I.T.S Engineering College, Greater Noida
Department of Electronics and Communication Engineering

S. No.	Subject Code/ Subject Name	Course Outcomes
1	REC301: DIGITAL LOGIC DESIGN	CO1: Students will be able to represent numerical values in various number systems and perform number conversions between different number systems CO2: Able to analyze and design digital combinational circuits like decoders, encoders, multiplexers, and de- multiplexers including arithmetic circuits. CO3: Students will be able to use the functionality of flip-flops for analysis and design of sequential circuits. CO4: Capable to analyze synchronous and asynchronous sequential digital circuits and able to identify and prevent various hazards CO5: Able to explain the nomenclature and technology in memory devices: ROM, RAM, PROM, PLD, FPGAs, etc.
2	REC302: ELCTRONIC DEVICES AND CIRCUITS	CO1: Ability to develop an in-depth understanding of the concept of carrier concentration and conduction mechanism in semiconductors. CO2: Able to apply the concept of semiconductor theory to various electronic and optoelectronic devices. CO3: Able to understand the circuit operation of the MOSFET and its applications as amplifier (low and high frequency operation) and switch. CO4: Able to understand the circuit operation of the BJT and its applications as amplifier (low and high frequency operation) and switch. CO5: Able to understand the concept of feedback, their properties and types, basic principle of sinusoidal oscillators and study of RC and LC oscillator circuits.
3	REC303: SIGNALS AND SYSTEMS	CO1. Able to describe signals mathematically and understand how to perform mathematical operations on signals. CO2. Able to understand Laplace-Transform and Z-transform, solutions of differential and difference equations, Regions of convergence (ROC), s- to z-plane mapping. CO3.Able to understand Fourier Transforms, FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT, Discrete time Fourier transform, inverse DTFT, convergence, properties and theorems, Comparison between CTFT and DTFT . CO4. Able to understand the classification of systems, co-relations, signal energy and energy spectral density, signal power and power spectral density, properties of power spectral density. CO5. Able to compute the Time and frequency domain analysis of systems, concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter.
4	REE305: NETWORK ANALYSIS AND SYNTHESIS	CO-1: Apply the knowledge of basic circuital law and evaluate transient response, Steady state response, network functions. CO-2: Analyze the circuit using Kirchhoff's law and Network simplification theorems and LT. CO-3: Analyze Graph Theory fundamentals. Computation of Ladder and Non-Ladder Networks. CO-4: Evaluate two-port network parameters, design attenuators and equalizers. CO-5: Synthesize one port network using Foster and Cauer Forms.
5	RVE301: HUMAN VALUES & PROFESSIONAL ETHICS	CO-1: To understand the importance of value education and professional ethics. CO-2: To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings CO-3: To know the importance of self-exploration as the ideal way for value education. CO-4: To understand the harmony at various levels. CO-5: To understand how to implement holistic understanding on professional ethics.
6	RAS301: MATHS-III	CO-1: Students should be able to understand the analyticity of function and to evaluate real integrals using complex variables. CO-2: Students should be able to understand the properties of integral transform and inverse integral transform and their applications to various engineering problems. CO-3: Students should be able to understand Probability and Statistics which are concerned with Engineering Problems. CO-4: Students should be able to understand various methods of Numerical Techniques to Finding the roots of an equation and Interpolation CO-5: Student will be able to analyze the various techniques to solve Linear Systems, ODE 's and ODE Systems by numerical techniques.

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1	REC401: Microprocessors & Microcontrollers	CO1: To introduce the students with the hardware details of 8085 microprocessor with the related signals and their implications. CO2: They will also learn programming and interfacing of 8085. CO3: To introduce students with the hardware details of 16-bit low-power MCU, MSP430. CO4: To introduce students with configuring peripherals in MSP430 and interrupts of MSP430. CO5: Students will also learn programming for interfacing of MSP430 with external hardware devices.
2	REC402: Electromagnetic Field Theory	CO1.Able to understand rectangular, cylindrical, and spherical coordinate systems, line, surface and volume integrals, Divergence and Stoke's theorem, Laplacian of a scalar. CO2.Able to understand Electrostatics, Electric field in material space and able to apply it for solving Electrostatic boundary value problems. CO3.Able to understand Magnetostatics, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, Magnetic forces, materials and devices. CO4.Ability to understand Maxwell's equation, Faraday's Law, Maxwell's equation in final form. CO5. Electromagnetic wave propagation, Power and the Poynting Vector, Reflection of a plain wave.
3	REC403: Electronic Inst. & Meas.	CO1: Able to develop an in-depth understanding of the concept of units, dimensions and standards. Different types of measurement errors and working principle of various DC measuring instruments. CO2: Able to develop an in-depth understanding of the working principle of Analog and Digital instruments for measurement of AC quantities. CO3: Able to understand the procedure for measurement of resistance, inductance and capacitance with the help of different types of bridges. CO4: Able to understand the construction, operation and applications of various types of oscilloscopes. CO5: Able to understand the concept of instrument calibration, construction and operation of recorders, plotters and transducers.
4	RCS406: Data Structures & Algorithms	CO1: Able to interpret and compute an algorithm to analyze the consumption of resources (time/space). CO2: Able to design and develop algorithm for stack, queue and list ADT to manage the memory using static and dynamic allocations. CO3: Able to implement different types of trees and to design applications like expression trees. CO4: Able to identify model, solve and develop code for real life problems like shortest path using graph theory. CO5: Able to design and develop the comparison based search algorithm and sorting algorithm,
5	RAS402: Environment & Ecology	CO1: To understand about the environment, ecosystem and impact of human activities upon the environment. CO2: To understand the natural resources, diseases caused by air and water and material cycles. CO3: To understand about the population growth, pollution, solid waste management and climatic problems. CO4: To understand the role of government, rules and regulations, NGO and women education.
6	ROE043: Laser Systems & Applications	CO1: Able to demonstrate understanding of basic principles of modern physics. CO2: Able to understand the basic phenomenon involved in interaction of light with matter, concept of light application, coherence and confinement of beam in an optical resonator. CO3: Able to demonstrate understanding of basic principal of laser action, mathematical analysis of laser system using laser rate equations and modification in the output of laser beam. CO4: Able to describe the principals and working of the most common laser types. CO5: Able to demonstrate understanding of practical applications of laser in industrial processing, medicine and surgery, fiber optic communication, holography and other fields.

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1	REC501: INTEGRATED CIRCUITS	CO1: Able to understand various types of Current Mirrors using BJT and MOSFETs, Large and Small Signal Analysis of various stages of an op-amp IC741C. CO2: Able to understand ideal and non-ideal linear applications of op-amp based Circuits, Generalized Impedance Converter Circuit and inductor simulation, First and second order filter realizations, State-Variable and Biquad Filters. CO3: Able to understand CMOS implementation of various Logic Gates, Boolean functions and Flip-Flops, Clocked SR and D Flip-flop Circuits. CO4: Able to understand different Non-Linear applications of IC Op-amps and various waveform generation circuits. CO5: Able to understand the operation and working of some special ICs like timer IC 555 and PLL 565, Analog-to-Digital and Digital-to-Analog Converters.
2	REC-502: PRINCIPLE OF COMMUNICATION	CO-1:Able to understand the basic building blocks of communication systems,the need for modulation, fundamentals of AM systems. CO-2:Able to understand the basic concept of angle modulation, methods used for modulation and demodulation of FM signals and few examples using MATLAB. CO-3:Able to understand the fundamentals of PAM, PWM, PPM and digital modulation scheme such as PCM, their representation, generation and introduction to the concept of power spectral density. CO-4:Able to understand the basic concept of DPCM, DM, ADM, and mathematical representation of noise signals. CO-5:Able to understand the fundamental of noise in AM and FM systems, SNR, and Figure of Merit.
3	REC-503: DIGITAL SIGNAL PROCESSING	CO1: Student will be able to understand and realize different types of realizations of digital systems (IIR and FIR) and their utilities. CO2: Student will be able to formulate the design parameters of analog IIR digital filters (Butterworth and Chebyshev filters) and various methods such as impulse invariant transformation and bilinear transformation of conversion of analog to digital filters. CO3: Student will be able to analyze different types of window functions used for the design of FIR filters. CO4: Student will be able to understand the principle of discrete Fourier transform & its various properties and concept of circular and linear convolution. Also students will understand the concept of FFT i.e. a fast computation method of DFT. CO5: Student will be able to understand the concept of decimation and interpolation. Also they will able to use it in various practical applications.
4	RAS-501: INDUSTRIAL MANANGEMENT	CO1: Introduce the basic knowledge of basic concepts of economic, demand theory, elasticity's, indifference curve and various techniques of Managerial Economics. CO2: Identify and model various type of demand forecasting that act on the production system and introduce the concept of supply analysis with reference to consumer requirement. CO3: Introduce the basic theories of production and cost and their application applicable to the industries. CO4: Introduce the basic concept and laws of various market conditions and competition theory. CO5: Explain the basic concepts of national income, GDP and business cycles.
5	RAS-502:INDUSTRIAL SOCIOLOGY	CO1: An ability to understand the relationship of society with science and engineering, and to be familiar with different social conditions and context at the work place CO2: To be aware of the various stages in the evolution of productive systems in order to understand today's working scenario CO-3: Awareness of different labor acts and policies so that the engineers can confront any unexpected situations in the industry CO-4: Knowledge about the industrial problems, grievances and disputes, and the different methods and mechanisms to handle such issues CO-5: An ability to visualize the future in respect to industrialization and various sociological concerns

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6	REC-051: ANTENNA & WAVE PROPAGATION	CO1: Able to understand the basics of Antennas like Radiation Intensity, Beam Efficiency, Signal-to-Noise Ratio. CO2: Able to understand the Point Sources and Their Arrays, Electric Dipoles, Thin Liner Antennas and Arrays CO3: Able to understand the operation of the Loop Antenna and Reflector Antenna., CO4: Able to understand the Ground Wave, Space Wave, Surface Wave and Sky wave Propagation
7	REC-052: COMPUTER ARCHITECTURE & ORGANIZATION	CO1: To understand design methodology at gate, register and processor levels. CO2: Developing the understanding of processor organization and data representation inside it. CO3: Analyzing arithmetic operations and pipeline processing inside processor. CO4: To understand the control system design including pipeline control in processors. CO5:To develop the understanding of the memory organization and communication methods of a computing system
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1	REC601: Microwave Engineering	CO1. To understands the basic concept of Microwaves waveguides. CO2. To distinguish different frequency spectrum, and microwave components. CO3. Able to understand about microwave tubes . CO4. Ability to understand microwave semiconductor diodes. & their applications. CO5. To understand different measurement techniques of microwaves.
2	REC602: Digital Communication	CO1:Able to Understand digital data transmission and generation & detection of various digital modulation systems. CO-2: Able to Understand concept of probability, random process and power spectral density. CO-3: Understands performance analysis of digital communication systems. CO-4: Understands Spread Spectrum Communications (FHSS, DSSS, CDMA & OFDM). CO-5: Able to Understand measure of Information, Source Encoding, generation and detection of different Error Correcting codes.
3	RIC603: Control Systems-I	CO1: Able to understand the basic components of a control system, block diagram reduction and signal flow graphs, DC Motors in Control Systems. CO2: Able to understand State-Variable Analysis, Similarity transformation, Concept of Controllability and Observability. CO3: Able to understand time-domain analysis of control systems and transient response of a prototype second order system. CO4: Able to understand the concept of stability of linear control systems using Routh-Hurwitz criterion and Root-Locus technique. CO5: Able to understand frequency-domain analysis using Nyquist stability criterion and the Bode plot.
4	RAS601: Industrial Management	CO1: Introduce the basic knowledge of production and productivity components of an industry and explain the various forms of industrial ownerships. CO2: Identify and model various functions of industrial process and support condition that act on management systems and introduce the concept of human resource management. CO3: Introduce the basic concept of work study and inventory management to the reducing and controlling cost of products. CO4: Introduce the basic concepts and laws of quality control and identify the various properties of TQM. CO5: Explain the project management and working of PERT/CPM.
5	RUC601: Cyber Security	CO-1: To understand the core information system, its development process, information assurance (IA) principles, various threats to information system and need of information security. CO-2: To understand the security issues associated with various applications and associated data, various threats and be able to identify the key components of cyber security network architecture, apply cyber security architecture principles. CO-3: To understand the process of developing the secure information system and various security issues associated with it. CO-4: To understand the need of different security policies, their development, review process and the security concerns in cloud, mobile, SCM, outsourcing etc. CO-5: To have the awareness about information security standards, cyber crimes, Cyber Laws, Intellectual Property rights and various laws related to softwares and semiconductors.
6	REC063: Analog Signal Processing	CO1. Students will become familiar with the new active elements used in modern signal processing circuits. CO2. Students will acquire the knowledge of Butterworth and Chebyshev responses at advanced level. CO3. Students will learn the various techniques of delay equalization used in signal processing circuits. CO4. Students will understand the realization techniques and properties of lossless ladder. CO5. Students will understand the operational transconductance amplifier circuits.

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1	REC075:Optical Communication	CO1. To understand the basic elements of an optical fiber communication link, basic principles of light propagation in optical fiber and classification of optical fiber structures. CO2. To understand and calculate different channel impairments like attenuation and dispersion for working out channel capacity. CO3. To understand characteristics, structures and working of optical sources required for optical fiber communication. CO4. To understand characteristics, structures and working of optical detector and receiver required for optical fiber communication. CO5. To analyze and design point - to – point fiber optic links, concept and components of WDM.
2	REC701:Data Communication & Networking	CO1. Able to describe and identify communication problem with its characteristics and mathematical models CO2. Explain representation of analog and digital modulated signals and signal to noise ratio. CO3. Able to explain optimal receivers and coding techniques in communication system. CO4. Describe Windowing techniques, Ethernet techniques and protocols required for communication system. CO5. Able to explain MAC layer protocols and channel allocation in LAN and MAN
3	REC702:VLSI DESIGN	CO-1: To Analyze the CMOS Fabrication and Layouts, how the design layers are used in the process sequence, and device packages and testing. CO-2: Ability to analyze various delay models with its timing and path analysis, power and its various dissipation methods in CMOS circuits. CO-3: To analyze energy- delay optimization, interconnect and it's modeling in low power architecture. CO-4: Ability to understand moderately complex dynamic logic circuits design and various semiconductor memories. CO-5: Able to analyze the low power CMOS logic circuits with its faults models and testing.
4	REC071:nformation Theory And Coding	CO1: To design the channel performance using the information theory. CO2: To obtain an understanding of the theoretical principles of source coding CO3: To focus on the application of Information Theory to communications in general and on channel coding and capacity in particular. CO4: To analyze various error correcting codes. CO5: Able to apply linear block codes for error detection and correction. Students will be introduced to convolution and block codes, decoding techniques, and automatic repeat request (ARQ) schemes.
5	ROE074:Universal Human Value	CO-1: To understand the importance of value education and professional ethics. CO-2: To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings CO-3: To know the importance of self-exploration as the ideal way for value education. CO-4: To understand the harmony at various levels. CO-5: To understand how to implement holistic understanding on professional ethics.
6	REC753:Industrial Training VivaVoce	CO-1.Understand the organisational structure of the industry and recognise the need of skill development. CO-2.Understand how to write a successful training report CO-3.Present your Skills in an effective manner with ethics. CO-4.Competence of acquiring and applying fundamental engineering principles CO5.Presentation on the learning and organisation. Queries handling capacity.
7	REC754:Project I	CO1Identification of a project proposal which is relevant to the subject of engineering and engage in state- of-art literature review to formulate an Engineering problem. CO2Design and implement proposed project methodolgy with estimated cost of completing the work. CO3Demonstrate leadership with team and individual work whilst abiding by established norms of Professional ethics. CO4Effective Communication skills (Written, oral and presentation) to assimilate their project work.

8	REC085:Wireless & Mobile Communication	CO1: They should have ability to explain the Classification of mobile communication systems. CO2: Ability to explain & analyze the radio channel characteristics and the cellular principle CO3: Able to analyze the measures to increase the capacity in GSM systems-sectorization and SpatialFiltering for Interference Reduction. CO4: Ability to analyze improved data services in cellular communication CO5: To design a 3G and 4G wireless communication system to meet desired needs within realistic constraints.
9	REC083:Satellite & Radar	CO1. Able to analyze basic RADAR principles and different types of RADAR CO2. Student will be able to analyze MTI Radar,detector and limitation. CO3. Able to analyze different types of tracking and surveillance of radar. CO4. Able to use and have understanding of link budget equations to provide sufficient margin for performance. CO5. Able to understand Propagation effects and their impact on satellite-earth links and Introduction of various satellite systems.
10	ROE086:Renewable Energy Resources	CO1.To study and understand various non-conventional energy resources and solar cell. CO2.To implement solar thermal power plant. CO3.To apply the Geothermal resources and MHD for energy production. CO4.To implementthermoelectrical, thermoionic and wind power energy conversion system. CO5.To demonstrate Biomass, ocean thermal energy, wave and tidal energy generation.
11	REC851:Seminar	CO1.Determine disciplinary and non-disciplinary engineering problems and conduct a literature review. CO2. Analyze modern technology and a current professional area of interest CO3. Investigate disciplinary and non-disciplinary engineering problems, as well as possible solutions. CO4, Demonstrate a report in front of an audience.
12	REC852:Project II	CO1.Analyse and interpret the results of experiments conducted on designed solution(s) for the identified engineering problem. CO2.Demonstrate a working model, prototype, proof of concept or technical innovation through effective oral communication. CO3.Independently engage in study of literature and assimilate a state of art literature review to formulate an Engineering problem. CO4.Identify mathematical, Scientific, Engineering and Management concepts and tools necessary to solve the formulated problem. CO5.Present a written record of the work in the form of a project report, poster, conference or research paper. CO6.Demonstrate team work, leadership and mentor-ship whilst abiding by established norms of professional ethics.