Department of Electronics and Communication Engineering

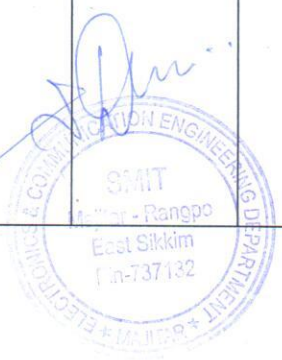
Sikkim Manipal Institute of Technology

Course Outcomes

III SEMESTER

Srl. No.	Semester	Subject code	Subject Name	Course Outcomes
1.	III	MA1303	Engineering Math-III	**CO1:** Able to perform critical analysis using mathematical tools to build a better electronic device/system. **CO2:** Gather the knowledge of Fourier Series and Fourier Transform which are very useful in Digital Signal Processing within an Electronic System. **CO3:** Learn the concept of Gradient, Divergence, Curl which are essential tools in Electromagnetic Appliances like Antenna Designs. **CO4:** Able to easily achieve the analytical solution for mathematical modeling of any engineering system.
2.		EC 1303	Electronic Devices and Components	**CO1:** The students should be able to learn about the fundamentals of semiconductor physics. **CO2:** The students should be able to gain insight of P-N Junction diodes and different types of contacts. **CO3:** The students should be able to gain idea about bipolar junction transistors (BJT). **CO4:** The students should be able to design different transistor amplifier circuits. **CO5:** The students should be able to understand the working of field effect transistors (FETs).
3.		EC1304	Electronic Instrumentation and Measurements Subject Code:	**CO1:** Students will be able to gather knowledge on basic measurement concepts. **CO2:** Students will be able to understand the concept of various bridges and their applications **CO3:** Students will be able to gather knowledge on various electronic measuring instrument, display devices and recorders.

				CO4: Students will be able to understand the knowledge of sensors and transducers **CO5:** Students will be able to understand telemetry and telecontrol.
4.		**EC1305**	**SIGNAL AND SYSTEM**	**CO1:** Students should be able to understand basics of signals and systems and their mathematical representation. **CO2:** Students should be able to interpret spectral analysis of periodic and aperiodic signals using Fourier methods. **CO3:** Students should be able to understand the LTI systems and their effect on signals passing through them in time and frequency domains. **CO4:** Students should be able to apply Laplace transform to continuous-time domain signals/systems for stability analysis. **CO5:** Students should be able to apply Z- transform to discrete-time domain signals/systems for stability analysis.
5.		**EC1306**	**Digital Electronics**	**CO1:** Students will be able to build basic knowledge on Binary System **CO2:** Students will be able to design combinational logic circuits with practical applications **CO3:** Students will be able to design sequential logic circuits with practical applications **CO4:** Students will be able to understand the internal circuits of various logic family ICs **CO5:** Students will be able to understand the basics of semiconductors memories
6.		**EC1308**	**Network Analysis and Synthesis**	**CO1:** Students will be able to understand the basic concepts of network theorems of electrical networks and apply them for analyzing electrical circuits. **CO2:** Students will be able to apply different mathematical tools like Laplace transform and differential equations for analyzing electrical networks **CO3:** Students will be able to calculate the network function and two port network parameters of an electrical network



				CO4: Students will be able to implement graph-based approach for network analysis **CO5:** Students will be able to design and understand the fundamentals of passive filters and synthesize electrical circuits from a given network function.
7.		**EC-1361**	**Electronics Devices and Components Laboratory**	**CO1:** Aware of how to use some basic instrument i.e. CRO, DMM, Function Generator, Power supply etc. for different electronics characterization. **CO2:** Identify different basic electronic components i.e. resistors, capacitors, inductors, diodes, transistors etc. **CO3:** Complete the experiments in laboratory and prepare the technical report. **CO4:** Realize how modern electronics industry reduces the size, cost as well as increases the performance of our daily life electronics appliances.
8.		**EC-1362**	**Signal And Circuit Simulation Laboratory**	**CO1:** Basic MATLAB programming (M-file) to generate different kinds of signals. **CO2:** Construct basic electrical circuits by using MULTISIM.
9.		**EC-1363**	**Digital Electronics Laboratory**	**CO1:** Practically see the working of the digital logic circuits designed by them. **CO2:** Experience the issues related to building the practical circuits and troubleshooting. **CO3:** Get the idea of using the available components and devices in efficient way.

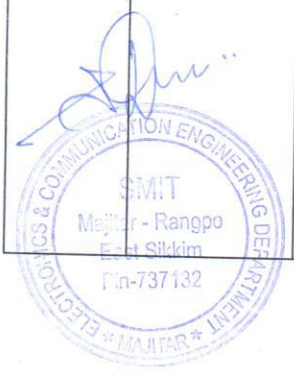
IV SEMESTER

Srl. No.	Semester	Subject code	Subject Name	Course Outcomes
1.	**IV**	**MA-1402**	**Engineering Math-IV**	**CO1:** Students will understand the basic concepts of Probability, conditional probability, independency, Baye's theorem, one dimensional random variable, mean, variance, expectation, Chebyschev's inequality, Two and higher dimensional random variables, covariance, correlation coefficients and curve fitting. **CO2:** Students will be able to apply the concepts of different probability distributions (Binomial, Poisson,

				Uniform, Normal, Gamma, Chi-square and exponential) in different areas of engineering and physical problems. **CO3:** Students will be able to apply probability distributions in Digital Communications & Modeling of physical problems. **CO4:** Students will be able to set up mathematical models of physical problems and its numerical solutions.
2.		**EC1403**	**Electromagnetic Waves**	**CO1**: Students should be able to apply the concepts of vector analysis, coordinate systems, and vector algebra in solving electromagnetic wave problems. **CO2:** Students should be able to comprehend the concepts of electrostatics and apply the knowledge in solving the relevant problems. **CO3:** Students should be able to comprehend the concepts of magnetostatics and apply the knowledge in solving the relevant problems. **CO4:** Students should be able to understand the Maxwell equations in steady and time-varying conditions. **CO5:** Students should be able to understand the electromagnetic wave propagation through different media and power measurement using Poynting vector theorem.
3.		**EC1404**	**MICROPROCESSORS**	**CO1:** Students should be able to understand the internal architecture, instruction set and working of 8085 microprocessors. **CO2**: Students should be able to write 8085 assembly language programs. **CO3:** Students should be able to understand interrupts and peripherals and implement hardware interfacing-based projects. **CO4:** Students should be able to understand the internal architecture, instruction set and working of 8086 microprocessor and other advanced processors. **CO5:** Students should be able to understand 8051 microcontroller and implement related projects.
4.		**EC1406**	**Design and Analysis of Digital Systems**	**CO1:** Students should be able to design and analyze synchronous sequential circuits

				CO2: Students should be able to design and analyze asynchronous sequential circuits **CO3:** Students should be able to understand the concept of VLSI design **CO4:** Students should be able to test digital circuits **CO5:** Student should be able to understand multivibrators.
5.		**EC1408**	**Analog Electronics & Integrated Circuits**	**CO1:** Students should be able to understand and design different types of feedback amplifiers and Oscillator **CO2:** Students should be able to understand and design different types of power amplifiers **CO3:** Students should be able to understand the working principle of Operational Amplifier and implement the linear and non-linear applications of Operational Amplifier **CO4:** Students should be able to analyze and design different types of filter circuits using OPAMPs **CO5:** Students should be able to understand and design Multivibrators and Special functional circuits
6.		**EC1409**	**Analog Communication**	**CO1:** Students should be able to understand the fundamental components of analog communication system and its importance. **CO2:** Students should be able to understand the basic concepts of amplitude modulation and demodulation techniques. **CO3:** Students should be able to understand the low power variants of amplitude modulation and demodulation. **CO4:** Students should be able to understand continuous angle (frequency and phase) modulation techniques, their generation and detection **CO5:** Students should be able to evaluate the performance of analog communication systems in presence of noise.
7.		**EC-1461**	**Analog Electronic Circuits Laboratory**	**CO1:** Students will be aware of some of the topics like Voltage Doubler, Quadrupler, Amplifier, Oscillator, Op-amp experimentally. **CO2:** Students will be able to identify the importance of the major topics including filters, converters which are

				useful for different electronic techniques. **CO3:** Students will be able to realize how modern electronics industry reduces the size, cost as well as increases the performance of our daily life electronics appliances.
8.		**EC 1491**	**Data Structure**	**CO1:** Students should be able to impart the basic concepts of data structures and algorithms. **CO2:** Students should be able to understand concepts about searching and sorting techniques. **CO3:** Students should be able to understand basic concepts about stacks, queues, lists, trees and graphs. **CO4:** Students should be able to understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures. **CO5**: Students should be able to apply appropriate data structures to solve real-world problems efficiently.
9.		**EC-1462**	**Microprocessor Laboratory**	**CO1:** Students will be able to write and execute 8085 assembly language programs. **CO2:** Students will be able to learn 8085 executions set and try to implement them in the laboratory.
10.		**EC-1463**	**Digital System Laboratory**	**CO1:** Students will learn the basic knowledge required to build a circuit on a bread board using digital ICs. **CO2:** Students will practically see the working of the digital logic circuits designed by them. **CO3:** Students will experience the issues related to building the practical circuits and hence learns to fix those. **CO4:** Students will get the idea of using the available components and devices in efficient way.
11.		**EC1841**	**Semiconductor Physics**	**CO1:** Students should be able to demonstrate a clear understanding of concepts of semiconductor materials and the physics of the materials and devices. **CO2:** Students should be able to demonstrate an understanding of Quantum Theory of Semiconductors. **CO3:** Students should be able to understand various carrier statistics in semiconductors.



				CO4: Students should be able to apply various models for the current transport in a semiconductor under different conditions. **CO5:** Students should be able to exhibit a clear understanding of various carrier dynamics and mathematical derivations for continuity and concentrations in semiconductor
12.		**EC 1842**	**Sensors and Actuators in IoT**	**CO1:** Students should be able to gain insight of sensors and transducers **CO2:** Students should be able to gain basic idea about microprocessors and microcontrollers **CO3:** Students should be able to gain insight of actuators **CO4:** Students should be able to learn about the utilization of different sensors and actuators in IoT based applications **CO5:** Students should be able to learn about the interfacing of sensors and actuators to embedded systems and computers.
13.		**EC 1843**	**Signal Processing for Communication**	**CO1:** Students should be able to gain insight into signals and vector spaces. **CO2:** Students should be able to understand the fundamental ideas of Stochastic Signal Processing. **CO3:** Students should be able to understand the steps in the process of A/D conversion and D/A conversion. **CO4:** Students should be able to gain insight into basic ideas of Multirate Signal Processing, and its importance. **CO5:** Students should be able to understand the uses of signal processing for an end-to-end communication system.

V SEMESTER

Srl. No.	Semester	Subject code	Subject Name	Course Outcomes
1.	**V**	**EC1501**	**Antenna Theory**	**CO1:** Students should be able to apply principles of electromagnetics to explain antenna radiation. **CO2:** Students should be able to explain various antenna parameters and design different antennas. **CO3:** Students should be able to establish mathematical equations for

				various parameters of thin linear antenna and explain working of wire antennas. **CO4:** Students should be able to explain working of microstrip antennas and their applications. **CO5:** Students should be able to understand the concept of antenna arrays.
2.		**EC1502**	**Linear and Digital Control System**	**CO1:** Characterize any system in Laplace domain to illustrate different specification of the system using transfer function concept. **CO2:** Employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions. **CO3:** Analyze the stability of the closed and open loop systems in time domain and design the various kind of compensators. **CO4:** Formulate different types of analysis in frequency domain to explain the nature of stability of the system. **CO5:** Analyze control systems using state space models.
3.		**EC1504**	**Advanced Microprocessor**	**CO1:** Understand the important features of Intel 80x86 family of microprocessor. **CO2**: able to develop 8086 assembly language programs. **CO3:** Understand the internal architecture and instruction set, signals and various other features of 8086 microprocessor. **CO4:** Understand the signals and various other features of 8086 microprocessor. **CO5:** Understand the programming of 8051 microcontroller.
4.		**EC1505**	**Digital Signal Processing**	**CO1:** Analyze the frequency response of discrete-time domain signals using DTFT and DFT/FFT. **CO2:** Design analog IIR filters for given specifications. **CO3:** Design digital IIR filters from analog IIR filters by various mapping techniques. **CO4:** Design digital FIR filters for given specifications. **CO5:** Realize the IIR and FIR Digital Filter structures to be used in digital circuits.
5.		**EC 1507**	**Computer Networks**	**CO1:** Realize the layered structure of a computer network topology. **CO2:** Explain the various processes and protocols in a data link layer.

				CO3: Build a clear understanding of the role of network layer in a computer network. **CO4:** Exhibit the understanding of transport and application layer in a computer network. **CO5:** Identify the different areas of applications of a computer network.
6.		**EC 1508**	**Object Oriented Programming with C++**	**CO1:** The students should be able to understand the basic concept of Object-oriented programming. **CO2:** The students should be able to understand the basic features and syntaxes of C++. **CO3:** The students should be able to write programs using the different concepts of object-oriented programming. **CO4:** The students should be able to understand file handling and input output operation. **CO5:** The students should be able to apply the concept of OOPs to solve some practical problems.
7.		**EC1509**	**Embedded System**	**CO1:** Describe basics of design, modeling, development of embedded systems **CO2:** Develop the hardware for embedded system application based on the processors. **CO3:** Simulate and synthesis embedded system by using Embedded system and Linux operating system. **CO4:** Apply various real time algorithms and implement the RTOS development tools in building real time embedded systems. **CO5:** Design various advance embedded system.
8.		**EC-1562**	**Communication Laboratory**	**CO1:** Design of low pass, high pass, wide band reject and wide band pass Filters. **CO2:** Design of fundamental analog modulation and demodulation scheme. **CO3:** Design of fundamental digital modulation and demodulation scheme.
9.		**EC-1563**	**Object Oriented Programming Laboratory with C++**	**CO1:** Familiar with the OOPs method of programming using C++ language. **CO2:** Able to develop C++ program for different real time embedded systems. **CO3:** Able to meet the requirements of the Industrial IT multinationals with their C++ programming skills and hence will get employed.

10.		EC-1564	Embedded System Lab	**CO1:** Students will be able to create transistor-level circuit -schematics and mask-layout for digital integrated circuits. **CO2:** Students will be able to understand the basics of an embedded system Design, implement and test an embedded system.
11.		EC1581	Industrial Training-I	**CO1:** Encourage the students to practically visit the industrial sites to have the experience of actual sites. **CO2:** Motivate the students to get an industrial exposure which may help them in professional career. **CO3:** Able to know the Industrial needs during their Industrial visit, which in turn may help them in.

VI SEMESTER

Srl. No.	Semester	Subject code	Subject Name	Course Outcomes
1.	VI	EC1601	Microwave Engineering	**CO1:** Students should be able to describe the basic principles of microwave engineering and high-frequency power measurements. **CO2:** Students should be able to measure the effects of impedance mismatches on power transmission and the use of tuners for impedance matching. **CO3:** Students should be able to link the scattering matrix properties with the two port waveguides **CO4:** Students should be able to describe the characteristics of passive components and microwave devices **CO5:** Students should be able to design microwave amplifiers.
2.		EC1604	Digital Communication	**CO1:** Students should be able to understand the basic block diagram of Digital Communication **CO2:** Students should be able to understand and design various digital waveform coding techniques like PCM, DPCM and DM **CO3:** Students should be able to analyze the baseband digital modulation techniques like ISI, Optimal Receivers etc.

				CO4: Students should be able to understand and design various RF modulation and demodulation techniques like ASK, FSK, PSK, QPSK etc. **CO5:** Students should be able to analyze the concepts of information theory and coding
3.		**EC 1606**	**Java Programming**	**CO 1:** Students should be able to impart the basic concepts of Java Programming. **CO 2:** Students should be able to understand different Data Types, Variables, and Operators, Control statements and Loop. **CO 3:** Students should be able to understand Classes and Objects, and different Java coding methods elaborately. **CO 4:** Students should be able to understand Inheritance, Interfaces, and Packages. **CO 5:** Students should be able to apply the knowledge of Java for Exception Handling and Multithreaded programming and learn the uses of Applet.
4.		**EC 1607**	**Microelectronics and VLSI Design**	**CO1:** Students should be able to understand the importance of DSP and smart antennas used in 5G communication. **CO2:** Students should be able to understand the basic concepts of millimeter wave technology and 5G Ultra-Reliable and Low Latency Communication (URLLC) use cases **CO3:** Students should be able to understand the role of Machine Learning in Big Data Era for Smart City and Security in Smart Grids **CO4:** Students should be able to grasp the knowledge of Embedded Systems towards Smart World **CO5:** Students should be able to implement industrial and commercial requirements towards recent trends in ECE
5.		**EC 1638**	**Recent Trends In Electronics And Communication Engineering (EL-I)**	**CO1:** Students should be able to understand the importance of DSP and smart antennas used in 5G communication. **CO2:** Students should be able to understand the basic concepts of millimeter wave technology and 5G Ultra-Reliable and Low Latency Communication (URLLC) use cases. **CO3:** Students should be able to understand the role of Machine Learning in Big Data Era for Smart City and Security in Smart Grids

				CO4: Students should be able to grasp the knowledge of Embedded Systems towards Smart World **CO5:** Students should be able to implement industrial and commercial requirements towards recent trends in ECE
6.		**EC 1691**	**Database Management System**	**CO1:** Students should be able to describe fundamental elements of a relational database management system **CO2**: Students should be able to design entity-relationship diagrams to represent simple database application scenarios **CO3**: Students should be able to explain the basic concepts of relational data model, and Map Entity-relationship model, Relational database design, relational algebra, and database language SQL **CO4**: Students should be able to practically visualize database using SQL, SQLite and NoSQL **CO5:** Students should be able to explain the basic concepts of transaction processing, concurrency control, Locking techniques, Deadlock handling, Recovery mechanisms and Concepts of database security mechanisms
7.		**EC-1661**	**Digital Signal Processing Laboratory**	**CO1:** Students will get an idea about Matlab Programming related to DSP **CO2:** Students will be able to visualize the effects of Transformations like FFT on Signals **CO3:** Students will also be able to design various types of digital filters and see their response based on the design parameters.
8.		**EC-1664**	**VLSI Laboratory**	**CO1:** Know the basics of VHDL. **CO2:** Able to design any digital logic using ISE tool.
9.		**EC-1663**	**Embedded System Laboratory**	**CO1:** Students will be able to create transistor-level circuit -schematics and mask-layout for digital integrated circuits. **CO2:** Students will be able to understand the basics of an embedded system, Design, implement and test an embedded system.
10.		**EC-1671**	**Mini Project**	**CO1:** Apply the knowledge gained in B. Tech. curriculum. **CO2:** Develop a model/prototype of practical importance **CO3:** To know the practical know-how of theoretical knowledge

VII SEMESTER

Srl. No.	Semester	Subject code	Subject Name	Course Outcomes
1	VII	EC1701	Satellite and Optical Communication Systems	**CO1:** The students should be able to understand the concept of backbone communication based on Satellite and Optical Communication. **CO2:** The students should be able to analyze popular coding techniques used in Satellite and Optical Communication. **CO3:** The students should be able to explain various Satellite subsystems. **CO4:** The students should be able to design radio propagation links for satellite communication. **CO5:** The students should be able to understand the propagation techniques through optical fibers and the applications related to optical fiber communication.
1.		EC1705	Mobile Communication	**CO1:** Students should be able to explain the concepts of wireless/mobile communication using cellular environment. **CO2:** Students should be able to understand the various modulation and propagation techniques used in mobile communication. **CO3:** Students should be able to understand and analyze the multiple access techniques used in the mobile communication. **CO4:** Students should be able to analyze the various wireless network systems and standards (LTE/4G) used in Mobile Communication. **CO5:** Students should be able to understand the fast-changing technologies in the field of mobile communication
3.		EC1721	Industrial IoT & Industry 4.0	**CO1:** The students should be able to understand the basic features and requirements of Industry 4.0 **CO2:** The students should be able to establish the need of robotics in industry 4.0 **CO3:** The students should be able to elucidate how extended realities (XR)

				are effective to enhance the performance of industrial production. **CO4:** The students should be able to comprehend various communication protocols used for different IIoT applications. **CO5:** The students should be able to recognize the importance of data analytics and data security in Industrial IoT.
4.		**BA 1510**	**Industrial Management**	**CO1:** Students should be able to understand theories of management and their practical applications in solving business/ industrial problems. **CO2:** Students should be able to use the available resources to achieve the desired goal in a more efficient and effective way. **CO3:** Students should be able to apply the production technique in solving the issues related with proper management of material and inventory management. **CO4:** Students should be able to apply the operation techniques in solving the issues related with proper management of material and inventory management **CO5:** Students should be able to apply statistical methods to solve various business-related issues.
5.		**EC1737**	**Machine Learning**	**CO1:** Students should be able to apply supervised learning algorithms to solve the relevant problems. **CO2:** Students should be able to acquire the concepts of unsupervised learning algorithm to solve the relevant problems. **CO3:** Students should be able to understand fundamental concepts and different architectures of the Artificial Neural Network (ANN). **CO4:** Students should be able to understand the issues involved in applying machine learning algorithms in practice. **CO5:** Students should be able to apply machine learning algorithms in real world applications.
6.		**EC1731**	**Digital Image Processing, PE II**	**CO1:** The students should be able to understand the basic concepts and applications of Digital Image Processing.

				CO2: The students should be able to understand the various transformations used in image processing like DCT, DFT and DWT **CO3:** The students should be able to understand and implement image enhancement and image filtering operations. **CO4:** The students should be able to understand image segmentation and compression. **CO5:** The students should be able to understand and implement image processing applications like image compression and recognition
7.		**EC1750**	**Data Science, PE III**	**CO1:** The students should be able to understand the basic concepts of Data Science Process and the role of Data Scientists **CO2:** The students should be able to apply mathematical techniques needed to perform Data Analysis **CO3:** The students should be able to implement the R programming language for data manipulation **CO4:** The students should be able to implement algorithms used for data analysis and data visualization **CO5:** The students should be able to apply knowledge of Data Science for developing Business Strategies
8.		**EC 1723 (Open Elective)**	**MEMS & NEMS**	**CO1:** Students should be able to explain the basic operation of microelectronics mechanical system, different MEMS manufacturing technologies and MEMS Devices **CO2 :** Students should be able to design micro devices and micro systems using the MEMS fabrication process. **CO3:** Students should be able to apply the concept of MEMS in the field of bio medical engineering **CO4:** Students should be able to explain Nano electronics, Micro system technologies and Nano devices **CO5:** Students should be able to understand different digital and analog circuits by using nano devices
9.		**EC 1742 (Program Elective-III)**	**Internet Of Things**	**CO1:** The students should be able to explain the basics of IoT.

				CO2: The students should be able to apply different Networking protocols to IoT applications **CO3:** The students should be able to apply different communication protocols to IoT applications **CO4:** The students should be able to explain the importance of data analytics in IoT **CO5:** The students should be able to explain utilization of IoT in smart world
10.		**EC-1763**	**Microwave Laboratory**	**CO1:** Students will get practical exposure of microwave devices like klystron, Gunn diode etc are given **CO2:** Since all the set ups are made up of many microwave components like attenuators, frequency meter, waveguides etc, students can identify them and understand their use in such applications. **CO3:** In the same lab, experiments related to antennas used in microwave frequencies also described. **CO4:** Designing of microwave antennas using IE3D software is also taught to them so that they can use this knowledge for their further studies and carry out useful projects under the curriculum. **CO5:** Fiber optic communication are also described using kits where they get the knowledge of bandwidth, coupling losses and numerical aperture.
11.		**EC-1762**	**Advanced Communication Laboratory**	**CO1:** Emphasis on Fundamental concepts. **CO2:** Emphasis on Operating principles and practice of widely implemented communications systems. **CO3:** Emphasis on Hot research and development topics. **CO4:** Opportunities and challenges for future deployment of advanced wireless communications systems like WCDMA, LTE-Advanced (4G).
12.		**EC-1781**	**Industrial Training-II**	**CO1:** Encourage the students to practically visit the industrial sites to have the experience of actual sites. **CO2:** Motivate the students to get an industrial exposure which may help them in professional career.

				CO3: Able to know the Industrial needs during their Industrial visit, which in turn may help them in.

VIII SEMESTER

Srl. No.	Semester	Subject code	Subject Name	Course Outcomes
1.	VIII	EC-1875	Major Project	**CO1:** To prepare students for real life design project leading to quality publications. **CO2:** To explore and enhance research potential. **CO3:** To learn the latest trends and technology in selected field of interest.