architecture from the UE and RAN perspectives, MR-DC bearers and strategies for managing secondary RAN node mobility and key 5G protocols for effective communication and security in mobile networks.
			3	Apply channel sounding, transport channel processing, and physical layer control signalling to design a radio-interface architecture that enables wireless connectivity.
			4	Analyze Multi-Antenna Transmission and Beam Management scenarios for enabling channel capacity for high throughput communications.
			5	Analyze the QoS requirements for enabling real time communications and private networks.
15	24WLT3404	Optical Wireless Communications	1	Interpret the behavior of wireless optical channel and its scattering parameters.

			2	Apply various channel models for estimation of losses in optical wireless communication.
			3	Analyze and interception of modulation techniques utilized in VLC.
			4	Analyze the application of optical source detectors
			5	Analyze the free space optical communications communications techniques.
16	24WLT3505	Machine Learning For Wireless Communications	1	Assess mobile network coverage and optimize capacity using machine and deep learning algorithms.
			2	Analyze techniques to optimize energy efficiency in mobile networks and automate them using Machine Learning.
			3	Analyze the Adaptive Modulation and Coding techniques in a mobile network using Machine Learning to optimize capacity and coverage.
			4	Analyze channel equalizers for enhancing efficiency in a mobile network using deep learning algorithms.
			5	Analyze mobile network optimization techniques using Machine Learning and Deep Learning algorithms.
17	24EC2210	Network Protocols And Security	1	Apply the knowledge of communication to understand the concepts of physical layer and datalink layer.
			2	Analyse various MAC protocols and apply IP addressing concepts to subnet a network.
			3	Analyse static and dynamic routing algorithms and transport layer protocols.
			4	Analyse application layer protocols and various cryptographic algorithms
			5	Analyse the functionality of the network using different protocols and working of various cryptographic algorithms.
18	24EC2235F	Resilient Networks	1	Interpret the basics of network threats and attacks
			2	Interpret network security Protocols and technologies such as SSL, TLS and IP Security Architecture
			3	Interpret Network defense using Access control, Password management, Incident response, security awareness
			4	Analyze different Secure network architectures and Hardening
			5	Analyze the network security functions by configuring networks with the given requirements
19	24EC2239F	Wireless LAN	1	Apply the knowledge of networks to WLANs and 802.11 WLANs and IP Networking
			2	Radio transmission capacity, Throughout, Interpret Bandwidth, efficiency, Forword error correction
			3	Interpret WLAN switches and MAC Protocols
			4	Analyse IEEE8020.11 protocols and frame structure.
			5	Simulate and verify the connectivity of Access controller (AC) and Access points(AP) using eNSP simulator
20	24DCM3101	TCP/IP & Other Protocol Suites	1	Apply the knowledge of networks understand the Architectural Evolution of TCP/IP, standards, Comparisons between OSI/ISO & TCP/IP Protocol Suite, different Addressing systems, ATM ARP ARP and their analysis

			2	Analyse DHCP Theory and Operation, DHCP Architecture, DHCP Auto-Configuration: Network Address Translation
			3	Analyse Domain Name system
			4	Analyse ICMPv4/v6, IGMP, MLD, UDP, IP Fragmentation, IP Sec, EAP
			5	Analyse and deployment different protocols suites using Cisco packet tracer
21	24DCM3202	Cloud Computing And Networks Security	1	Apply the concepts of Cloud computing in Networking
			2	Able to analyse different Topologies and Architecture standards
			3	Apply security concepts in could computing
			4	Analysis of various Network Security issues
			5	Inspect the privacy and security, architecture, design in Edge computing
22	24DCM3303	VOIP Systems & Broadband Networks	1	Apply the basic concepts of Classical Telephony, IP Networking and SS7 signaling
			2	Analyze different VoIP Architectures and Protocols
			3	Analyze Broadband Wireless, Access Technologies, Passive Optical Networks and Fiber-to-the-Home in real time scenario
			4	Analyze Broadband Optical NWs and Multimedia Network-Connection
			5	Analysis of VoIP Protocols using Cisco packet tracer
23	24DCM3404	5G Mobile And IEEE Standards	1	Apply the concept of 5G & RF Front-End, advancement over LTE Beyond 4G, building Blocks of 5G, 5G Architecture, 5G for IoT Apps in modern communication issues.
			2	Apply the principles of advanced waveforms and air interfaces, 5G Waveforms, Channels, Milli-meter wave technology, 5G Radio Access Technologies.
			3	Apply 5G Evaluation & Applications: MTC, D2D Communication, Multi-hop D2D, Multi-carrier D2D
			4	Appy IEEE802Std: 802.11 (WiFi), 802.15.1 (Bluetooth), 802.15.4 (Zigbee), 802.16 (WiMax), 4G/5G
			5	Implementation of call procedures used in 5G networks in 5G lab.
24	24DCM3505	IP Multimedia Subsystems And Emerging Technologies	1	Interpret Next-Gen NWs, IMS Standards, Models, IMS Architectures and IMS Core NW
			2	Interpret IMS Protocol Stacks & IMS Operation: H248, MEGACO, RTP, RTCP, IMS to IMS Call/Flow Operation
			3	Interpret IMS-PSTN, IMS Services: Comparison of GSM, IMS, PSTN, Web-Msg, Voice Video, VoLTE, RCS
			4	Inspect Emerging Tech. of IMS & Appn: Cloud, IoT Applications, NFV, SDN, PDAS, DSL, Cable-Set-Top Box
			5	Inspect the knowledge of IP Multimedia Subsystems and Emerging Technologies to solve real world problems

24	24SDEC04	Design Of Networks Using NS-3	1	Analyze and simulate Simple Topology Creation, TCP/IP Performance Analysis, Routing Protocols Evaluation, Traffic Modelling, Quality of Service (QoS) Analysis, Using NS-3
			2	Analyze and simulate Congestion Control Algorithms, Network Security Analysis, Network Protocol Development, Wireless Network Simulation, Peer-to-Peer (P2P) Networks, MPLS, IoT, SDN Using NS-3
			3	Analyze and simulate Wireless Network Simulation, Peer-to-Peer (P2P) Networks, MPLS, IoT, SDN Using NS-3
26	24EC03HF	Peer-To-Peer Networks	1	Demonstrate the client - server networks and their dynamics
			2	Apply and Practice the unstructured networks and their applications
			3	Apply the random walk techniques for peer to peer networks
			4	Analyze the structured networks and their applications
			5	Analyze the different peer to peer networks
27	24EDS3101	Advanced Embedded Systems	1	Understand the concept of embedded systems and multicore System on chip.
			2	Identify the various communication interfaces and protocols for efficient embedded system and the interconnection networks.
			3	Development of Software Tools and Debugging Techniques
			4	Apply the concept of multicore SoC in building real time applications
			5	Analyse the programming of microcontroller and interface various peripheral devices to the microcontroller
28	24EDS3202	Embedded Systems For IOT	1	Able to Understand the requirements of functional blocks and the functioning of IoT devices
			2	Able to understand and apply the Communication models that are used for the development of the IoT based Systems
			3	Able to understand and apply different networking topologies and protocols used for the development of IoT based Networks
			4	Able to Understand and apply IoT Application in different Case studies
			5	Analyze the programming & interfacing of NODE MCU using the hardware/software tool
29	24EDS3303	EMBEDDED AND REAL-TIME SYSTEMS	1	Apply the different task-scheduling algorithms for real-time systems application
			2	Apply Multiprocessor scheduling and real-time communication, databases, and synchronization in Real-time System
			3	Able to analyse an RTOS and be able to interpret the feasibility of a task set to accomplish and Timers.
			4	Analyze to develop model-driven development approaches to construct an execution environment with case studies.
			5	Analyze a performance of real-time application and different task scheduling algorithms in real-time systems

30	24EDS3404	CLOUD ARCHITECTURE IN IOT	1	Able to understand the need for new computing paradigms and apply the major components of Cloud architectures.
			2	Able to Identify potential technical challenges of the transition process and suggest solutions.
			3	Able to Build data collection, analytics, and decision-making capabilities into these Cloud and Edge compute systems, Analyze data and application requirements and pertaining issues.
			4	Able to Design and model infrastructures and analytics into Cloud and Edge Computing to perform decision-making.
			5	Design Cloud and Edge compute systems to provide multi-level intelligence for IoT, transducers and other devices, using the OpenFog Reference Architecture.
31	24IN2202	Embedded System Design	1	Able to apply the principal concept of embedded systems and the architecture of embedded system design.
			2	Able to apply the role of controller, timer, and interfaces for embedded system design
			3	Able to design and analyse the various communication interface and protocols for efficient embedded systems.
			4	Able to analyse an embedded system considering the trade-off between designing functionality in hardware versus software.
			5	Able to apply and analyse the Embedded system design knowledge using the architecture and programming and Performance analysis for modular implementation for a complete system.
32	24EC2229F	Wireless Sensor Networks	1	Able to Understand the various theoretical concepts related to wireless sensors and networking of the sensors
			2	Apply WSNs Architectures, Energy consumption of Sensor nodes for the development of the IoT based Systems
			3	Apply different MAC protocols, Routing mechanism used for the development of WSNs Application
			4	Apply node and network management related concepts for real time application of WSNs
			5	Analyse the programming & interfacing of WSNs using the hardware/software tool
33	24MT2007	Random Variables And Stochastic Process	1	Apply Mathematical models of random phenomena and solve probabilistic problems.
			2	Analyze different types of random variables and compute statistical parameters of the random variables.
			3	Apply random processes in the time domain and model time varying linear systems.
			4	Analyze random processes in frequency domains and model spectral characteristics of LTI systems.
34	24EC2224F	Deep Network Architectures	1	Apply CNN and asses various metrics for realistic applications
			2	Apply various deep learning techniques for training and testing of data sets

			3	Apply various network architectures for the analysis of data
			4	Apply deep and recurrent neural networks with various case studies.
35	24GAM3101	Natural Language Processing And Applications	1	Apply the fundamental concepts in NLP and review different NLP applications.
			2	Apply the basic structure of NLP Pipelines for text-based applications.
			3	Analyze the performance of algorithms for semantics in NLP and prioritize them for the existing applications.
			4	Apply machine learning models for finding solutions for problems in NLP and judge their performance.
			5	Evaluate and Analyze the operations applied in NLP pipelines through Python code development using NLTK, SpaCY, and Tensorflow Frameworks.
36	24GAM3202	DEEP LEARNING FOR COMPUTER VISION APPLICATIONS	1	Understand the fundamentals of deep learning and neural network architectures for vision tasks.
			2	Apply convolutional neural networks (CNNs) for image classification and recognition.
			3	Analyze and implement object detection and segmentation methods.
			4	Evaluate advanced architectures like RNNs, GANs, and transformers in vision applications.
			5	Design and develop computer vision solutions using deep learning frameworks.
37	24GAM3303	GENERATIVE AI ARCHITECTURES	1	Understand the principles and evolution of generative AI models.
			2	Apply Variational Autoencoders (VAEs) and Generative Adversarial Networks (GANs) for data generation.
			3	Analyze diffusion models and transformer-based generative architectures.
			4	Evaluate generative AI techniques for images, text, and multimodal applications.
			5	Design and implement generative AI solutions for real-world problems.
38	24GAM3404	DESIGN OF LARGE LANGUAGE MODELS	1	Understand the foundations and architectures of large language models.
			2	Apply tokenization, embeddings, and attention mechanisms in LLM design.
			3	Analyze training strategies, scalability, and optimization techniques for LLMs.
			4	Evaluate performance, limitations, and ethical concerns of large language models.
			5	Design and implement applications using large language models for real-world tasks.
39	24GAM3505	AI PRODUCT DEVELOPMENT AND MANAGEMENT	1	Understand the lifecycle of AI product development and deployment.
			2	Apply design thinking and agile methods in AI solution development.
			3	Analyze market needs, user experience, and feasibility for AI products.

			4	Evaluate ethical, legal, and societal aspects of AI product management.
			5	Design and manage end-to-end AI products for real-world applications.
40	OEEC0011	Image Processing	1	Understand the fundamental concepts of a digital image processing system and transformation techniques
			2	Understand image enhancement techniques in spatial and frequency domains.
			3	Apply image restoration and compression techniques
			4	Apply image segmentation, representations, and description
41	OEEC0017	Machine Learning For Engineering And Scientific Applications	1	Understand machine learning concepts
			2	Apply machine learning techniques to engineering problems
			3	Explore real-world engineering and scientific applications
			4	Evaluate and interpret machine learning results
42	24EC2209	Electromagnetic Waves &Transmission Lines	1	Apply the laws of static fields to determine the boundary conditions on time invariant Electric fields.
			2	Apply the principles of static magnetic fields to determine the magnetic boundary conditions.
			3	Apply the concepts of time varying electric and magnetic fields to analyze the propagation characteristics in conducting and dielectric media.
			4	Apply the principles of wave propagation in bounded media and analyze the propagation characteristics in transmission lines.
43	24EC2224F	Radiating Systems & Wave Propagation	1	Apply the concept of radiation mechanism of EM waves and interpret the relationships between antenna parameters.
			2	Apply the theoretical principles of a small current element and illustrate the power radiated by different antennas and their radiation characteristics.
			3	Analyze different types of antennas arrays and discuss the antenna in real time applications.
			4	Analyze the atmospheric and terrestrial effects on radio wave propagation at different frequencies.
44	24EC2233F	RF System Design	1	Apply the behavior of high frequency components and Interpret RF and Microwave Circuit using Scattering parameters.
			2	Interpret different types of RF filters and its design considerations.
			3	Analyze Stability Considerations and Stabilization methods of RF Amplifiers using Small Signal Analysis and configure basic RF Oscillator circuit.
			4	Analyze RF Receiver circuit design, its optimization techniques and real time applications.
45	24RFM3101	MICROWAVE ENGINEERING	1	Apply the high frequency parameter analysis for Microwave Components to study the behavior of Microwave passive components.
			2	Apply the concept of Microwave Active components and Microwave tubes
			3	Analyze the solid state device concept and microwave oscillators

			4	Analyze the measurement techniques for Microwave solid state devices
46	24RFM3202	Advanced Antenna Design For Wireless And 5G Applications	1	Interpret Antenna design for wireless and 5G Applications
			2	Interpret the basic Concepts for 5G FR1 Single Band and Multi-Band Mobile Antenna Design
			3	Analyze the concept of the different MIMO-Based 5G FR1 Band Mobile Antennas for 5G and Wireless Application
			4	Analyze the different Antenna-in-Package for 5G and Mobile Antennas
47	24RFM3303	Modern Radar Systems & Navigational Aids	1	Interpret the principles of operation and design of radar systems
			2	Apply the target-based concept to various types of Radars for Air Traffic Control applications.
			3	Analyze the principles of various Radar tracking systems used in different applications
			4	Analyze the concepts related to different tracking systems and sensors for navigation.
48	24RFM3404	RF And Millimeter-Wave Circuit Design	1	Apply the concept of Amplifier to different RF & mm-Wave transceivers
			2	Interpret the concept of Mixers design for RF & mm-Wave.
			3	Analyze the concept of Oscillators to design for RF Oscillators for mm-Wave.
			4	Analyze the concepts of RF and Millimeter-Wave circuits for various synthesizers.
49	24RFM3505	Satellite Design	1	Apply the Kepler's law concepts for Satellite design
			2	Interpret the subsystems and payload requirements of a satellite
			3	Analyze the Structural requirements and specifications of a satellite
			4	Analyze the concepts for mission planning and designing of CubeSats
50	24SDEC03	Planar Antenna Design Using HFSS	1	Analyse the concept of feeding techniques for MSA application
			2	Analyse the various Parameters of MSA
			3	Design and analyse the Slot mechanism for Microstrip Patch to enhance bandwidth
51	24SDEC04	Advanced Radiating System Modeling	1	Design and analyze the Concept of Array and MIMO antenna for wireless applications
			2	Design and analyze the Concept of defected ground structure for Ultra-wide band
			3	Design and analyze the concept of Reconfigurability for Mobile applications
52	OEEC0014	Electronic Warfare, EMI & EMC	1	Interpret the basic concept of Electronic Warfare
			2	Interpret the concept of EMI and EMC
			3	Apply the different EMI control techniques for EMC
			4	Demonstrate the different EMC design guidelines for testing of EMC.
53	24EC2223F	Fundamentals Of Robotics	1	Apply the functional elements to build simple robot
			2	Apply Denavit -Hattenberg parameters to position the manipulators
			3	Apply the differential motion through Jacobian to control the manipulator

			4	Analyze the force control techniques using Lagrange dynamic model
			5	Analyze the movement of manipulator with the required kinematics.
54	24EC2231F	Electronics Instruments & Automation	1	To understand the characteristics of Electronics instruments and their Measurements and use them to compute measurements.
			2	Explore the fundamental design concepts of Electronic Measuring Instruments and discover their usage in real time environment.
			3	Applying the importance of Control Systems in Automation to construct a robotic system with desired response.
			4	To analyze the industrial automation-based applications and summarize their advantages in sustainable development.
			5	Synthesize various electronic instruments and control systems for automation.
55	24RAN3102	Advanced Robotics	1	Apply the control techniques for path planning.
			2	Apply the basics of DH parameters for developing the models of Advanced Robotic Manipulator.
			3	Apply the functional and critical operational Robotics methods for preparing advanced level of Robotics.
			4	Analyze the concepts of Advanced Robotics Systems and Real-time environment for various applications.
			5	Analyze the fetch and frieght robots with various coordinate frames and joint angles
56	24RAN3202	Autonomous Vehicles & Automotive Electronics	1	Understanding and applying the basics of vehicular dynamics and control for autonomous vehicles.
			2	Study different types of sensors and actuators used in vehicles and apply them to control different vehicular parameters.
			3	Understand and apply the concepts of Automotive Electronics to automotive systems and subsystems.
			4	Apply the basics of wireless electronics and networking to attribute the reliability, safety, and smartness to autonomous vehicles.
57	24RAN3304	Autonomous Mobile Robot Systems	1	Apply the basic mechanical and electrical systems concerning robots' locomotion and manipulation.
			2	Apply the mathematical models and computational and motion control methods to mobile robotic systems.
			3	Apply the sensor systems related to state measurements, navigation and localization.
			4	Analyse the A-star, Dijkstra algorithm for planning the required path.
			5	Analyse the path planning for the multiple robots
58	24RAN3406	Human Machine Interface & Brain Machine Interface	1	Apply Norman's model to HMI
			2	Apply different GOMS models, Fitts Laws for improving the Human Machine Interaction
			3	Apply the concepts of Brainwaves for Bain Machine Interface
			4	Analyze different methodologies for HMI/BMI Applications

59	24RAN3507	Computer Vision &Robotics Applications	1	Apply the fundamental concepts of signal processing to computer vision
			2	Apply different methodologies of feature extraction, pattern analysis and visual geometric modelling to stochastic optimization problems
			3	Apply various Boundary and Edge Detection techniques in 3D signal (Video).
			4	Analyze the classifiers in different applications such as Biometrics, Medical diagnosis, document processing, mining of visual content, surveillance, and advanced rendering.
			5	Analyse the histogram and texture of image and Classification Model LDA in Python / MATLAB for Computer Vision applications
60	24RAN3101	Robot Motion Planning, Dynamics& Control	1	Understand the basic principles of robot trajectory planning
			2	Apply motion of robot in the presence of obstacles
			3	Analyze motion planning and robot control
			4	Perform basic motion, force, and hybrid motion-force control to mobile robotics.
			5	Perform lab experiments using Robo studio and Movelt studio for motion planning.
61	23RAN3203	Robot Manipulation & Wheeled Mobile Robots	1	Understand the various contacts elements required for robot's manipulator
			2	Apply the concept of forces/ friction to find out the performance of the manipulator
			3	Apply the basic concepts used to check the performance of mobile robots
			4	Apply the concept of feedback control and odometry for Mobile robots
62	24RAN3405	Artificial Intelligence For Robotics	1	Understand the concepts of AI
			2	Apply basic principles of AI in solutions that require problem-solving
			3	Apply basic principles of AI in solutions that require planning
			4	Analyze AI in Robotics
63	24EC1101	Basic Electrical & Electronic Circuits	1	Understand the basic concepts of circuits and its fundamentals
			2	Grasp the principles of AC circuits, including sinusoidal waveforms, impedance, and power factor.
			3	Comprehend the behavior of basic electronic components, such as diodes, and transistors.
			4	Understand the basic functional Principles of analog and digital ICs.
			5	Design and test simple electrical and electronic circuits for practical applications.
64	24EC2107	Analog Electronic Circuit Design	1	Apply the knowledge of Semiconductor physics and discuss BJT configurations and their applications
			2	Apply the limitations of BJT and discuss the characteristics and applications of Field Effect Transistors

			3	Apply the linear and nonlinear circuits approaches and realize the characteristics of operational Amplifiers
			4	Apply the concept of a feedback system and realize the working principles of Oscillators and multivibrators
			5	Design and analyze analog circuits for real-time applications using Passive and Active Components.
65	24EC2211	VLSI Design	1	Realize MOS device with transient and DC characteristics
			2	Understand the characteristics of CMOS inverter
			3	Analyze the static and dynamic characteristics of CMOS circuits
			4	Evaluate the performance of CMOS circuits
			5	Design and implement the combinational and sequential circuits using Cadence VLSI Design Full Suite
66	24VLS3101	ANALOG VLSI DESIGN	1	Understand MOS transistor characteristics and small-signal models
			2	Apply current mirrors, biasing techniques, and differential amplifiers in circuit design.
			3	Analyze performance metrics of analog building blocks such as gain, bandwidth, and noise.
			4	Evaluate operational amplifier architectures and their stability.
			5	Design and simulate analog VLSI circuits for practical applications.
67	24VLS3202	TESTING AND VERIFICATION OF VLSI CIRCUITS	1	Understand fault models and the need for testing in VLSI circuits.
			2	Apply simulation-based and formal verification techniques for digital designs.
			3	Analyze design-for-testability (DFT) methods such as scan chains and BIST.
			4	Evaluate test pattern generation, fault coverage, and performance metrics.
68	24VLS3303	VLSI PHYSICAL DESIGN AUTOMATION	1	Understand the fundamentals of VLSI design flow and physical design stages.
			2	Apply partitioning, floorplanning, and placement techniques in chip design.
			3	Analyze routing algorithms and clock tree synthesis methods.
			4	Evaluate design rule checks, power optimization, and timing closure strategies.
			5	Design and implement automated physical design solutions using CAD tools.
69	24VLS3404	MIXED SIGNAL IC DESIGN	1	Understand the principles of mixed-signal circuits integrating analog and digital domains.
			2	Apply data converter architectures such as ADCs and DACs in IC design.
			3	Analyze clock generation, phase-locked loops, and timing issues in mixed-signal systems
			4	Evaluate noise, nonlinearity, and performance trade-offs in mixed-signal circuits.
70	24VLS350	SYSTEM-ON-CHIP	1	Understand the fundamentals of SoC architecture and design

	5			methodologies.
			2	Apply hardware/software co-design principles in SoC development.
			3	Analyze on-chip interconnects, memory subsystems, and processor cores.
			4	Evaluate power, performance, and area trade-offs in SoC design.

71	24EC2241F	FUNDAMENTALS OF NANOTECHNOLOGY	1	Understand the concepts of nanoscale science and size-dependent phenomena..
			2	Apply synthesis techniques for nanomaterials using physical and chemical methods.
			3	Analyze the structural, electrical, optical, and mechanical properties of nanomaterials.
			4	Evaluate the applications of nanotechnology in electronics, energy, and healthcare.
			5	Design simple nanosystems and assess their potential for real-world applications.
72	24EC2242F	NANOSCALE IMAGING AND ANALYSIS	1	Understand the principles of imaging and analysis techniques at the nanoscale.
			2	Apply electron microscopy methods such as SEM and TEM for nanomaterial characterization.
			3	Analyze surface properties using scanning probe techniques like AFM and STM.
			4	Evaluate spectroscopic methods for chemical and structural analysis of nanomaterials.
			5	Interpret nanoscale imaging data using computational and MATLAB-based tools.
73	24NT03102	NANOSCALE ENGINEERING FOR CLEAN ENERGY	1	Understand nanoscale principles relevant to clean energy generation and storage.
			2	Apply nanomaterials in solar cells, fuel cells, and batteries.
			3	Analyze the role of nanostructures in enhancing energy conversion efficiency.
			4	Evaluate nanotechnology-based solutions for sustainable and renewable energy.
			5	Design nanoscale engineering approaches for advanced clean energy applications.
74	24NT03203	NANOTECHNOLOGY AND	1	Understand the fundamentals of nanotechnology and nanoscale materials.
			2	Apply nanomaterials in the

		NANOSENSORS		design and development of sensors.
			3	Analyze the working principles of nanosensors for physical, chemical, and biological detection..
			4	Evaluate performance metrics such as sensitivity, selectivity, and stability of nanosensors.
75	24NT03305	NanoMaterials For Bio-Medical Applications	1	Understand the interaction of nanomaterials with biological systems.
			2	Apply nanomaterials in drug delivery, imaging, and diagnostics.
			3	Analyze the biocompatibility and toxicity issues of biomedical nanomaterials.
			4	Evaluate the role of nanomaterials in tissue engineering and regenerative medicine.
			5	Design nanomaterial-based biomedical solutions for healthcare applications.
76	24NT03408	INDUSTRIAL NANOTECHNOLOGY	1	Understand the principles of nanotechnology applied in industrial processes.
			2	Apply nanomaterials for enhanced performance in manufacturing and product design.
			3	Analyze the role of nanotechnology in energy, textiles, coatings, and electronics industries.
			4	Evaluate the economic, safety, and environmental aspects of industrial nanotechnology.
77	24NT03509	Biosensing And Bioelectronics	1	Understand the fundamentals of biosensors, biorecognition elements, and transducers.
			2	Apply electrochemical, optical, and nanomaterial-based techniques in biosensing.
			3	Analyze signal processing and electronic interfacing in bioelectronic devices
			4	Evaluate performance metrics such as sensitivity, selectivity, and response time of biosensors.