SECOND YEAR ELECTRONICS AND TELECOMMUNICATION ENGINEERING PROGRAM
SCHEME OF INSTRUCTION AND EXAMINATION, REVISED COURSE (2019-2020)

SEMESTER – III

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Duration (Hrs)	Marks					Credits
						Th	IA	TW**	P	Total	
ET310	Mathematics- III	3	1	--	3	100	25	25	--	150	4
ET320	Circuit Analysis and Synthesis	3	--	--	3	100	25	--	--	125	3
ET330	Electronic Devices and Circuits	3	1	--	3	100	25	25	--	150	4
ET340	Digital System Design	3	1	--	3	100	25	25	--	150	4
ET350	Electromagnetic Field & Wave Theory	3	1	--	3	100	25	25	--	150	4
ET360	Electronic Devices and Circuits Lab	--	--	2	--	--	--	25	25	50	1
ET370	Digital System Design Lab	--	--	2	--	--	--	25	25	50	1
HM001	Technical Communication	2	--	--	--	--		75	--	75	2
AC390	Mathematics-I and II(Bridge Course*)	--	--	--	--						
	TOTAL	17	4	4	--	500	125	225	50	900	23

L-Lecture T-Tutorial P-Practical Th-Theory TW-Term Work IA-Internal Assessment

*Applicable to direct second year /lateral entry students

**Term Work marks are to be awarded through continuous evaluation

SECOND YEAR ELECTRONICS AND TELECOMMUNICATION ENGINEERING PROGRAM
SCHEME OF INSTRUCTION AND EXAMINATION, REVISED COURSE (2019-2020)

SEMESTER – IV

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Duration (Hrs)	Marks					Credits
						Th	IA	TW*	P	Total	
ET410	Signals and Systems	3	1	--	3	100	25	25	--	150	4
ET420	Microprocessors and Interfacing	4	--	--	3	100	25	--	--	125	4
ET430	Linear Integrated Circuits	4	--	--	3	100	25	--	--	125	4
ET440	Transmission Lines and Antennas	3	--	--	3	100	25	--	--	125	3
ET450	Statistical Communication Theory	3	1	--	3	100	25	25	--	150	4
ET460	Microprocessors and Interfacing Lab	--	--	2	--	--	--	25	50	75	1
ET470	Linear Integrated Circuits Lab	--	--	2	--	--	--	25	50	75	1
HM008	Engineering Economics and Management	3	--	--	3	100	25	--	--	125	3
	TOTAL	20	2	4	--	600	150	100	100	950	24

L-Lecture T-Tutorial P-Practical Th-Theory TW-Term Work IA-Internal Assessment

*Term Work marks are to be awarded through continuous evaluation

THIRD YEAR ELECTRONICS AND TELECOMMUNICATION ENGINEERING PROGRAM
SCHEME OF INSTRUCTION AND EXAMINATION, REVISED COURSE (2019-2020)

SEMESTER – V

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Duration (Hrs)	Marks					Credits
						Th	IA	TW*	O	Total	
ET510	Analog and Digital Communication	3	1	--	3	100	25	25	--	150	4
ET520	Digital Signal Processing	3	1	--	3	100	25	25	--	150	4
ET531	Embedded Systems	3	--	--	3	100	25	--	--	125	3
ET532	Power Electronics										
ET533	Soft Computing										
ET534	Numerical Methods and Approximations										
ET535	Solid State Devices and Technology										
ET541	Microwave Engineering	3	--	--	3	100	25	--	--	125	3
ET542	Electromagnetic Compatibility Engineering										
ET543	Digital Image Processing										
ET544	Electronic Instrumentation and Automation										
ET545	Information Theory and Coding										
ET550	Communication Engineering Lab	--	--	2	--	--	--	25	25	50	1
ET560	Electronic Measurement Lab	--	--	2	--	--	--	25	25	50	1
**	**Open Elective**	3	--	--	3	100	25	--	--	125	3
HM009	Ethics and Entrepreneurship	3	--	--	3	100	25	--	--	125	3
	TOTAL	18	2	4	--	600	150	100	50	900	22

L-Lecture T-Tutorial P-Practical O-Oral Th-Theory TW-Term Work IA-Internal Assessment

*Term Work marks are to be awarded through continuous evaluation

** Student will have to enter the course code that he/she takes as part of the open elective

THIRD YEAR ELECTRONICS AND TELECOMMUNICATION ENGINEERING PROGRAM
SCHEME OF INSTRUCTION AND EXAMINATION, REVISED COURSE (2019-2020)

SEMESTER – VI

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Duration (Hrs)	Marks					Credits
						Th	IA	TW*	O	Total	
ET610	Control System Engineering	3	1	--	3	100	25	25	--	150	4
ET620	VLSI Technology and Design	3	1	--	3	100	25	25	--	150	4
ET631	Real Time Operating Systems	3	--	--	3	100	25	--	--	125	3
ET632	Radar System Engineering										
ET633	Artificial Neural Networks										
ET634	Nanoelectronics										
ET635	Wireless Sensor Networks										
ET641	Motor Control and Applications	3	--	--	3	100	25	--	--	125	3
ET642	Adaptive Signal Processing										
ET643	Bio-medical Electronics and Instrumentation										
ET644	Mobile Communication										
ET645	Error Control Coding										
ET650	VLSI Lab	--	--	2	--	--	--	25	25	50	1
ET660	Electronic System Design Laboratory	--	--	2	--	--	--	25	25	50	1
**	Open Elective	3	--	--	3	100	25	--	--	125	3
HM006	Cyber Law and IPR	3	--	--	3	100	25	--	--	125	3
	TOTAL	18	2	4	--	600	150	100	50	900	22

L-Lecture T-Tutorial P-Practical O-Oral Th-Theory TW-Term Work IA-Internal Assessment

*Term Work marks are to be awarded through continuous evaluation

** Student will have to enter the course code that he/she takes as part of the open elective

FOURTH YEAR ELECTRONICS AND TELECOMMUNICATION ENGINEERING PROGRAM
SCHEME OF INSTRUCTION AND EXAMINATION, REVISED COURSE (2019-2020)

SEMESTER – VII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination						
		L	T	P	Duration (Hrs)	Marks					Credits
						Th	IA	TW*	O	Total	
ET710	Data Communication	3	1	--	3	100	25	25	--	150	4
ET721	Robotics	3	--	--	3	100	25	--	--	125	3
ET722	Machine Learning										
ET723	Wavelets and Multirate Signal Processing										
ET724	Consumer Electronics										
ET725	Hardware Description Language										
ET730	Data Communication Lab	--	--	2	--	--	--	25	25	50	1
**	Open Elective	3	--	--	3	100	25	--	--	125	3
ET740	Internship	--	--	6	3	--	--	50	50	100	3
ET750	Project Work - Phase I	--	--	6	3	--	--	50	75	125	3
	TOTAL	9	1	14	--	300	75	150	150	675	17

L-Lecture T-Tutorial P-Practical O-Oral Th-Theory TW-Term Work IA-Internal Assessment

*Term Work marks are to be awarded through continuous evaluation

FOURTH YEAR ELECTRONICS AND TELECOMMUNICATION ENGINEERING PROGRAM
SCHEME OF INSTRUCTION AND EXAMINATION, REVISED COURSE (2019-2020)

SEMESTER – VIII

Course Code	Nomenclature of the Course	Scheme of Instruction Hrs/Week			Scheme of Examination					
		L	T	P	Duration (Hrs)	Marks				Credits
						Th	IA	TW	O	Total	
ET810	Advanced Communication Engineering	3	--	--	3	100	25	--	--	125	3
ET821	Process Control Instrumentation	3	--	--	3	100	25	--	--	125	3
ET822	RF Design										
ET823	High Performance Computer Architecture										
ET824	Secure Communication										
ET825	System Verification and Validation										
ET830	Elective - NPTEL / MOOC / SWAYAM	3	--	--	--	--	--	50	50	100	3
ET840	Project Work - Phase II	--	--	18	--	--	--	200	200	400	9
	TOTAL	9	0	18	--	200	50	250	250	750	18

L-Lecture T-Tutorial P-Practical O-Oral Th-Theory TW-Term Work IA-Internal Assessment

*Term Work marks are to be awarded through continuous evaluation

SECOND YEAR ELECTRONICS AND TELECOMMUNICATION ENGINEERING PROGRAM
SYLLABUS, REVISED COURSE (2019-2020)

SEMESTER – III

MATHEMATICS-III					
Course Code	**ET310**		**Credits**	**4**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**1**	**0**	**39hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 150 marks	**25**	**25**	**100**	**0**	**0**

Course Objectives:

The objective of the course is to make students understand fundamentals of Mathematics necessary to formulate, solve and analyze engineering problems

Course Outcomes:

The student will be able to:

CO1	Solve problems in engineering domain related to Linear Algebra using matrices.
CO2	Analyze and solve engineering problems using Laplace Series
CO3	Analyze and solve engineering problems using Fourier Series.
CO4	Solve engineering problems using Complex Integration.

UNIT -1	
Matrices: Types of matrices, Determinant, adjoint, inverse of matrix, elementary transformation, Elementary matrices, Rank of matrix, Reduction to normal form, canonical form. Rank using elementary transformation, Linear independence end dependence. System of the form AX=0 and AX=B, their solutions. Eigen values, Eigen vectors with properties. Cayley Hamilton theorem with Applications. Minimal polynomial, Diagonalisation.	9hrs

UNIT -2	
Laplace Transforms: Definition. Existence conditions, Properties, Laplace transform of periodic functions, Laplace transform of Dirac-Delta function, Inverse Laplace Transform, Convolution theorem, Application of Laplace transforms in solving linear differential equations with initial conditions and system of linear simultaneous differential equations.	10hrs
UNIT -3	
Fourier Series: Fourier Series, Fourier series of Periodic functions, Trigonometric Series, Euler's formulas, Dirichlets condition, Even and Odd functions, Half range series, Parseval's Identity. **Wave equation derivation and solution using separation of variable method**. Derivation and solution of one dimensional heat equation using separation of variable method.	10hrs
UNIT -4	
Complex Integration, Cauchy's Integral theorem and its application. Integral formula for simply and multiply connected domains and its applications. Taylors and Laurents' series and their application. Singular points. Liouvilles theorem with applications. Residue theorem and applications. Contour Integration. Boundary value problems.	10 hrs

TEXTBOOKS	
1	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010
2	Frank Ayres; Theory and Problems of Matrices; Schaum Outline Series. 2011
3	H.S. Kasana; Complex Variables (Theory and Applications); - PHI. 2005
4	Srimanta Pal, Subodh C. Bhunia; Engineering Mathematics; Oxford University Press..2015

REFERENCES

1	J. Brown and R. Churchill; Complex Variables and Its applications; McGraw-Hill Education. 2013
2	K.P. Gupta; Special Functions; Krishna Prakashan Media. 1991
3	Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2011

CIRCUIT ANALYSIS AND SYNTHESIS					
Course Code	**ET320**		**Credits**	**3**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**0**	**0**	**39hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125 marks	**25**	**0**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with:

1. Ability to analyze linear electrical networks and perform Time domain analysis of electrical circuits.
2. An understanding of graph theory and its application for circuit analysis.
3. Ability to synthesize an electrical circuit and model a circuit into any equivalent Two port network.
4. An understanding of the Construction and working of various types of attenuators, motors and bridges.

Course Outcomes:

The student will be able to:

CO1	Explain the concepts related to Electrical Networks, Graph theory & Motors.
CO2	Apply Network Theorems & Laplace Transforms.
CO3	Analyze Electrical Networks using Time and frequency domain techniquess,
CO4	Design & Synthesize Electrical Networks.

UNIT -1	
Network Classification: Distributed and lumped, passive and active, time variable and time invariant, symmetrical and asymmetrical networks. **Network Analysis:** Mesh and nodal analysis, super-node and super-mesh analysis. **Network Theorems (AC and DC analysis):** Thevenin's, Maximum power transfer, Norton's, Superposition, Compensation, Reciprocity and Tellegen's theorem.	10 hrs
UNIT -2	
Graph Theory: Basic definitions, Duality, Matrices associated with network graphs: Incidence, Tieset, Cutset matrices. Applications to mesh and nodal analysis.	10hrs

Time- domain analysis: Network equations in time- domain, first and second order circuits, Initial condition. Analysis of transient and steady state response to step, ramp, impulse, exponential, sinusoidal input; Application of Laplace transform to analysis of networks for different inputs (sinusoidal, step, ramp, impulse, sinusoidal).	
UNIT -3	
Two Port Networks: Characterization in terms of Z,Y,H and ABCD parameters, Equivalent circuits; interrelationship between the two port parameters; input, output ,characteristic impedance and image impedances of two ports. Introduction to s parameters. **Elements of Network Synthesis:** Positive real functions, Reactance functions, R, L and RC functions (Foster method and Caver method). **Attenuators –** Classification, Analysis and design of T, pi, Lattice and Bridged-T attenuator.	10hrs
UNIT -4	
Construction and working of DC motors, stepper motors, servo motors, synchro motors, single phase Induction motors **Review of DC Bridges:** Wheatstone bridge, Wein Bridge, errors and precautions in using bridges. **AC Bridges:** Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance- Schearing Bridge. Kelvin Bridge, Q-meter	9hrs

TEXTBOOKS	
1	A. Sudhakar & P. Shyamohan; Circuits & Networks- Analysis and Synthesis; Tata McGraw-Hill.2006
2	M.E. Van Valkenburg; Network Analysis; 3e Pearson Education. 2015
3	D. Roy Choudhary; Networks & systems; New Age International Publishers.2005.
4	A.K. Sawhaney; A Course in Electrical and Electronic measurements & Instrumentation; Dhanpat Rai & Sons. 2015

REFERENCES	
1	F. F. Chuo; Network Analysis and Synthesis; 2ed Wiley Eastern 2006
2	A. Chakrabarti; Circuit theory Analysis and Synthesis); Dhanpat Rai Publishing Company. 2018
3	K. L. Kishore; Electronic Measurements & Instrumentations; Pearson Education 2012

ELECTRONIC DEVICES AND CIRCUITS					
Course Code	**ET330**		**Credits**	**4**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**1**	**0**	**39hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 150 marks	**25**	**25**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with:

1. An understanding of energy band theory for semiconductor device operation.
2. Ability to perform transistor modeling and analysis of circuits.
3. An understanding of multi stage and large signal amplifier, feedback mechanism and its application in amplifier and oscillator circuits.
4. Ability to design RC differentiator, integrator , Multivibrator circuits and to perform analysis of JFET and MOSFET biasing circuits.

Course Outcomes:

After successful completion of the course student will be able to :

CO1	Explain the concept of conduction & qualitative theory in semiconductors, the theory of p-n junction diodes and filters.
CO2	Analyze BJT hybrid and re models ,JFET and MOSFET biasing for various configurations..
CO3	Analyze filter circuits, multi stage and large signals BJT amplifiers, different configurations of negative feedback in amplifier circuits
CO4	Design RC Differentiator and Integrator circuits and different types of oscillator circuits.

UNIT -1	
Energy Band Theory of Crystals - Insulators, Semiconductors and Metal. Conduction in semiconductors: electrons and holes, conductivity of semiconductors, carrier concentration in intrinsic semiconductors, donor and acceptor impurities, charge densities in semiconductors, Fermi level in semiconductors, diffusion, carrier lifetime, continuity equation, hall effect. Semiconductor Diode Characteristics- Qualitative theory of the PN junction, PN junction as a diode, band structure of an open circuited p-n junction, Quantitative theory of the p-n diode currents, The Volt-Ampere characteristic, The Temperature dependence of p-n characteristics.	9 hrs
UNIT -2	
BJT transistor modelling, Amplification in the ac domain, input and output impedance, current and voltage gain, hybrid and re equivalent model, BJT small signal analysis for CE voltage divider biasing configuration, approximate and complete hybrid equivalent model for CE voltage divider biasing configuration. Miller's theorem Multistage Amplifiers-direct, RC-coupled and transformer coupled, Darlington pair, Difference between voltage and power amplifiers, classification of power amplifiers, Class A Power Amplifiers (Direct coupled with resistive load, transformer coupled with resistive load), Class B Power Amplifier. Class B Push-pull amplifier, crossover distortion, Class AB Push-pull amplifier, complementary Symmetry Class B Push-pull amplifier	10hrs
UNIT -3	
Principle of negative feedback in amplifiers, voltage series, voltage shunt, current series, current shunt types of feedback. Typical transistor circuit effect of negative feedback on input and output impedance, voltage and current gains, bandwidth, noise and distortion. Principle of positive feedback, concept of feedback and stability in electronic circuits, the Nyquist Criterion, Gain and Phase Margin, Sinusoidal Oscillators, Barkhausen criterion, various types of oscillators – RC, Clapps, Wein Bridge, Colpitt, Hartley, Tuned LC , crystal oscillator.	10hrs
UNIT -4	
Filters: L, C, LC and CLC analysis.	10hrs

Steady state response of RC differentiator & integrating circuits to square wave, BJT as a switch, Improving switching times. Analysis & Design of Basic BJT Bistable , Astable and Monostable Multivibrator. FET BIASING: (JFETs and Depletion –type MOSFET) -Fixed-Bias, Self-Bias and Voltage-Divider Bias Configurations(both n- and pchannel); Enhancement-Type MOSFETs-Feedback Biasing arrangement, Voltage – Divider Biasing arrangement.	

TEXTBOOKS	
1	J. Millman, C. Halkias & Satyabrata Jit; Electronic Devices and Circuits; 4e McGraw Hill. 2015
2	R. Boylestad & L. Nashelsky; Electronic Devices and Circuit Theory; 10e Pearson Education Limited 2009.
3	David Bell; Solid State Pulse Circuits;4e Oxford University Press. 2007
4	J. B Gupta; Electronic Devices and Circuits; S. K. Kataria & Sons. 2013

REFERENCES	
1	B.G. Streetman; Solid State Electronic Devices, 6e PHI 2010
2	S. M. Sze; Physics of Semiconductor Devices 3e Wiley Publication.2008
3	Garud & Jain; Electronic Devices & Linear circuits; Tata McGraw Hill. 1983

DIGITAL SYSTEM DESIGN					
Course Code	**ET340**		**Credits**	**4**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**1**	**0**	**39hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 150 marks	**25**	**25**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with:

1. An understanding of various Number Systems & Codes along with Boolean algebra.
2. An ability to solve Boolean algebra problems.
3. An ability to design combinational and sequential circuits.
4. An understanding of various digital Logic families.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Explain different combinational logic circuits, flip-flops, sequential circuits, registers and digital logic families.
CO2	Solve Boolean expressions using Boolean algebra and implement different logic circuits
CO3	Analyze combinational and sequential circuits
CO4	Design combinational and sequential circuits

TEXTBOOKS	
1	M. Morris Mano; Digital Logic and Computer Design; PHI. 2016
2	Anand Kumar; Fundamentals of Digital Circuits; 4e PHI. 2016
3	Vincent P. Heuring, Harry F. Jordan, T.G. Venkatesh;Computer Systems Design and Architecture, 2e PHI 2012
4	Thomas Floyd; Digital Fundamentals - A Systems Approach; 11e Pearson Education. 2015

REFERENCES	
1	D. Leach, A. P. Malvino, G. Saha; Digital Principles & Applications; 8e Tata McGraw-Hill.2014
2	William Fletcher; An Engineering Approach to Digital Design; PHI. 2009
4	Neil H. E. Weste; Principles of CMOS VLSI Design; Addison-Wesley Publishing Company.. 1993

UNIT 1	
Number Systems & Codes: Decimal, Binary, Hexadecimal, Octal systems; Interconversions, Signed & Unsigned Binary numbers, Complements, Binary Arithmetic: Addition & Subtraction using 1's & 2's complements. **Binary Codes-**Decimal codes (BCD, Excess-3, 8421, 2421), Error Detection codes (Parity generation & Detection), Reflected code, Alphanumeric codes (EBCDIC, ASCII), Study of Binary logic with logic gates. **Boolean Algebra:** Postulates & Theorems, Boolean functions and their Algebraic manipulation, Canonical & Standard forms, Minterms & Maxterms. Simplification of Boolean functions: K-maps, POS & SOP simplification and their inter conversions, NAND & NOR implementation, Plotting & Reading of K-map using VEM.	9 hrs
UNIT -2	
Combinational Logic: Design Procedure for Combinational logic circuits, Design & Analysis of Half Adder, Full Adder, Subtractor, Code Conversion, binary Parallel Adder, Look-ahead Carry generator, Decimal Adder (BCD Adder), Magnitude Comparator, Decoders, Combinational logic implementation, Demultiplexers, Encoders, Multiplexers, Boolean function implementation with multiplexers. Design of Seven-segment display, Parity generator, checker. **Flip-flops:** Basic flip-flop circuit, Clocked RS flip-flop, D flip-flop, JK flip-flop, T flip-flop, Triggering of flip-flops, Master Slave flip-flop, Edge triggered flip-flops: their schematic symbols, truth table & Excitation table, conversion between different types of flip flops.	10hrs
UNIT -3	
Sequential Circuits: Design procedure for sequential circuits using state diagrams, state table, state equations, state reduction and assignment, Circuit implementation, Moore & Mealy Machine. Finite state machine. Design and analysis of counters, Modulo Counters, Synchronous, Ripple and ring counters (Switch tail, Johnson), Application of counters, Timing Sequences, Word time generation, timing signals. **Registers:** SISO, SIPO, PISO, PIPO, Register with parallel load, Shift registers, Universal shift register.	10 hrs
UNIT -4	
Design of Arithmetic circuits – Adders: Carry Save, Carry Look Ahead, Carry Select Adder delta delay. Multipliers: Wallace Tree, Braun Multiplier, Restoring and Non Restoring Dividers. **Digital Logic Families:** Characteristics of Digital ICs, TTL-Operation of TTL NAND gate, Active pull-up, Open Collector output, Wired AND, three state (or tri-state) output, Schottky TTL, ECL. Characteristics of MOSFET's, CMOS Inverter, NAND and NOR, CMOS to TTL and TTL to CMOS interfacing. .	10 hrs

ELECTROMAGNETIC FIELD & WAVE THEORY					
Course Code	**ET350**		**Credits**	**4**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**1**	**0**	**45 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 150 marks	**25**	**25**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with:

1. An understanding of different coordinate systems.
2. Ability to perform analysis for Electrostatics and Magnetostatic fields.
3. An understanding of the Electromagnetic wave equation and its solution for application in real world problems.
4. An ability to handle design issues in Guided waves.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Understand basic concepts of static electric fields, static magnetic fields, and time-varying electromagnetic fields.
CO2	Apply vector calculus to quantify the behavior of electric, magnetic, and electromagnetic fields in standard configurations.
CO3	Analyze electromagnetic wave propagation in free-space and waveguides.
CO4	Evaluate field quantities and characteristic parameters of electromagnetic waves through different material media.

UNIT -1	
System of Coordinates: Cartesian, cylindrical and spherical coordinate system, transformation from cartesian to cylindrical and spherical coordinate system, Divergence of a vector field, Curl of a vector, Stoke's theorem. Conservative and non-conservative fields, Helmholtz's theorem.	12 hrs

Electrostatics: Coulomb's Law, Electric Field Intensity due to point charges and distributed charges. Electric Flux density, Electric flux, Postulates of the electrostatic field, Gauss's law and its applications, **Electric Potential:** Electrical potential due to point charges and distributed charges. Energy in electrostatic field, Energy due to point and distributed charges. **Boundary Value Problems:** Poisson's equations for the electrostatic field, Laplace's equation for the electrostatic field, Solution methods, Solution by direct integration.	
UNIT -2	
Interface Conditions: Interface conditions between two dielectrics, Interface conditions between dielectrics and conductors. **Capacitance:** Parallel plate capacitor, Capacitance of infinite structures. **Conduction and Convection Current Density:** Convection current and convection current density, Conduction current and Conduction current density, Power dissipation and Joule's law, The continuity equation. **The Static Magnetic Field:** Magnetic Field, Magnetic Field Intensity, Magnetic Flux Density and Magnetic Flux, Postulates of static Magnetic field, Magnetic Vector potential, Magnetic Scalar potential, Magnetic Dipole, Biot Savart Law, Ampere's circuital Law. Behaviour of Magnetic Materials, Diamagnetic and Ferromagnetic materials. **Magnetic Circuits:** Magnetomotive force, Magnetic reluctance, Forces in the magnetic field. Energy stored in the magnetic field.	9hrs
UNIT -3	
Magnetostatic energy in terms of fields. Time varying Electric and Magnetic fields: Faraday's Law, Lenz's Law, Electromotive force, Eddy currents. Maxwell's Equations: Continuity equation for time varying fields, Displacement current density, Generalized Ampere's Law, Maxwell's equations in differential, integral and time harmonic representation. **Interface Conditions for Electromagnetic Field:** Interface condition for the electric field, interface condition for the magnetic field. **Electromagnetic Wave Equation and its Solution:** Electromagnetic waves, Time dependent wave equation, Time Harmonic Wave Equation, Solution of the wave equation for uniform plane waves in free space, perfect dielectrics.	12hrs

Poynting's Theorem: Poynting vector, Complex Poynting vector, Electromagnetic power density. Propagation of Plane waves in Materials.	
UNIT -4	
Propagation of plane waves in lossy dielectrics, low loss dielectrics and conductors, Concept of Phase and Group velocity. Polarization of Plane Waves: Concept of Polarization, Linear, Elliptical and Circular Polarization. **Reflection and Transmission of Plane Waves:** Reflection and Transmission at a General Dielectric Interface with Normal Incidence, Standing Waves, **Guided Waves:** Waves between parallel planes; Transverse electric (TE) waves, Transverse magnetic (TM) waves; Characteristics of TE and TM waves; Transverse electromagnetic (TEM) waves; Velocities of propagation	12hrs

TEXTBOOKS	
1	M. Sadiku; Elements of Electromagnetics, 4th edition; Oxford University Press.2006
2	E. C. Jordan, K. G. Balmain; Electromagnetic Waves & Radiating Systems; 2e,PHI.2011
3	J. D. Kraus; Electromagnetics 5th Edition; McGraw Hill.2010
4	D. K. Cheng; Field and Wave Electromagnetics, Second Edition; Pearson Education. 2014

REFERENCES	
1	N. Ida; Engineering Electromagnetics, 2nd Edition; Springer International Edition.2007
2	J. Edminister, Mahmood Nahvi; Theory and Problems in Electromagnetics; Schaum Series, 4e McGraw Hill. 2014
3	W. H. Hayt, J. A. Buck; Engineering Electromagnetics, Seventh Edition; Tata McGraw Hill Edition. 2012

ELECTRONIC DEVICES AND CIRCUITS LAB					
Course Code	**ET360**		**Credits**	**1**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	0	**0**	**2**	**26 hrs/sem**	
Scheme of Examination TOTAL = 50 marks	**IA**	**TW**	**TM**	**P**	**O**
	0	**25**	**0**	**25**	**0**

Course Objective

To understand the concepts,working and characteristics of Diodes, BJT and FET Transistors, amplifiers and biasing techniques of transistors.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Verify the working of different diodes, transistors, CRO probes and measuring instruments. Identifying the procedure of doing the experiment.
CO2	Design the circuits with basic semiconductor devices (active & passive elements), measuring instruments & power supplies that serves many practical purposes.
CO3	Construct, analyze and troubleshoot the designed circuits.
CO4	Measure and record the experimental data, analyze the results, and prepare a formal laboratory report.

List of Experiments:

(At least 10 experiments should be conducted from the following list of experiments.)

SN	Experiment
1	Filters
2	Transistor DC biasing
3	RC-coupled
4	Transformer coupled,
5	Darlington pair
6	Class A
7	Class B, complementary symmetry
8	Push-pull amplifiers
9	Class C Amplifier
10	Voltage series, voltage shunt, current series, current shunt types of feedback
11	RC & LC Oscillator
12	Clapps Oscillator
13	Wein Bridge Oscillator
14	Colpitt Oscillator
15	Hartley Oscillator

16	Steady state response of RC differentiator & integrating circuits
17	Design of Basic BJT Monostable Multivibrator
18	Design of Basic BJT Astable Multivibrator
19	Design of Basic BJT Bistable Multivibrator
20	Design of BJT Schmitt trigger
21	Fixed- Bias, Self-Bias and Voltage-Divider Bias Configuration for FET

DIGITAL SYSTEM DESIGN LAB					
Course Code	**ET370**		**Credits**	**1**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**0**	**0**	**2**	**26 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 50 marks	**0**	**25**	**0**	**25**	**0**

Course Objectives

- To know the concepts of Combinational circuits.
- To understand the concepts of flipflops, registers and counters

Course Outcomes

The student will be able to:

CO1	Verify the working of basic digital gates
CO2	Construct basic combinational circuits and verify their functionalities
CO3	Apply the design procedures to design basic sequential circuits
CO4	Learn about counters, Shift Registers and verify their operation

List of Experiments:

(At least 10 experiments should be conducted from the following list of experiments.)

SN	Experiment
1	Truth Table and Logic Gates
2	Half Adder, Full Adder
3	Half Subtractor, Full Subtractor
4	BCD Adder
5	Multiplexer& Demultip[lexer
6	Encoder &Decoder
7	Magnitude Comparator
8	SR & JK Flip-Flop
9	Ring & Twisted Ring Counter
10	Binary Asynchronous Counter
11	Synchronous UP/DOWN Counter Design
12	SISO, SIPO Shift register
13	Universal Shift Register

TECHNICAL COMMUNICATION					
Course Code	**HM380**		**Credits**	**2**	
Scheme of Instruction Hours/ Week	**L**	**T**	**P**	**TOTAL**	
	2	**0**	**2**	**26hrs/sem**	
Scheme of Examination TOTAL = 75 marks	**IA**	**TW**	**TM**	**P**	**O**
	0	**75**	**0**	**0**	**0**

Course Outcomes:

The student will be able to:

CO1	Demonstrate precise language skills with suitable vocabulary and apt style.
CO2	Develop life skills/interpersonal skills to progress professionally.
CO3	Apply traits of suitable candidature for a job/higher education.
CO4	Deliver formal presentations and effectively implementing the verbal and non-verbal skills.

UNIT -1	7 Hrs
Communication **Oral Communication** Listening, Speaking, Reading, Writing (LSRW), Conversational Dialogues, Role Play, Barriers to Oral Communication, Effective Oral Communication, Principles of Communication, Dos and Don'ts of Group Discussion **Global Communication** Social Media, People Analytics, Models of Culture, Cross-Cultural Communication, Compare Cultures of the World, Impact of Cultural Differences on Managerial Communication, Effective Communicator in a Cross-Cultural setting	
UNIT -2	7 Hrs
Personality Development Social Etiquette, Email Etiquette, Table Etiquette, Telephone Etiquette, SWOC Analysis, Life Coaching, Emotional Intelligence, Leadership, Time Management, Motivation, Goal Setting, Team Work and Collaboration, Critical Thinking and Problem Solving, Professional Attitude, Persuasion, Anxiety and Stress Management, Social Responsibility	

UNIT -3	6Hrs
Career Development Resume Building, Interviewing Skills, Job Search, Personal Networking and Branding, Personal Finance, Build Professional Portfolio	
UNIT -4	6Hrs
Public Speaking Methods to overcome anxiety, Build Confidence, Use of Media Aids, Craft an Impactful Speech, Design Impactful Presentations, Effective Presentation Delivery	

TEXTBOOKS	
1	Meenakshi Raman and Sangeeta Sharma; Technical Communication: Principles and Practice, 3rd ed; Oxford University Press
2	Meenakshi Raman, Prakash Singh; Business Communication; 2nd ed.; Oxford University Press
3	Dr. K. Alex; Soft Skills: Know Yourself and Know The World; 3rd ed; S. Chand Publishing

REFERENCES

1	Nicky Stanton; Mastering Communication; 5th ed.; Palgrave Master Series; Red Globe Press
2	Ghosh, B. N.; Managing Soft Skills for Personality Development; Tata McGraw Hill; 2012
3	Wallace and Masters; Personal Development for Life and Work;10th edition; Thomson Learning
4	Lehman, Dufrene, Sinha; BCOM : A South-Asian Perspective with CourseMate; 2nd edition; Cengage Learning
5	Ashraf Rizvi; Effective Technical Communication; Tata McGraw-Hill; 2005
6	MolefiKete Asante, William B. Gudykunst, Bella Mody; Handbook of International and Intercultural Communication; 2nd ed.; Sage Publications

MATHEMATICS-I& II (BRIDGE COURSE)					
Course Code	**AC390**		**Credits**	**0**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**2**	**0**	**0**	**28 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 0 marks	**0**	**0**	**0**	**0**	**0**

Course Outline:

This is an audit course.

This course is compulsory to direct second year/lateral entry students. It is introduced to reduce the knowledge gap in the students.

The syllabus is selected topics from FE110 Mathematics I and FE120 Mathematics II.

The Text books and References are same as shown in FE110 Mathematics I and FE120 Mathematics II.

SIGNALS AND SYSTEMS					
Course Code	**ET410**		**Credits**	**4**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**1**	**0**	**39hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 150 marks	**25**	**25**	**100**	**0**	**0**

Course Objective:

The course aims to provide the student with:

1. Understanding of time-domain representation and analysis of signals and systems.
2. An ability to perform frequency-domain representation and analysis using Fourier tools.
3. An ability to perform frequency-domain representation and analysis using Laplace transform and Z transforms.
4. An understanding of sampling, aliasing and Signal reconstruction

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Explain the concepts related to Fourier Series representation, Sampling and Fourier Domain Analysis
CO2	Apply Linear Time-Invariant, Fourier Series, Fourier Transform, Laplace Transform and Z - Transform properties
CO3	Analyze CT and DT signals and systems in Frequency domain using tools like CTFS, CTFT, DTFS and DTFT
CO4	Develop frequency domain representation of a time domain signal.

UNIT -1	
Introduction: Definitions and concept of different types of signals; continuous time and discrete time signals; transformation of independent variable; exponential and sinusoidal signal; unit impulse and unit step functions. **Systems:** continuous time and discrete time system and basic system properties.Linear time invariant (LTI) systems: Introduction, Discrete time LTI system, the convolution sum, continuous time LTI systems, the convolution integral, Impulse and step response.	9hrs
UNIT -2	
Fourier Series: introduction; response of LTI system to complex exponential; Fourier series representation of continuous-time periodic signals; convergence of the Fourier series; Parseval's relation. Fourier series representation of discrete time periodic signals; properties of discrete-time **Fourier Series: Properties:** linearity, time shifting, time reversal, time scaling, conjugation and conjugate symmetry, frequency shifting, convolution, multiplication	10hrs
UNIT -3	
Continuous-Time Fourier Transform: Representation of aperiodic signals: Fourier transform of aperiodic signals and their properties; linearity, time shifting, differentiation, integration, conjugation and conjugate symmetry, time ,frequency scaling, duality, Parseval's relation, convolution. **Discrete-Time Fourier Transform:** Representation of aperiodic signals; Fourier transform of aperiodic signals. **Sampling:** Introduction; representation of continuous time signals by its samples; sampling theorem; reconstruction of a signal from its samples using interpolation; the effects of undersampling; aliasing; Discrete-time processing of continuous-time signals; sampling of discrete- time signals.	10hrs
UNIT -4	
The Laplace transform: introduction; Laplace transforms; the region of convergence; inverse Laplace transform; Analysis and characterization of LTI system using the Laplace transform. Unilateral Laplace transforms.	10hrs

The Z-transform: introduction; Z-transform; the region of convergence; the inverse Z-transform; properties of Z-transform: linearity, time shifting, scaling ,time reversal, conjugation, convolution analysis and characterization of LTI system using Z-transforms.	

TEXTBOOKS	
1	A. V. Oppenheim, A.V.Willsky, S. Hamid; Signals and systems; 2nd Edition PHI.
2	S. Haykins , B. V. Veen; Signals and Systems; 2ed Wiley India. 2007
3	D. G. Rao, S. Tunga; Signals and systems; Pearson Education. 2010
4	R. E. Ziemer, W.H Tranter, D.R.Fannin; Signal and Systems; 4ed Pearson Education, Asia. 2013

REFERENCES

1	I. J. Nagrath, S.N.Sharan, R. Ranjan, S. Kumar; Signal and Systems; Tata McGraw Hill. 2013
2	A. Anand Kumar ;Signal and Systems , 3ed ,PHI, 2013
3	B.P. Lathi ;Linear Systems and Signals , 2ed, Oxford University Press, 2010

MICROPROCESSORS AND INTERFACING					
Course Code	**ET420**		**Credits**	**4**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**4**	**0**	**0**	**52hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125marks	**25**	**0**	**100**	**0**	**0**

Course Objectives:

The course aims to provide the student with:

1. An in-depth understanding of the Intel 8085 architecture and programming model.
2. An ability to write Assembly language programs for a given task.
3. An understanding of different types of memories, peripheral IC's like 8255, 8259 and 8251and their interfacing with the processor.
4. An ability to interface various I/O devices with the processor.

Course Outcomes:

The Student will be able to:

CO1	Explain the concepts related to Microcomputer System and Semiconductor Memories.
CO2	Understand the Architecture and Working of 8085 µP and Interfacing ICs such as 8255, 8259 and 8251.
CO3	Analyze the instruction set and the timing sequence of various instructions.
CO4	Create Assembly language programs for a given task & Design Interfacing of Memory and I/O devices

UNIT -1	
Introduction of Microcomputer System: CPU, I/O devices, clock, memory, bus architecture, tri-state logic, address bus, data bus and control bus. **Semiconductor Memories:** Development of semiconductor memory, internal structure and decoding, memory read and write timing diagrams, RAM, ROM, EPROM, EEPROM, DRAM. **Architecture of 8-bit Microprocessor:** Intel 8085A microprocessor, Pin description and internal architecture.	10 hrs

Operation and Control of Microprocessor: Timing and control unit, op-code fetch machine cycle, memory read/write machine cycles, I/O read/write machine Cycles, interrupt acknowledge machine cycle.	
UNIT -2	
Instruction Set: Addressing modes; Data transfer, arithmetic, logical, branch, stack and machine control groups of instruction set, Subroutines, parameter passing to subroutines. Writing, Assembling & Executing A Program, Debugging The Programs, Decision Making, Looping, Stack & Subroutines, Developing Counters And Time Delay Routines, Code Conversion, BCD Arithmetic And 16-Bit Data Operations.,	14hrs
UNIT -3	
Interfacing: Interfacing of memory chips, address allocation technique and decoding; Interfacing of I/O devices, LEDs, and toggle-switches as examples, memory mapped and isolated I/O structure. **Programmable Peripheral Interface:** Intel 8255, pin configuration and block diagram, modes of operation, programming; ADC and DAC chips, stepper motor their interfacing and programming.	14hrs
UNIT -4	
Interrupts: Interrupt structure of 8085A microprocessor, processing of vectored and non-vectored interrupts, Handling multiple interrupts, and programming. **Programmable Interrupt Controller:** Intel 8259, Block diagram, Interrupt operation, programming. Serial I/O Concepts, SID and SOD, Intel 8251A programmable communication Interface, pin configuration, internal block diagram, programming.	14hrs

TEXTBOOKS	
1	Gaonkar R. S.; “Microprocessor Architecture, Programming and Applications”; 5th Ed.; Penram International; 2007.
2	Hall D. V.; “Microprocessor and Interfacing-Programming and Hardware”; 2nd Ed.; Tata McGraw-Hill Publishing Company Limited; 2008.
3	Stewart J; “Microprocessor Systems- Hardware, Software and Programming”; Prentice Hall International Edition; 1990.
4	Short K. L.; “Microprocessors and Programmed Logic”; 2nd Ed.; Pearson Education; 2008.

REFERENCES

1	Manual on 8-bit Processors 808; Intel.
2	Manual on Peripheral Devices; Intel.

LINEAR INTEGRATED CIRCUITS					
Course Code	**ET430**		**Credits**	**4**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**4**	**0**	**0**	**52hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125marks	**25**	**0**	**100**	**0**	**0**

Course Objectives:

This course introduces the theoretical & circuit aspects of Op-amp, which is the backbone for the basics of Linear integrated circuits.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.
CO2	Explain and design the linear and non-linear applications of an opamp and special application ICs.
CO3	Explain and compare the working of multivibrators using special application IC 555 and general purpose opamp
CO4	Illustrate the function of application specific ICs such as Data Converters, Voltage Regulators, OLL and its application in communication

UNIT -1	
Basics of Op-Amp: Differential amplifiers, ac and dc analysis, FET differential amplifier, constant current bias, current mirror circuit, op-amp parameters, definitions, measurements. Functional block diagram and working specification of IC741, equivalent circuit of Op-amp and voltage transfer curve, open loop inverting, non-inverting, differential amplifier. Disadvantages of open loop op-amp	14 hrs

Basics of Op-Amp: Frequency response and methods of frequency compensation, offset compensation, closed loop inverting and non-inverting amplifiers, voltage follower. Applications of op-amp: Differentiator, integrator, summing scaling and averaging amplifier.	
UNIT -2	
Applications of Op-Amp: Instrumentation amplifier, V-I & I-V converter, precision rectifier, log and antilog amplifier. Op-Amps as comparators, zero crossing detectors, Schmitt trigger, comparator characteristics, limitations of comparator, sample and hold circuit. Advantages of active filter, Butterworth low pass, high pass, band pass, band reject filter, design problems. Square wave generator, triangular wave generator, Wien bridge oscillator, Phase shift oscillators, design problems.	12hrs
UNIT -3	
Voltage Regulators: Specifications,&functional block diagrams of IC 723, Design of IC 723 as high and low voltage regulators. Specifications& working of three terminal regulators-IC78XX, 79XX, LM309, LM317 voltage regulator , principle and working of switching mode regulators, tracking regulator Introduction to resolution and accuracy in convertors, quantization error. **ADC and DAC:** Principle of successive approximation, successive approximation ADC. Binary weighted resistors and R-2R resistor ladder design problems, specifications, functional block diagrams of 0809 & 0808.	13hrs
UNIT -4	
Voltage controlled oscillator IC566: block diagram of IC566. **PLL:** Basic principles of phase-locked loop and block diagram, transfer characteristics of PLL, lock range and capture range (no derivations). Applications of PLL as frequency multiplier, AM demodulation, FM demodulation, Study of PLLIC565 and design problems.	13hrs

IC 555: Functional block diagram and specification, modes of IC555, applications of IC555 as monostable and astable multivibrator, design problems, modification for 50% duty cycle. Applications of IC 555 as VCO, missing pulse detector, frequency divider, PWM, IC 8038 and its applications in waveforms generation.	

TEXTBOOKS	
1	Ramakant A. Gayakwad; Op-Amps and linear integrated circuits; Pearson 2015
2	K. R. Botkar; Integrated Circuits; Khanna Publishers.2004
3	S. Franco; Design with operational amplifiers and analog integrated circuits; 3ed McGraw Hill. 2001
4	Tony Chan Carusone, David Johns, Kenneth Matins; Analog Integrated Circuit Design; 2e, John Wiley & Sons, 2013

REFERENCES

1	J. Millman, C. Halkias, C. Parikh; Integrated Electronics: Analog and Digital Circuits and Systems; 2ed, McGraw Hill. 2017
2	Gray Paul R., Meyer, Hurst, Lewis; Analysis and Design of Analog Integrated Circuits; 5ed, Wiley India Pvt Ltd
3	K. Michael Jacob; Applications and Design with Analog Integrated Circuits; 2ed, PHI

TRANSMISSION LINES AND ANTENNAS					
Course Code	**ET440**		**Credits**	**3**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**0**	**0**	**39hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125marks	**25**	**0**	**100**	**0**	**0**

Course Objectives:

The subject aims to provide the student with:

1. An understanding of Transmission Lines under different Terminal Conditions.
2. An understanding of Transmission Lines at Radio Frequency and Matching of Transmission Lines under different loads.
3. An understanding of the Antenna Concepts and Parameters.
4. An understanding of Antenna Arrays and Analysis of Field Patterns.

Course Outcomes:

The student after undergoing this course will be able to:

CO1	Explain the concepts of Transmission line theory, infinite line, line parameters, lossless lines, Antenna parameters and antenna arrays.
CO2	Apply the concepts of Transmission lines and Antennas to obtain parameters for distortion less lines, lines at radio frequencies, smith charts, antenna dipoles and antenna arrays.
CO3	Analyze the working of Transmission Lines under different Terminal Conditions and working of different types of antennas.
CO4	Solve problems on Transmission lines, power and impedance and antenna parameters.

UNIT -1	
Transmission-Line Theory: Equation for Voltage & Current for line of cascaded T-sections, line constants: Z, Y, characteristic impedance Z_o, propagation constant Expressions for Attenuation constant, Phase constant, velocity of propagation, Condition for minimum attenuation, Causes of distortion, condition for minimum distortion, infinite line, transfer impedance. The distortion less line, Reflection on a line not terminated in Z_o (Voltage and current-phasors), Reflection coefficient, Open- and short-circuited lines.	10hrs
UNIT -2	
The Line At Radio Frequencies: Introduction, Constants for the line of zero dissipation (Lossless Lines), Voltages and currents on the dissipation less line.	10hrs

Standing waves, nodes, standing wave ratio (SWR), Directional Coupler. **Input-impedance of the dissipation less line**: Input impedance of open- and short circuited lines, Power and Impedance measurement on lines, Reflection losses on the unmatched line. The quarter-wave line, half-wave line, eighth-wave line. The Smith circle diagram, Applications of the Smith chart; matching with the Smith chart.	
UNIT -3	
Basic Antenna Concepts: Antenna Parameters, Antenna Aperture and Aperture Efficiency, Effective Height, Maximum Effective Aperture of a Short Dipole and a Linear Half-Wave Antenna, Friss transmission formula. Point Sources, Power patterns, Power theorem, radiation intensity, different power patterns (Unidirectional and bi-directional cosine, sine, sine-squared, cosine squared and (cosine) ^{n}). **The short electric dipole**: Retarded vector potential, fields and radiation resistance, Radiation resistance of a half wave dipole and half wave antennas.	10hrs
UNIT -4	
Various forms of Antenna arrays, Arrays of point sources: Isotropic point sources of: (i) same amplitude and phase (ii) same amplitude but opposite phase (iii) same amplitude and in phase quadrature (iv) equal amplitude and any phase (v) unequal amplitude and any phase. **Patterns multiplication**: Radiation pattern of four and eight isotropic elements fed in phase. **Linear array**: Linear array with n isotropic point sources with equal amplitude and spacing; Broadside case; End-fire case, End fire array with increased directivity, **Loop antenna:** Field of a small loop **Helical Antenna:** Geometry, Transmission and radiation modes. **Construction and Characteristics of**: Horn antennas (Rectangular and Conical), Reflector antennas: Corner, paraboloidal, Cassegrain feed, Lens antennas, Yagi-Uda array, V- and Rhombic-antenna.	9hrs

TEXTBOOKS	
1	J.D. Ryder; Networks, Lines and Fields; 2ed, Pearson, 2015
2	J.D. Kraus;Antennas and Wave Propagation; McGraw Hill Education. 2010

3	K. D. Prasad; Antenna & Wave Propagation;Satya Prakashan 2009
4	E.C. Jordan, K. G. Balmain; Electromagnetic Waves & Radiating Systems; 2ed,PHI.2011

REFERENCES

1	Simon Ramo , John R. Whinnery, T.V. Duzer; Fields and Waves in Communication Electronics; 3ed, John Wiley & Sons.
2	George Kennedy; Electronic Communication Systems, 3rd Edition; Tata McGraw Hill

STATISTICAL COMMUNICATION THEORY					
Course Code	**ET450**		**Credits**	**4**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**1**	**0**	**39hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 150 marks	**25**	**25**	**100**	**0**	**0**

Course Objective

Understand the mathematical foundations that lead to the design of optimal receivers in AWGN channels.

Course Outcomes:

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

CO1	Understand representation of random signals
CO2	Investigate characteristics of random processes
CO3	Make use of theorems related to random signals
CO4	Understand propagation of random signals in linear systems

UNIT -1	
Review of Probability Theory: Probability Space, Marginal, Conditional, and Joint Probability, Statistical Independence, Bayes' Theroem, Bernoulli Trials. Random Variables: Concept of a Random Variable, Distribution and Density Functions - Cumulative Distribution Function, Probability Density Function and its relation to Probability, Joint Cumulative Distribution and Probability Density, Development of an Optimal Receiver. Expectation, Variance, Correlation, and Covariance of Random Variables. Useful Distributions and Properties: Gaussian Probability Density, Cumulative Gaussian Probability – The Error Function, Rayleigh Probability Density, Rician Distribution, Binomial Distribution, Exponential Distribution – Example of Life Length of an Appliance, Poisson Distribution.	10hrs
UNIT -2	
Limit theorems – Strong and Weak laws of Large Numbers, The Central Limit Theorem, Tchebyheff's Inequality, Schwarz Inequality. Development of Optimal Receiver for Discrete Messages for Noise Described by a Distribution Function. Random Processes: Ensemble Averages, Classification – Strict-sense Stationary, Wide-sense Stationary, Non-stationary. Ergodic Processes. Power Spectral Density (PSD) of Random Processes – Definition and its dependence on Autocorrelation. PSD of Digital Data, Transmission of a Random Process Through Linear Systems, Effect of First Order R-C, R-L, Filters on Digital Data	10hrs
UNIT -3	
Mathematical Representation of Noise: Sources of Noise, Frequency-domain Representation of Noise - Effect of Filtering on Probability Density of Gaussian	10hrs

Noise, Spectral Components of Noise, White Gaussian Noise (WGN), Response of Narrowband Filter to Noise, Effect of Filter on PSD of Noise, Superposition of Noises – Mixing Noise with Sinusoid, Mixing Noise with Noise. Linear Filtering of Noise – The RC Low pass Filter, The Ideal Low Pass Filter, The Rectangular Bandpass Filter, The Differentiating Filter, The Integrator. Noise Bandwidth. .	
UNIT -4	
Statistical Decision Theory: Hypothesis Testing - Neyman-Pearson Theorem, Possible Hypothesis Testing Errors and their Probabilities – Probability of Detection and Missed Detection, Probability of False Alarm, Decision Regions and Probabilities, NP test application in Signal Detection and DC level in WGN, Minimum Probability of Error with example of Minimum Error Criterion for DC level in WGN, Bayes' Risk, Multiple Hypothesis Testing with example of Multiple DC Levels in WGN.	9hrs

TEXTBOOKS

1	Athanasios Papoulis and S. Unnikrishna Pillai,;*robability, Random Variables, and Stochastic Processes* Fourth Edition, McGraw Hill Education.
2	Herbert Taub, Donald Schilling, and Goutam Saha;*Principles of Communication Systems* Third Edition, Tata McGraw Hill.
3	Steven Kay; *Fundamentals of Statistical Signal Processing, Vol. II – Detection Theory* , 2010, Pearson Education.

REFERENCES

1	David Middleton,An Introduction to Statistical Communication Theory ,Wiley-IEEE Press, 1996.
2	H. Stark and J. Woods;Probability and Random Processes with Applications to Signal Processing, Third Edition, Pearson Education.
3	Simon Haykin; Communication Systems, 5e, John Wiley & Sons, 2009
4	JohnProakis and Masoud Salehi;Fundamentals of Communication Systems; 2007, Pearson Education

MICROPROCESSORS AND INTERFACING LAB					
Course Code	**ET460**		**Credits**	**1**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**0**	**0**	**2**	**26 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 75marks	**0**	**25**	**0**	**50**	**0**

Course Objective

To introduce the basic concepts of microprocessor and to develop in students the assembly language programming skills and real time applications of Microprocessor and Interfaces.

Course Outcomes:

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

CO1	Understand and apply the fundamentals of assembly level programming of microprocessors
CO2	Work with standard microprocessor real time interfaces
CO3	Troubleshoot interactions between software and hardware
CO4	Analyze abstract problems and apply a combination of hardware and software to address the problem

List of Experiments:

(At least 10 experiments should be conducted from the following list of experiments.)

SN	Experiment
1	Writing programs using Data Transfer and arithmetic
2	Writing programs using logical and branch instructions
3	Writing Subroutines and passing parameters to subroutines
4	Developing Counters and Time Delay Routines
5	Developing programs for Code Conversion
6	Developing programs for BCD Arithmetic
7	Developing programs for 16-Bit Data Operations
8	Interfacing of memory chips

9	Interfacing of I/O devices: LEDs and toggle-switches
10	Interfacing Intel 8255
11	Interfacing ADC and DAC chips
12	Interfacing Stepper motor
13	Interrupt Programming
14	Interfacing Intel 8259
15	Interfacing Intel 8251

LINEAR INTEGRATED CIRCUITS LAB					
Course Code	**ET470**		**Credits**	**1**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**0**	**0**	**2**	**26 hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 75marks	**0**	**25**	**0**	**50**	**0**

Course objective

- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function ICs

Course Outcomes:

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

CO1	Understand the working of op-amp and its applications
CO2	Design and analyze various linear and non-linear application circuits of op-amp
CO3	Construct and trouble shoot op amp circuits in the laboratory with proper use of test equipment.
CO4	Develop IC based project kits in above areas according to specifications

List of Experiments:

(At least 10 experiments should be conducted from the following list of experiments.)

SN	Experiment
1	Current mirror circuit
2	Op-amp open loop inverting and non-inverting circuit
3	Op-amp Inverting and Non-Inverting amplifier
4	Op-amp: Differentiator, Integrator
5	Op-amp: Summing, Scaling and Averaging amplifier
6	Op-amp: Instrumentation amplifier
7	Op-amp Schmitt Trigger and Monostable Multivibrator
8	Binary Weighted &R-2R Laddertype D- A Converterusing op-amp.
9	Op-amp: Square wave generator, triangular wave generator

10	Active HP, LP and BP filter using op-amp
11	RC Phase Shift and Wein Bridge oscillator using op-amp
12	Astable and Monostable Multivibrator using IC 555
13	PLL Characteristics

ENGINEERING ECONOMICS AND MANAGEMENT					
Course Code	**ET480**		**Credits**	**3**	
Scheme of Instruction	**L**	**T**	**P**	**TOTAL**	
Hours/ Week	**3**	**0**	**0**	**39hrs/sem**	
Scheme of Examination	**IA**	**TW**	**TM**	**P**	**O**
TOTAL = 125marks	**25**	**0**	**100**	**0**	**0**

Course Objectives:

1. To expose students to basic Economic concepts and apply economic reasoning to problems of business.
2. To enhance students understanding of macroeconomic issues and problems.
3. To familiarize the students with the basic principles of management.
4. To acquaint the students with standard concepts that they are likely to find useful in their profession when employed.

Course Outcomes:

After the successful completion of the course, the student will be able to:

CO1	Calculate current demand, supply and forecast future demand
CO2	Calculate National Income, Inflation and Price Index
CO3	Evaluate different management theories
CO4	Apply managerial concepts to solve complex problems related to global issues.

UNIT -1	
Central concepts of Economics- Definitions of Economics , Scarcity and Efficiency, Nature of Economics: Positive and normative economics, Microeconomics and Macroeconomics **Basic Elements of Supply and Demand**- The Demand Schedule, The Demand Curve, Market Demand , Forces behind the Demand Curve, Shifts in Demand. The Supply Schedule The Supply Curve, Forces behind the Supply Curve , Shifts in Supply. Equilibrium of Supply and Demand , Effect of a Shift in Supply or Demand. Supply and Demand: Elasticity and Applications to major economic issues	9Hrs

Estimation/Forecasting of Demand: Meaning, importance, methods – trend, exponential smoothing, regression analysis	
UNIT -2	
Macroeconomics: Key Concepts of Macroeconomics. Objectives and Instruments of Macroeconomics. Aggregate Supply and Demand. **National Income Terms:** -Gross Domestic Product: The Yardstick of an Economy's Performance. Real vs. Nominal GDP. Net Domestic Product, GNP, National Income, Per capita income, Disposable Income, Price Index, Inflation. Consumption and Investment- Consumption, Income, and Saving, Investment. Determinants of Investment.	10 Hrs
UNIT -3	
General Principles of Management: Introduction to Management, Functions of a manager , Different schools of management –Scientific ,modern operational and behavioral. **Planning** :importance of planning, types of plans. Controlling-Basic control process, Critical control points and standards, Types of controls . Requirements for effective controls. Human Resource Management and Selection **Appraising and Rewarding Performance:** Money as a means of Rewarding Employees, performance appraisal, Economic Incentives Systems, the Reward Pyramid MBO Process, How to set objectives, benefits and weaknesses, Span of management , Factors determining an effective span, Organisation, Structure of organisation, Formal and informal organisation, Departmentation, Matrix Organisation, Strategic Business Unit Decentralisation and Delegation, OD process.	10 Hrs

UNIT -4	
Communication : Nature and Importance of Communication, The Two-Way Communication Process, Communication Barriers , Downward and Upward Communication/ Formal Informal Communication, Forms of communication **Motivation :**Model of Motivation, Motivational Drives, Human Needs, Types of Needs, Maslow's Hierarchy of Needs, Hezberg's Two-Factor Theory, Behavior Modification, Goal Setting ,Motivational Applications, The Expectancy Model Leadership: Ingredients of leadership,Trait theory, Behavioural theory, Contingency theory **Managing Change:** Nature of Work Change ,three Stage in Change, reaching a New Equilibrium, the Organizational Learning Curve for Change **Interpersonal Behavior:** Nature and Levels of Conflict, Sources of Conflict, Effects of Conflict, Model of Conflict: Participant Intentions, Resolution Strategies. Transactional Analysis: Ego States, Types of Transactions, Benefits. **Safety responsibility and Rights:** Responsibility of Engineers, Risk-Benefit Analysis, Ethical issues in Cost-benefit Analysis, Ethics and Risk Management, Reducing Risk.	10 Hrs

TEXTBOOKS	
1	P.A. Samuelson & W.D. Nordhaus, Economics, 19th Edition McGraw Hill, New York, 1995
2	John W. Newstrom, Keith Davis; Organizational Behavior (Human Behavior at Work); Tenth Edition, Tata McGraw Hill

3	R. L. Varshney, K L Maheswari; Managerial Economics; Nineteenth, Revised and Enlarged Edition; Sultan Chand and Sons Publications.

REFERENCES

1	P.C. Tripathi and P.N, Reddy, Principles of management, 2nd edition Tata McGraw Hill,1991
2	A. Alavudeen, R. Kalil Rahman and M. Jayakumaran; Professional Ethics and Human Values; Laxmi Publications.