BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE OUTCOMES (COs)

B.TECH – ELECTRONICS AND COMMUNICATION ENGINEERING

JNTUH: R13 REGULATIONS

Code	Course Name	Course Outcomes
		I B. Tech
A10001	English	**At the end of this course, each student should be able to:** CO1. Understand the value of English as an international language, as a Lingua-Franca and try to improve their knowledge regarding language skills and elements to be perfect in their usage. CO2. Usage of English Language, written and spoken. CO3. Enrichment of comprehension and fluency CO4. Gaining confidence in using language in verbal situations. CO5. Develop the ability to analyze the language used in descriptions and narrations.
A10002	Mathematics – I	**At the end of this course, each student should be able to:** CO1. Able to write the matrix representation of a set of linear equations and to analyze solutions of system of equations. CO2. Able to understand the methods of differential calculus to optimize single and multivariable functions. CO3. Able to evaluate the multiple integrals and can apply the concepts to find the areas, volumes, moment of inertia etc., of regions on a plane or in space. CO4. Able to identify the type of differential equation and uses the right method to solve the differential equation. Also able to apply the theory of differential equations to the real world problems. CO5. Able to solve certain differential equations using Laplace transform. Also able to transform functions on time domain to frequency domain using Laplace transforms.
A10003	Mathematical Methods	**At the end of this course, each student should be able to:** CO1. Able to predict the value of the data at an intermediate point and by curve fitting, can find the most appropriate formula for a guessed relation of the data variables. This method of analysis data helps engineers to understand the system for better interpretation decision making. CO2. Able to find a root of a given equation and will be able to find a numerical solution for a given differential equation. CO3. Helps in describing the system by an ODE, if possible. Also, suggests to find the solution as a first approximation. CO4. Able to find the expansion of a given function by Fourier series and Fourier transform of the function. CO5. Helps in phase transformation, phase change and attenuation coefficients in acoustics. CO6. Able to find a corresponding partial differential equation for an unknown function with many independent variables and to find their solution.

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A10004	Engineering Physics	**At the end of this course, each student should be able to:** CO1. The student would be able to learn the fundamental concepts on behavior of crystalline solids. CO2. The knowledge on fundamentals of Quantum Mechanics, Statistical Mechanics enables the student to apply to various systems like Communications Solar Cells, Photo Cells and so on. CO3. Design, Characterization and study of properties of materials help the student to prepare new materials for various Engineering applications. CO4. This course also helps the student exposed to non-destructive testing methods. CO5. Finally, engineering physics course helps the student to develop problem solving skills and analytical skills.
A10005	Engineering Chemistry	**At the end of this course, each student should be able to:** CO1. Extrapolate the knowledge of cell, electrode, cathode, anode, electrolysis, electromotive force and reference electrode. CO2. Explore the engineering applications of polymeric materials. CO3. Develop awareness about the usage of conducting polymers as an engineering material. CO4. Justify the immense importance of basic constructional material, Portland cement in Civil Engineering works. CO5. Summarize the application of phase rule to one and two component systems.
A10501	Computer Programming	**At the end of this course, each student should be able to:** CO1. Identify and understand the working of key components of a computer system. CO2. Develop algorithms and flowcharts for solving mathematical and engineering problems. CO3. Design programs involving decision structures, loops and functions. CO4. Use structured data types and the concept of arrays in simple data processing applications. CO5. Understand the concept of recursion and describe its implementation using a stack. CO6. Understand simple data structures, use of pointers, memory allocation and data handling through files in C.
A10301	Engineering Drawing	**At the end of this course, each student should be able to:** CO1. Identify the basic concepts of Engineering Drawing. CO2. Construct various conic sections, cycloids and scales. CO3. Apply the principles of orthographic projections to projections of points and lines. CO4. Sketch different sections and sectional views of solids. CO5. Show the orthographic projection of the isometric views. CO6. Design the perspective projections of various points, lines, plane figures and simple solids.
A10581	Computer Programming Lab	**At the end of this course, each student should be able to:** CO1. Write programs in C to solve real-world problems. CO2. Choose the appropriate data structure and algorithm design method for a specified application. CO3. Implement linear data structures such as lists, stacks, queues. CO4. Implement simple searching and sorting methods.

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		CO5. Understand which algorithm or data structure to use in different scenarios. CO6. Write complex applications using structured programming methods.
A10081	Engineering Physics/Engineering Chemistry Lab	**At the end of this course, each student should be able to:** **Physics Lab:** CO1. Understand the concept of error and its analysis. CO2. Compare the theory and correlate with experiment. CO3. Understand the applications of physics experiments in day to day life **Chemistry Lab:** CO4. Develop experimental skills to design new experiments in Engineering. c. Exposure to these experiments the student can compare the theory and correlate with experiment. CO5. Estimate the number of free ions, charge & mobility of ions in the mixture of acids using conductivity meter and also gets an idea about titrations without using any indicator. CO6. Determine the presence and quantity of impurities in water and he can estimate amount of metal in metalores.
A10083	English Language Communication Skills Lab	**At the end of this course, each student should be able to:** CO1. Ability to discuss role and importance of communication skills and learn to make use of various forms of communication in their respective professional fields. CO2. Ability to use communication tool to be an effective team leader or team member. CO3. Ability to use communication modes as a tool for success in career progression. CO4. Ability to present in various social and professional situations formally. CO5. Ability to analyze and share the ideas by various media of information transfer. CO6. Ability to design various behavioral aspects in relation to problem solving.
A10082	IT Workshop/ Engineering Workshop	**At the end of this course, each student should be able to:** **Engineering Workshop** CO1. Prepare various jobs with carpentry trade and fitting trade. CO2. Prepare various jobs with Black smithy trade. CO3. Produce various patterns with foundry techniques. CO4. Combine various metal pieces with the techniques of welding. CO5. Identify various power tools in construction, wood working, electrical and mechanical engineering. CO6. Recognize the methods of plumbing. **IT Workshop** CO1. Understand various aspects of information technology. CO2. Demonstrate capability to work with LaTeX. CO3. Perform upgrading and repairing of PC's.
	II B. Tech I Semester	
A30007	Mathematics -III	CO1. Solve Cauchy's and Legendre's differential equations CO2. Identifying ordinary points, singular points and regular singular points for the given ODE. CO3. Determine the solution of ordinary differential equations

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		in series form, Frobenius method to obtain a series solution for the given linear ODE.
		CO4. Identify Bessel equation and Legendre equation and solve them under special conditions with the help of series solutions method.
		CO5. Analyze the complex functions with reference to their analyticity, Integration using Cauchy's integral theorem.
		CO6. Identify the conditions for a complex variable function to be analytic and/or harmonic.
A30405	Probability and Statistics	CO1. Identify distribution in certain realistic situation.
		CO2. Differentiate among many random variables involved in the probability models.
		CO3. Calculate mean and proportions (small and large sample) and to make important decisions from few samples which are taken out of unmanageably huge populations.
		CO4. Find the expected queue length, the ideal time, the traffic intensity and the waiting time.
		CO5. Understand the random process, Markov process and Markov chains which are essentially models of many time dependent processes such as signals in communications, time series analysis, queuing systems.
		CO6. Find the limiting probabilities and the probabilities in nth state.
A30406	Signals and Systems	CO1. Understand the principles of vector spaces, including how to relate the concepts of basis, dimension, inner product, and norm to signals. Know how to analyze, design, approximate, and manipulate signals using vector-space concepts.
		CO2. Understand and classify signals (e.g. periodic, even) and systems (e.g. causal, linear) and an understanding of the difference between discrete and continuous time signals and systems, understand the principles of impulse functions, step function and signum function
		CO3. Analyze the implications of linearity, time-invariance, causality, memory, and bounded-input, bounded-out (BIBO) stability.
		CO4. Determine the response of linear systems to any input signal by convolution in the time domain, and by transformation to the frequency domain, filter characteristics of a system and its bandwidth, theconcepts of auto correlation and cross correlation and power density spectrum.
		CO5. Understand the definitions and basic properties (e.g. time-shift, modulation, Parseval's Theorem) of Fourier series, Fourier transforms, Laplace transforms, Z transforms, and an ability to compute the transforms and inverse transforms of basic examples using methods such as partial fraction expansions, ROC of Z Transform/ Laplace Transform.
		CO6. Analyze the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous-time signals in discrete time so that they can be processed by digital computers
A30482	Switching Theory and logic Design	CO1. Understand number systems, binary addition and subtraction, 2's complement representation and

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		operations with this representation and understand the different binary codes CO2. Explain switching algebra theorems and apply them for logic functions CO3. Identify the importance of SOP and POS canonical forms in the minimization or other optimization of Boolean formulas in general and digital circuits CO4. Discuss about digital logic gates and their properties CO5. Evaluate functions using various types of minimizing algorithms like Boolean algebra, Karnaugh map or tabulation method. CO6. Analyze the design procedures of Combinational logic circuits
A30404	**Electronic Devices and Circuits**	CO1. Understand the operation of various semiconductor diodes CO2. Analyze characteristics of different types of diodes CO3. Understand the function of diode as rectifier CO4. Analyze and design various rectifier circuits. CO5. Understand the operation of transistors in different configurations CO6. Analyze and design amplifier circuits and oscillators employing BJT, FET devices
A30204	**Electrical Circuits**	CO1. Define basic electrical concepts, including electric charge, current, electrical potential, electrical Power and energy CO2. Distinguish the relationship of voltage and current in resistors, capacitors, inductors, and mutual Inductors CO3. Differentiate circuits with ideal, independent, and controlled voltage and current sources and able to apply Kirchhoff's voltage and current laws to the analysis of electric circuits. CO4. Illustrate to apply concepts of electric network topology, nodes, branches, and loops to solve circuit problems, including the use of computer simulation CO5. Emphasize on basic laws and techniques to develop a working knowledge of the methods of analysis are used. CO6. Interpret to solve series and parallel magnetic circuits
II B. Tech II Semester		
A40009	Environmental Studies	CO1. Determine the Natural resources on which the structure of development is raised for sustainability of the society through equitable maintenance of natural resources. CO2. Illustrate about biodiversity that raises an appreciation and deeper understanding of species, ecosystems and also the interconnectedness of the living world and thereby avoids the mismanagement, misuse and destruction of biodiversity. CO3. Summarize a methodology for identification, assessment and quantification of global environmental issues in order to create awareness about the international conventions for mitigating global environmental problems CO4. Sustainable development that aims to meet raising human needs of the present and future generations through preserving the environment CO5. Outline green environmental issue provides an opportunity to overcome the current global environmental issues by

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		implementing modern techniques like CDM, green building, green computing etc.
A40415	Pulse and Digital Circuits	CO1. Understand the linear wave shaping circuits like high pass circuits for various input signals. CO2. Understand the linear wave shaping circuits like low pass RC circuits for various input signals CO3. Analyze the application of attenuators. CO4. Understand the non-linear wave shaping circuits like clippers diodes and transistors. CO5. Understand the non-linear wave shaping circuits like clampers using diodes. CO6. Analyze the clamping circuit theorem.
A40412	Electronic Circuit Analysis	CO1. Analyze various transistor amplifier circuits and their freq. responses at low, mid and high frequencies. CO2. Designing amplifier circuits using BJTs. CO3. Analyze the concepts of both positive and negative feedback in electronic circuits. CO4. Design, construct & analyze oscillator circuits to generate signals in various frequency ranges. CO5. Design different types of power amplifiers for practical applications of desired specifications. CO6. Understand the concepts MOS characteristics and amplifier
A40410	Digital Design using Verilog HDL	CO1. Describe Verilog Hardware Description Language. CO2. Describe various constructs and features in Verilog HDL CO3. Model various designs in gate level modeling CO4. Model various designs in gate level modeling CO5. Construct Test benches examine the functionality of the designs using behavioral model CO6. Synthesize RTL models to Standard cell libraries and FPGAs
A40411	Electromagnetic Theory and Transmission Lines	CO1. Understand and design the electrical machines based on the concept of electrostatics. CO2. Generate modified equations for boundaries and Medias CO3. Design the long time charge storage devices CO4. Know the energy storage design of high magnetic field coils used in transformers, motors and generators CO5. Understand and development of Maxwell's equation for dielectric and conducting media CO6. Understand the design of long length transmission lines for point to point communications
A40215	Principles of Electrical Engineering	CO1. Understand the DC transient analysis of RL, RC and RLC circuits. CO2. Apply the basic fundamentals to construct and operate DC generators, DC Motors, transformers. CO3. Develop the basic skills needed to perform and design experimental projects. CO4. Apply the principles to form simple electric apparatus and machinery that are of use in practical situations. CO5. Formulate problems and projects and to plan a process for solution, taking advantage of diverse technical knowledge and skills. CO6. Impart knowledge of electrical engineering principles along

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		with the required supporting knowledge of computing, engineering fundamentals, mathematics, and science.
III B. Tech I Semester		
A50418	Antenna and Wave propagation	CO1. Aware of the parameter consideration viz. antenna efficiency, beam efficiency, radiation resistance etc. in the design of an antenna CO2. Capable of analyze the designed antenna and field evaluation under various conditions and formulate the electric as well as the magnetic fields equations set for far field and near field conditions CO3. Capable of analyze the designed antenna and field evaluation under various conditions and formulate the electric as well as the magnetic fields equations set for far field and near field conditions. CO4. Understand and design issues, operation of fundamental antennas like Yagi-Uda, Horn antennas and Helical structure and also their operation methodology in practice. CO5. Design a lens structure and also the bench setup for antenna parameters measurement of testing for their effectiveness CO6. Knowledge about the means of propagation of Electromagnetic wave i.e. free space propagation and also about frequency dependent layer selection, its respective issues for an effective transmission of information in the form of EM wave to a remote location and related issues.
A50408	Analog Communications	CO1. Understand the baseband signal and system CO2. Design procedure of AM transmission and reception, Analyze, Measure and Evaluate the performance of a Telecommunication system against given criteria CO3. Understand basic knowledge of FM transmission and reception CO4. Understand various types of VSB transmission and reception CO5. Design Tuned Radio frequency receiver and Super Heterodyne receiver CO6. Understand the concepts of generation of PAM,PPM,PWM
A50425	Linear and Digital IC Applications	CO1. Understand the internal operation of Op-Amp and its specifications. CO2. Analyze and design linear applications like adder, subs tractor, instrumentation amplifier and etc. using Op-Amp. CO3. Analyze and design non linear applications like multiplier, comparator and etc, using Op-Amp CO4. Operate 555 timers in different modes like bistable, monostable and astable operations and study their applications CO5. Understand the conversion process of ADC and DAC in digital electronics CO6. Explain the differences between CMOS and TTL logic families and study various digital ICs
A50516	Computer Organization and	CO1. Describe organization of digital computers and explain the basic principles and operations of different components

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	Operating systems	CO2. Identify the operation of the arithmetic unit including the algorithms and implementation of fixed-point and floating-point addition, subtraction, multiplication and division. CO3. Compare various data representations and understand how arithmetic and logical operations are performed by computers CO4. Differentiate Instruction formats classification based on number of operands, size of instruction, and way of accessing the data. CO5. Identify different I/O data transfer techniques with performance comparison CO6. Demonstrate how computing resources are used by application software and managed by system software
A50422	Electronic Measurements and Instrumentation	CO1. Describe the fundamental concepts and principles of instrumentation CO2. Explain the operations of the various instruments required in measurements CO3. Apply the measurement techniques for different types of tests CO4. Select specific instrument for specific measurement function CO5. Understand principle of operation, working of different electronic instruments like digital multi meter, ohmmeters CO6. Apply knowledge of different Oscilloscopes like CRO, DSO
A50217	Control Systems	CO1. Understand and analyze the operation of open loop and closed loop systems CO2. Analyze transfer functions for electro-dynamic plants and machines, with electrical, electro-mechanical, electro-pneumatic, and electro-hydraulic elements from plant site collected data CO3. Understand and analyze the stability of a system in S – Domain CO4. Analyze the control systems in the frequency domain and solve the problems related to compensation techniques CO5. Understand the problems relating to stability of control systems and formulate state model to electrical and electro mechanical plants and evaluate plant response to particular inputs CO6. Understand state space analysis and its applications
III B. Tech II Semester	
A60420	Digital Communications	CO1. Understand the basic concepts of digital communications with an insight into practical applications CO2. Identify the importance of conversion of analog signals in to digital domain CO3. Differentiate between PCM and DM and to know their usage in specific applications CO4. Compare and contrast ASK, FSK, PSK digital carrier modulation schemes in terms of occupied bandwidth, complexity etc., and extend these into QPSK, MPSK, QAM for improved spectral efficiency CO5. Apply the basics of information theory to calculate channel

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		capacity and other measures
		CO6. Distinguish between source coding and channel coding for optimization of discrete memory-less source (DMS) ,with error-free/min error transmission of data over a channel
A60430	Microprocessors and Micro controllers	CO1. Understand I/O operation with 8086 and software interaction and integration
		CO2. Understand the memory organization and interrupts of processors/ micro-controllers helps in various system designing aspects
		CO3. Design and conduct experiments related to microprocessor/ microcontroller based system design
		CO4. Identify the significance of serial communication in8086
		CO5. Identify the significance of interrupts / serial communication, real time functionality in 8051
		CO6. Understand the internal architecture and operation of advanced microcontrollers
A60010	Managerial Economics and Financial Analysis	CO1. Describe the economic activities performed by the businessmen in the business for profit earning
		CO2. Understand the significance of demand, its analysis, measurement of demand and its forecasting
		CO3. Write the production function through the Cobb Douglas Production Function
		CO4. Design and implement different structures of market covering how price is determined under different market structures
		CO5. Analyze different forms of business organizations existing in the modern business
		CO6. Describe the allocation of capital which plays a vital role in a business organization
A60432	VLSI Design	CO1. Acquire qualitative knowledge about the fabrication process of integrated circuit using MOS transistors
		CO2. Choose an appropriate inverter depending on specification required for a circuit.
		CO3. Draw the layout of any logic circuit which helps to understand and estimate parasitics of anylogic circuit
		CO4. Design different types of logic gates using CMOS inverter and analyze their transfer characteristics
		CO5. Provide design concept required to design building blocks of data path using gates
		CO6. Design simple logic circuit using PLA, PAL, FPGA and CPLD
A60421	Digital Signal Processing	CO1. Understand how digital to analog (D/A) and analog to digital (A/D) converters operate on a signal and be able to model these operations mathematically
		CO2. Perform time, frequency and Z-transform analysis on signals and LTI systems and study the properties like stability, causality, time-invariance and etc.
		CO3. Understand the inter-relationship between DFT and various transforms
		CO4. Understand the significance of various filter structures and effects of round-off errors
		CO5. Design of infinite impulse response filters for a given

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		specification
		CO6. Understand the fast computation of DFT and appreciate the FFT Processing
IV B. Tech I Semester		
A70434	Cellular and Mobile Communication	CO1. Identify the limitations of conventional Mobile Telephone Systems; understand the basic cellular mobile system
		CO2. Understand the concept of frequency Reuse channels, Deduce the Co-channel interference reduction factor
		CO3. Explain Co-channel interference
		CO4. Explain adjacent channel interference, near end far end interference and UHF TV interference
		CO5. Understand cell coverage for signal and traffic
		CO6. Learn cell site and mobile antennas
A70442	Microwave Engineering	CO1. Analyze wave propagation in TE, TM or TEM modes, in structures such as rectangular waveguides
		CO2. Compare the passive microwave components and applications such as directional couplers, power divider/ combiner and etc., with given characteristics
		CO3. Understand the characteristics of slow wave structures
		CO4. Differentiate the performance characteristic of a microwave solid state devices
		CO5. Compare different types of magnetrons and their characteristics
		CO6. Understand the microwave bench setup for measuring microwave parameters
A70014	Management Science	CO1. Exercise critical thinking to propose, communicate, and implement, action plan that address opportunities and issues
		CO2. Identify and utilize ethical and legal standards in contemporary management practices while taking into account all relevant stakeholders
		CO3. Observe and recognize behaviors in organizational settings to aid in predicting outcomes
		CO4. Gain personal and professional insight into organizational behavior, diversity, personalities, goal setting, motivation, empowerment, and leadership style
		CO5. Demonstrate an understanding of the importance of values, ethics, and social responsibility for the self and for contemporary society
		CO6. Reflect on how values shape personal and community ethics and decision-making. An ability to function effectively on multi-disciplinary teams (team work).
A70440	Embedded System Design	CO1. Understand basic concept of embedded systems
		CO2. Apply and analyze the applications in various processors and domains of embedded system
		CO3. Remember the definitions of ASICs, PLDs, memory, and memory interface
		CO4. Analyze to understand real time operating systems with examples and Ability to learn debugging techniques for an embedded system
		CO5. Analyze to understand different concepts of a CTOS,

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		sensors, memory interface, communication interface
		CO6. Analyze to learn how to design RTOS in embedded systems and to document their designs and explain them to others
A70515	Computer Networks	CO1. Understand the basics of Computer Networks and various protocols
		CO2. Understand the World Wide Web concepts
		CO3. Describe Computer Networks and the basic components of a Network system
		CO4. Discuss the different internetworking devices and their functions
		CO5. Analyze the services and features of the various layers of data networks
		CO6. Analyze the features and operations of various application layer protocols such as HTTP, DNS, and SMTP
A70436	Digital Image Processing	CO1. Explain the basic elements and applications of image processing
		CO2. Design and implement two-dimensional spatial and frequency filters for image enhancement
		CO3. Explain the image segmentation and image compression problem
		CO4. Analyze image sampling and quantization requirements and implications
		CO5. Model the image restoration problem in both time and frequency domains
		CO6. Develop Wavelet based applications
IV B. Tech II Semester		
A80450	Radar Systems	CO1. Understand about radar fundamentals
		CO2. Analyze detectable ranges and parameters of general radar equation
		CO3. Understand the Doppler effect and the concepts of continuous wave radars
		CO4. Understand the FMCW Altimeter
		CO5. Analyze the operation of MTI and pulse Doppler radar
		CO6. Analyze the tracking radar systems and mono pulse radar
A80452	Satellite Communications	CO1. Obtain different types of satellites
		CO2. Calculate the orbital determination and launching methods
		CO3. Develop commands, monitoring power systems and developments of antennas
		CO4. Calculate multiple access techniques like TDMA, CDMA, FDMA, DAMA
		CO5. Design antennas to provide Uplink and Down link Frequency
		CO6. Demonstrate the impacts of GPS, Navigation, NGSO constellation design for tracking and launching
A80454	Wireless Communications and Networks	CO1. Understand the principles and fundamentals of wireless communications
		CO2. Understand cellular system design concepts in wireless mobile communication networks
		CO3. Understand fundamentals of Radio Wave Propagation Basic Propagation Mechanisms
		CO4. Analyze perspective on Fundamentals of Equalization and Mobile Radio Propagation Multipath Measurements

Code	Course Name	Course Outcomes
		CO5. Analyze various multiple access schemes used in wireless communication CO6. Demonstrate wireless local area networks and their specifications and Understand wireless wide area networks and their performance analysis