Course Code and Title with L-T-P Structure: **EC 309: Intelligent Instrumentation (3-0-0)**
Semester : **5th Semester**
Programme : **B.Tech. in Electronics and Communication Engineering** Course Offering Department : **Electronics and Communication Engineering**

Syllabus:

Intelligent sensors: Definitions- Classical sensors and transducers, Smart sensors, Cogent sensors, Self adaptive sensors, VLSI-ANN sensors, MEMs , Computational sensors, Integrated intelligent sensors (ISS), Passive and active elements, AD and DA conversions, Micromachining sensors, Thermocouple and RTD signal processing-Cold junction compensation, Integrated compensating ADC, Realization of differential temperature, Temperature compensation in Resistive strain gauge sensors- Integrated compensating DAC, Calibration of IC thermal sensors- Integrated calibration and compensation in pressure sensors, Integrated offset, gain and nonliterary compensation

Sensor Intelligence: Metrological intelligence-Linearization techniques, Look up table, Piece-wise linearization, Interpolation, Progressive polynomial, LMS curve fitting, PWM, ANN , Auto calibration-autozero and autorange, Offset nullification, Error and drift compensation , Ambient errors , Circuit compensation- Dummy circuit, Mathematical compensation- Intelligent compensation,
Electrical/Electronics errors, Mechanical errors, Computational errors.

Transmission intelligence- Sampling ,Digitization and AD conversion, Signal conversion, Voltage to frequency conversion, Voltage to current conversion, 4-20mA transmitter, Capacitance/Inductance to duty cycle, Modulation, FM, PWM

Signal manipulation intelligence- Semantic transformation, Data validation, Missing data and data restoration, Decision making, Derived information

Artificial and adaptive Intelligence- Human intelligence, Array based sensors, Basic Sensor Metrics, Signal and image features, Prognostics diagnostics and predictive, Tracking, classification and discrimination, Adaptive least square models

Other Intelligences- Power saving, Voltage and current regulation, Reliability, Failure detection

Intelligent Sensor Standards and Protocols : IEEE 1451.1, Network communication models, STIM, Lon Talk TM Protocol, Integrated SAE JI850, MI bus, FieldBus

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Apply different types of sensors in various applications
2. Perform linearization and compensation techniques for sensor performance optimization
3. Apply transmission intelligence in the field of instrumentation
4. Apply artificial and adaptive intelligence in engineering solutions
5. Discuss the sensor standards and protocols

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Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1, 2
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	2,3,4,5
3	The graduates will have a good understanding of professional and ethical responsibility.	5
4	The graduates will be able to express themselves effectively through written and oral communication.	
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1,3,4
6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	1
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	2,3,4
8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1,2,3
9	The graduates will be able to participate and succeed in competitive examinations.	1,2,3

Course Code and Title with L-T-P Structure: **EC310: CMOS Design (3-0-0)**
Semester : **5th Semester**
Programme : **B.Tech. in Electronics and Communication Engineering** Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Review of MOS transistor models, Non-ideal behaviour of the MOS Transistor. 5 lectures

Transistor as a switch. Inverter characteristics 5 lectures

Integrated Circuit Layout: Design Rules, Parasitics. Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.
5 lectures

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic.
10 lectures

Sequential Circuit Design: Static circuits. Design of latches and Flip-flops.
5 lectures

Course Outcomes:
At the end of the course the students will be able to

1. Design different CMOS circuits using various logic families along with their circuit layout. 2. Use tools for VLSI IC design.
3. Utilize the knowledge for higher studies.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO		SN	Program Outcome (PO)	CO

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1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.			6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within	1, 2		7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary	1, 2
	the context of electronics and communication engineering.				technological challenges.	
3	The graduates will have a good understanding of professional and ethical responsibility.			8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	3
4	The graduates will be able to express themselves effectively through written and oral communication.			9	The graduates will be able to participate and succeed in competitive examinations.	
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.					

EC 409: Introduction to MEMS (3-0-0)

7th Semester

B.Tech. in Electronics and Communication Engineering

Electronics and Communication Engineering

Syllabus

Introduction and Historical Background, Scaling Effects.

5 lectures

Micro/Nano Sensors, Actuators and Systems overview: Case studies.

8 lectures

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

7 lectures

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods,

7 lectures

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

Course Outcomes: At the end of the course the students will be able to 1. Appreciate the underlying working principles of MEMS and NEMS devices. 2. Design and model MEMS devices.
3. Utilize the knowledge for higher studies and research.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1,2
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1, 2

SN	Program Outcome (PO)	CO
6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	1, 2

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3	The graduates will have a good understanding of professional and ethical responsibility.			8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research	3
					programs in various organizations of national and international repute.	
4	The graduates will be able to express themselves effectively through written and oral communication.			9	The graduates will be able to participate and succeed in competitive examinations.	
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.					

EC413: Fuzzy Logic and Neural Networks (3-0-0)

7th Semester

B.Tech. in Electronics and Communication Engineering

Electronics and Communication Engineering

Syllabus

Introduction to Fuzzy sets, Fuzzy relation, Approximate reasoning, Rules. Fuzzy control design parameters, Rule base, database, and choice of fuzzification procedure, choice of defuzzification procedure. Nonlinear fuzzy control, adaptive fuzzy control.

Introduction to neural networks, biological neurons, artificial neurons, artificial neural Networks - various structures, learning strategies, applications.

Course Outcomes (COs)

Upon completion of the course, the student will be able to

1: Understand the concept of fuzzy set theory and fuzziness involved in various systems.

2: Comprehend the fuzzy logic control to the application of fuzzy logic control to real world systems.

3: Comprehend the concepts of feed forward neural networks and learning algorithms.

4: Analyze the application of neural networks to real world systems.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of B. Tech in Electronics and Communication Engineering

SN	Program Outcome (PO)	CO		SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1,3		6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	2,4		7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	2,4
3	The graduates will have a good understanding of professional			8	The graduates will have good background for admission to	2,4

	and ethical responsibility.				post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	
4	The graduates will be able to express themselves effectively through written and oral communication.			9	The graduates will be able to participate and succeed in competitive examinations.	1,3
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.					

Course Code and Title with L-T-P Structure: **EC102: Basic Electronics (2-1-1)**

Semester : **2nd Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Theory:

Unit 1: Diodes and Applications (10 hours):

Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Clippers and clampers circuits. Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications

Unit 2: Transistor Characteristics (10 hours):

Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits

Unit 3: Transistor Amplifiers and Oscillators (7 hours):

Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;

Unit 4: Operational Amplifiers and Applications (5 hours):

Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground;

Unit 5: Digital Systems (10 hours):

Number Systems and Codes, r's Complements and (r-1)'s Complements, Binary Addition and Subtraction, Representation of Negative Number, Floating Point Representation. Logic Gates: Basic and Universal, Boolean Theorems, De' Morgan's theorems, Sum-of-Products form, Algebraic Simplification, Karnaugh Map, Basic Combinational Circuit Concept : Half Adder, Full Adder, Sequential circuit concept : Basic Flip-Flops (RS, D, JK Flip-Flop).

Total: 42 lectures

Course Outcomes (COs)

Towards the end of the course the student will be expected to –

1. explain semiconductor technology
2. illustrate the use of various semiconductor devices
3. apply the knowledge of semiconductor technology in electronics circuit
4. analyze different transistor circuits
5. classify different types of amplifier circuits and their applications
6. build digital circuits with minimum hardware components

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1, 4
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1-6
3	The graduates will have a good understanding of professional and ethical responsibility.	1-6
4	The graduates will be able to express themselves effectively through written and oral communication.	
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1-6
6	The graduates will have a good understanding for the need of lifelong learning and will be able to work in teams.	
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	1-6
8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1-6
9	The graduates will be able to participate and succeed in competitive examinations.	1-6

Course Code and Title with L-T-P Structure: **EC 201: Electronics devices (3-0-0)**

Semester : **3rd Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-Vcharacteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode.

Bipolar Junction Transistor, I-V characteristics, Ebers-Moll Model,MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell; Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor Physics
2. Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO	`	SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	2		6	The graduates will have a good understanding for the need of lifelong learning and will be able to work in teams.	1,2
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication	1		7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	2

	engineering.					
3	The graduates will have a good understanding of professional and ethical responsibility.			8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1,2
4	The graduates will be able to express themselves effectively through written and oral communication.			9	The graduates will be able to participate and succeed in competitive examinations.	1,2
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	2				

Course Code and Title with L-T-P Structure: **EC 203: Digital System Design (3-0-0)**

Semester : **3rd Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan'sTheorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, CodeConversion. MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half andFull Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Rippleand Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM,Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, PseudoRandom Binary Sequence generator, Clock generation Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Conceptof Programmable logic devices like FPGA. Logic implementation using Programmable Devices. VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data typesand objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

Course Outcomes (COs)

1. After completing the course, students are expected to have the basic knowledge of the Digital Circuits and which will help them to take advance courses on digital system design in higher semester.

2. The course deals with the basic and fundamental concept of digital electronics, which will help the students to design digital circuits.

3. Students can utilize the knowledge of digital electronics in engineering problem solving.

4. Students are expected to do their final year project work using the digital electronics concepts.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO		SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.			6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	4
2	The graduates will be able to	1,2,3		7	The graduates will show good	

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	understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.				proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	
3	The graduates will have a good understanding of professional and ethical responsibility.			8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1,3
4	The graduates will be able to express themselves effectively through written and oral communication.			9	The graduates will be able to participate and succeed in competitive examinations.	1,2,3
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1,2,3				

Course Code and Title with L-T-P Structure: **EC205: Signals and Systems (3-0-0)**

Semester : **3rd Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Signals and systems as seen in everydaylife, and in various branches of engineering and science.

(1 lecture)

Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. (10 lectures)

Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations. Periodic and semi-periodic inputs to an LSI system, the notion of a frequencyresponse and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.The idea of signal space and orthogonal bases, (15 lectures)

The Laplace Transform, notion ofeigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior. (3 lectures)

The z-Transform for discrete time signals and systems- eigen functions, region of convergence, zdomain analysis. (3 lectures)

State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems. (4 lectures)

Total: 36 lectures

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Course Outcomes (COs)

1. Understand the fundamental concepts of signals and systems.

2. Application of mathematical concepts to solve problems like Laplace Transform, Fourier Transform etc.

3. To apply these concepts in subjects like communication, digital signal processing and research in signal processing.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	2,3
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1,2,3
3	The graduates will have a good understanding of professional and ethical responsibility.	
4	The graduates will be able to express themselves effectively through written and oral communication.	
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	3
6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	3
8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1,2,3
9	The graduates will be able to participate and succeed in competitive examinations.	1,2,3

Course Code and Title with L-T-P Structure: **EC 206 : Network Theory (3-0-0)**

Semester : **3rd Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus:

Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits. Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.
Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1, 3
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	2,3,5
3	The graduates will have a good understanding of professional and ethical responsibility.	
4	The graduates will be able to express themselves effectively through written and oral communication.	
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	2,4
6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	2,3,5
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	2,3,5
8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	2,3,4,5
9	The graduates will be able to participate and succeed in competitive examinations.	2,3,5

Course Code and Title with L-T-P Structure: **EC207: Analog and Digital Communication (3-0-0)**

Semester : **4th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Theory:

Review of signals and systems, Frequency domain representation of signals, Principles of AmplitudeModulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. (8 lectures)

Review of probability and random process. Gaussian and white noise characteristics,Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation. (2 lectures)

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM),Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers. (8 lectures)

Elements of Detection Theory, Optimum detection of signals in noise,Coherent communication with waveforms- Probability of Error evaluations. BasebandPulse Transmission- Inter symbol Interference and Nyquist criterion.Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying,Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. (10 lectures)

Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channelsMaximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation. (2 lectures)

Total: 30 lectures for theory

Practical:

Exp 1. Study of A/D conversion process in Pulse Code Modulation transmitter trainer.
Exp 2. Study of Amplitude Modulation technique.

Exp 3. Study of Frequency Modulation.

Exp 4. Study of Envelope Detection technique.

Exp 5. Study NRZ-L coding, NRZ-M coding, RZ coding, Bi-phase Manchester coding.
Exp 6. Study of ASK modulation and demodulation

Exp 7. To generate 31-bit PN sequence and find the jitter value.

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Total: 20 hours for practical

Course Outcomes (COs)

1. Understand the basic concepts of communication systems both Analog and Digital.
2. Apply the concepts of various modulation schemes to build communication systems.
3. Analyse any communication system based on their system performance.
4. Prerequisite for higher studies/ research in communication, signal processing and R&D.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO	SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1,2,3	6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	4
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	3	7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	3,4
3	The graduates will have a good understanding of professional and ethical responsibility.		8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	4
4	The graduates will be able to express themselves effectively through written and oral communication.		9	The graduates will be able to participate and succeed in competitive examinations.	1,2,3,4
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	3,4			

Course Code and Title with L-T-P Structure: **EC 209: Analog Circuits (3-0-0)**

Semester : **4th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Diode Circuits, Amplifiermodels: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.

High frequency transistor models, frequency response of single stage andmultistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators(phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators

Current mirror: Basic topology and its variants, V-I characteristics, outputresistance and minimum sustainable voltage (VON), maximum usable load. Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OPAMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.

OP-AMP applications: review of inverting and non-inverting amplifiers, integratorand differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistorstring etc. Analog-todigital converters (ADC): Single slope, dual slope, successive approximation, flash etc.

Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.

Course Outcomes (COs)

1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO	SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1,2,3,4,5	6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	1,2,3,4,5
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1,2,3,4,5	7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	2,3,4,5
3	The graduates will have a good understanding of professional and ethical responsibility.	-	8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1,2,3,4,5
4	The graduates will be able to express themselves effectively through written and oral communication.	-	9	The graduates will be able to participate and succeed in competitive examinations.	1,2,3,4,5
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1,2,3,4,5			

Course Code and Title with L-T-P Structure: **EC 211: Microcontroller and Microprocessor (3-0-0)**

Semester : **4th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Module 1 [10 lectures]

Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, instruction sets of microprocessors (with examples of 8085 and 8086);

Module 2 [10 lectures]

Interfacing with peripherals - timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic Coprocessors; System level interfacing design;

Module 3 [5 lectures]

Concepts of virtual memory, Cache memory, Advanced co-processor Architectures- 286, 486, Pentium; Microcontrollers: 8051 systems,

Module 4 [5 lectures]

Introduction to RISC processors; ARM microcontrollers interface designs.

Total: 30 lectures

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Do assembly language programming
2. Do interfacing design of peripherals like, I/O, A/D, D/A, timer etc.
3. Develop systems using different microcontrollers
4. Understand RSIC processors and design ARM microcontroller-based systems

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	X
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1-3
3	The graduates will have a good understanding of professional and ethical responsibility.	1-3

4	The graduates will be able to express themselves effectively through written and oral communication.	3
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1-4
6	The graduates will have a good understanding for the need of lifelong learning and will be able to work in teams.	3
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	1-4
8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1-4
9	The graduates will be able to participate and succeed in competitive examinations.	1-4

Course Code and Title with L-T-P Structure: **EC 303: Computer Architecture (3-0-0)**

Semester : **5th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Module 1 [8 lectures]

Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Subroutines

Module 2 [3 lectures]

Processor organization, Information representation, number formats

Module 3 [4 lectures]

Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats

Module 4 [7 lectures]

Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Micro-programmed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Micro-programmed computers - CPU control unit.

Module 5 [4 lectures]

Memory organization, device characteristics, RAM, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

Module 6 [2 lectures]

System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces

Module 7 [2 lectures]

Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network

Total: 30 lectures

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Learn how computers work
2. Know basic principles of computer's working
3. Analyze the performance of computers
4. Know how computers are designed and built
5. Understand issues affecting modern processors (caches, pipelines etc.).

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	2, 3

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2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1-4
3	The graduates will have a good understanding of professional and ethical responsibility.	1-4
4	The graduates will be able to express themselves effectively through written and oral communication.	2, 4
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1-4
6	The graduates will have a good understanding for the need of lifelong learning and will be able to work in teams.	1-4
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	1-4
8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1-4
9	The graduates will be able to participate and succeed in competitive examinations.	1-4

Course Code and Title with L-T-P Structure: **EC 301: Electromagnetic Waves (3-0-0)**

Semester : **5th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Module 1 [8 lectures]

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Lossless and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Module 2 [4 lectures]

Maxwell's Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface.

Module 3 [5 lectures]

Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor

Module 4 [5 lectures]

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Module 5 [6 lectures]

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide

Module 6 [4 lectures]

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

Total: 32 lectures

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Use sections of transmission line sections for realizing circuit elements
4. Characterize uniform plane wave
5. Calculate reflection and transmission of waves at media interface
6. Analyze wave propagation on metallic waveguides in modal form
7. Understand principle of radiation and radiation characteristics of an antenna

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Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	5-6
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1-7
3	The graduates will have a good understanding of professional and ethical responsibility.	1-7
4	The graduates will be able to express themselves effectively through written and oral communication.	1-7
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1-7
6	The graduates will have a good understanding for the need of lifelong learning and will be able to work in teams.	6,7
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	2,3,5,6
8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1-7
9	The graduates will be able to participate and succeed in competitive examinations.	1-7

Course Code and Title with L-T-P Structure: **EC304: Probability Theory & Stochastic Process** (3-0-0)

Semester : **5th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Sets and set operations; Probability space; Combinatorial probability and sampling models. (4 lectures)

Conditional probability and Bayes theorem; (2 lectures)

Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions; (6 lectures)

Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds; (5 lectures)

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem. (4 lectures)

Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density. (5 lectures)

Total: 25 lectures for theory

Course Outcomes (COs)

1. Learn the fundamental concepts of Probability Theory required for understanding and analysing digital communication system, machine learning, pattern recognition, AI etc.

2. Learn the concepts of Stochastic processes to apply in signal processing applications.

3. Utilize the knowledge for further studies/research in communication systems, signal processing, machine learning and AI applications.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO	SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1,2,3	6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	3
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1,2,3	7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	3
3	The graduates will have a good understanding of professional and ethical responsibility.		8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1,2,3
4	The graduates will be able to express themselves effectively through written and oral communication.		9	The graduates will be able to participate and succeed in competitive examinations.	1,2,3
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	3			

Course Code and Title with L-T-P Structure: **EC 305: Digital Signal Processing (3-0-0)**

Semester : **5th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT),Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

Design of FIR Digital filters: Windowmethod,Park-McClellan's method.Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters.

Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing.

Application of DSP.

Course Outcomes (COs)

1. Represent signals mathematically in continuous and discrete time and frequency domain
2. Get the response of an LSI system to different signals
3. Design of different types of digital filters for various applications

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO		SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	1,2,3		6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	1,2,3
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1,2,3		7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	3
3	The graduates will have a good understanding of professional and ethical responsibility.	-		8	The graduates will have good background for admission to post graduate programs (in same domain), management degree	1,2,3

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					programs and also research programs in various organizations of national and international repute.	
4	The graduates will be able to express themselves effectively through written and oral communication.	-		9	The graduates will be able to participate and succeed in competitive examinations.	1,2,3
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1,2,3				

Course Code and Title with L-T-P Structure: **EC307: Mobile Communication and Network (3-0-0)**

Semester : **5th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Theory:

Unit 1: Cellular Concepts

(6 lectures)

Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Wireless Standards: Overview of 2G and 3G cellular standards.

Unit 2: Signal Propagation

(8 lectures)

Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and *rms* delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.. Capacity of flat and frequency selective channels.

Unit 3: Antennas

Antennas for mobile terminal monopole antennas, PIFA, base station antennas and arrays.

(4 lectures)

Unit 4: Multiple Access Schemes

(4 lectures)

FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

Unit 5: Diversity and Combining Techniques

(4 Lectures)

Diversity and Combining Methods, Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. Transmit diversity-Altamonte scheme.

Unit 6: Performance Measures (4 lectures)

MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing trade-off. Performance measures- Outage, average snr, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Total: 30 lectures for theory

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Course Outcomes (COs)

Towards the end of the course the student will be expected to –

1. explain the concept of cellular theory
2. understand the architecture to develop mobile communication system
3. illustrate the wireless communication systems and standards
4. apply analytical and experiential models in the design of wireless links/systems
5. explain the characteristics of different multiple access techniques in mobile/wireless communication
6. apply source and channel coding models, diversity, equalization and channel estimation techniques
7. explain the radio propagation over wireless channel and different limitations

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of engineering physics and chemistry.	6
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1-7
3	The graduates will have a good understanding of professional and ethical responsibility.	1,3
4	The graduates will be able to express themselves effectively through written and oral communication.	
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1-7
6	The graduates will have a good understanding for the need of lifelong learning and will be able to work in teams.	
7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	1-7
8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1-7
9	The graduates will be able to participate and succeed in competitive examinations.	1-7

Course Code and Title with L-T-P Structure: **EC 312: Computer Network (3-0-0)**

Semester : **6th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus:

Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic , Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Switching in networks: Classification and requirements of switches, a generic switch, Circuit Switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical

Multiplexing. Transport layer: Connectionless transport - User Datagram Protocol, Connection oriented transport – Transmission Control Protocol, Remote Procedure Call.

Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport Transmission Control Protocol, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines,
TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing

Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to

1. Apply layer and switching concepts in the design of computer networks
2. Apply routing algorithms in LAN, WAN etc.
3. Apply link design and addressing in internetworking
4. Apply communication protocols in internet
5. Apply TCP/IP protocols in high speed communication networks

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) of Electronics and Communication Engineering

SN	Program Outcome (PO)	CO		SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations etc. and basic knowledge of			6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	4,5

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	engineering physics and chemistry.					
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1, 2,3,4,5		7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	2,3,4
3	The graduates will have a good understanding of professional and ethical responsibility.	4,5		8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1,2,3
4	The graduates will be able to express themselves effectively through written and oral communication.	1,2,3		9	The graduates will be able to participate and succeed in competitive examinations.	1,2,3,4,5
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	1,2,3				

Course Code and Title with L-T-P Structure: **EC 418: Power Electronics (3-0-0)**

Semester : **8th Semester**

Programme : **B.Tech. in Electronics and Communication Engineering**

Course Offering Department : **Electronics and Communication Engineering**

Syllabus

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT-Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Controlled Rectifiers: Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.
Choppers: Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Single-phase inverters: Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter
Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Course Outcomes (COs):

At the end of this course students will demonstrate the ability to

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS

SN	Program Outcome (PO)	CO		SN	Program Outcome (PO)	CO
1	The graduates will be able to apply the concepts of Engineering mathematics through Laplace, z-transform, linear algebra, probability and statistics, differential equations	2		6	The graduates will have a good understanding for the need of life long learning and will be able to work in teams.	

	etc. and basic knowledge of engineering physics and chemistry.					
2	The graduates will be able to understand, interpret the problem, design and perform the experiments to meet the desired solution of the problem within the context of electronics and communication engineering.	1,2,3		7	The graduates will show good proficiency in applying the techniques and knowledge of modern engineering skills in tackling contemporary technological challenges.	1,2,4
3	The graduates will have a good understanding of professional and ethical responsibility.			8	The graduates will have good background for admission to post graduate programs (in same domain), management degree programs and also research programs in various organizations of national and international repute.	1,2,3,4
4	The graduates will be able to express themselves effectively through written and oral communication.			9	The graduates will be able to participate and succeed in competitive examinations.	2,3
5	The graduates will have a good understanding and knowledge in applying the engineering solutions to society.	4				