Department: Electrical Engineering

Curriculum Structure for 3rd Semester
(to be effective from 2018-19 admission batch)

Department: Electrical Engineering

3rd Semester								
Sl No	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. THEORY								
1	ES	EE 301	Electrical Circuit Analysis	3	1	0	4	4
2	PC	EE 302	Measurement and Instrumentation	3	0	0	3	3
3	PC	EE 303	Analog Electronics	3	0	0	3	3
4	BS	M(EE)301	Mathematics - III	3	1	0	4	4
Total of Theory							**14**	**14**
B. PRACTICAL								
5	ES	EE 391	Electrical Circuit Analysis Laboratory	0	0	3	3	1.5
6	PC	EE 392	Measurement and Instrumentation Laboratory	0	0	3	3	1.5
7	PC	EE 393	Analog Electronics Laboratory	0	0	2	2	1
C. SESSIONAL								
8	MC	MC 301	Environmental Science	2	0	0	2	2 Units
9	MC	MC 381	Basic innovations, Creativity & Aptitude	0	0	2	2	2 Units
D. PROJECT*								
10	**Project Code**		**Project Name**	**Contact Hours/Week**				**Credit Points**
	EE 351		Projects on Electrical Circuit Analysis	1				0.5
	EE 352		Projects on Measurement and Instrumentation	1				0.5
	EE 353		Projects on Analog Electronics	1				0.5
	M(EE) 351		Projects on Mathematics - III	1				0.5
Total of Theory, Practical, Sessional & Project							**30**	**18+2**

* Student need to select any four projects (Total Credit: 0.5 × 4 = 2)

Subject Name: Electrical Circuit Analysis
Subject Code: EE301
Total Contact Hours: 40
Credit: 4

Prerequisite: The students to whom this course will be offered must have the concept of Basic electrical engineering ,Laplace transform, First order ordinary differential equation and Second order ordinary differential equation.

Course Objectives: To prepare students with the knowledge of Electrical Circuit Theory so that they can apply appropriate technique to solve Electrical Circuit Problems at optimal effort and time.

Course Outcomes (COs): At the end of this course, students will demonstrate the ability to

EE301.1	Understand the basic concepts of electric, magnetic and filter circuits.
EE301.2	Analyze the electric and magnetic circuits.
EE301.3	Analyze the filter circuits.
EE301.4	Analyze two port circuit behaviors.

Course contents:

MODULE I: INTRODUCTION (3)
Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks , Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals, Source transformation, KVL & KCL.

MODULE II: COUPLED CIRCUITS (3)
Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modelling of coupled circuits, Ideal Transformer, Solution of problems.

MODULE III: **LAPLACE TRANSFORM IN CIRCUIT ANALYSIS (8)**
Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros. Frequency response (magnitude and phase plots), series and parallel resonances.

MODULE IV: NETWORK THEOREMS (5)
Loop variable analysis, Node variable analysis, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Millman's Theorem Solution of Problems with DC & AC sources.

MODULE V: GRAPH THEORY (4)
Concept of Tree, Branch, Tree link, Incidence Matrix, Cut Set Matrix, Tie Set Matrix, Formation of incidence, tie set, cut set matrices of electric circuits.

MODULE VI: TWO PORT NETWORK (6)

Open circuit Impedance & Short circuit Admittance parameter, Transmission parameter, Hybrid Parameter, Conditions Of Reciprocity And Symmetry, Interrelation between different parameters, Driving point impedance & Admittance. Interconnection Of Two Port Networks. Solution of problems.

MODULE VII: **FILTER (5)**

Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier.

MODULE VIII: **FOURIER SERIES ANALYSIS (6)**

Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave. Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Dirichlet's conditions, Sum of Fourier series. Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its Periodic extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only).

PROJECT DOMAIN

- Design of an Inductor.
- Measurement of parameters of a coupled inductor.
- Design of Filters.
- Fourier analysis of a standard repetitive waveform

Text / References:

1. Sudhakar:Circuits & Networks:Analysis & Synthesis 2/e TMH
2. D. Roy Choudhury, "Networks and Systems", New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, "Electric Circuits", McGraw Hill Education, 2004.
5. D.Chattopadhyay and P.C.Rakshit: Electrical Circuits

Reference Books:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2006.
2. K. V. V. Murthy and M. S. Kamath, "Basic Circuit Analysis", Jaico Publishers, 1999.
3. Sivanandam: Electric Circuits Analysis
4. V.K. Chandna, A Text Book of Network Theory & Circuit Analysis, Cyber Tech References.
5. Kuo F. F., "Network Analysis & Synthesis", John Wiley & Sons.

CO-PO MAPPING

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EE301.1	H	H	M	M	M						L	H
EE301.2	H	H	H	M	M						L	H
EE301.3	H	H	H	M	M						M	H
EE301.4	H	H	H	M	M						M	H

Subject Name: Measurement and Instrumentation
Subject Code: EE302
Total Contact Hours: 33
Credit: 3

Pre requisite: Concepts of Basic Electrical Engineering.

Course Objective:
At the end of this course, students will demonstrate the ability to
- To explain the operating principles of electrical and electronic measuring instruments.
- To apply the knowledge for measurements of physical parameters.

Course Outcome:
At the end of this course, students will demonstrate the ability to

EE302.1. Understand the operating principles of electrical and electronic measuring instruments.

EE302.2. Identify and measure various physical parameters using appropriate measuring instruments.

EE302.3. Measure various electrical parameters.

EE302.4. Understand statistical data analysis and computerized data acquisition.

Course contents:

Module-I

Measurements: (4)
Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Errors in measurement. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, Cp, Cpk.

Analog meters: (4)
General features, Construction, Principle of operation and torque equation of Moving coil and Moving iron, Electrodynamometer, Induction instruments, Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers. Disadvantage of shunt and multipliers

Galvanometer: (2)
Basic concept: Principle of operation, Advantage, Disadvantage, Error and Application.

Module-II

Instrument transformer: (2)
Advantage of Instrument transformers, Principle of operation of Current &Potential transformer, errors.

Measurement of Power: (2)
Principle of operation of Electrodynamic & Induction type wattmeter. Wattmeter errors.

Measurement of Energy: (2)
Construction, theory and application of AC energy meter. Testing of energy meters.

Module-III

Measurement of resistance: (3)
Measurement of medium, low and high resistances, Megger. Basic concept of Crompton's DC potentiometer Polar and Co-ordinate type AC potentiometer. Application.

AC Bridges: (4)
Measurement of Inductance, Capacitance frequency

Module-IV

Cathode ray oscilloscope (CRO): (3)
Basic concept of Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO. Digital Storage Oscilloscope

Electronic Instruments: (3)
Basic concept of Digital voltmeter(Electronic), Resolution and sensitivity of digital meters, Digital Multi meter Digital frequency meter, True RMS meters, Clamp-on meters

Sensors & Transducers: (4)
Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.

PROJECT DOMAIN

- Design of Current Transformer.
- Development of Weighing Machine using load cell.
- Measurement of frequency and phase of an unknown sinusoidal signal.
- Development of Digital Meter.

Text Books:

1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing.
3. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.

Reference Books:

1. Sensors & Transducers, D. Patranabis, PHI, 2nd edition.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication.
4. Instrument transducers, H.K.P. Neubert, Oxford University press

CO-PO MAPPING

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EE302.1	H											
EE302.2	H	M										
EE302.3		H			L							
EE302.4		H	M		M							

Subject Name: Analog Electronics
Subject Code: EE 303
Total Contact Hours: 34
Credit: 3

Pre requisites:
Basic knowledge about electronic components(R,L,C). Network Theorems (Kirchoffs law, Thevenin's theorem, Norton's theorem, Miller theorem etc.). Basic knowledge about the operation of semiconductor devices (Diode, Transistor, JFET, MOSFET, etc.),Basic idea of integrated circuit, Voltage current equations. Basic knowledge of Differentiation, Integration, Differential equation, matrix etc.

Course Objective:
Students will be able to design, test and examine simple circuits with diode, transistor, op-amp, etc. They will have clear knowledge of basic circuit analysis and its functions and their limitations. Most importantly they will be able to understand, modify and repair majority of circuits used in professional equipment design. They will also be able to take-up new design exercise.

Course Outcome:
EE 303.1. Students will be able to design D.C power supplies.
EE 303.2: Students will be able to analyze transistor amplifier circuit.
EE 303.3: Students will be able to understand effects of different feedback mechanism in amplifier circuit.
EE 303.4: Students will be able to analyze signal generator Circuit.
EE 303.5: Student will be able to design power amplifier circuit.
EE 303.6: Students will be able to understand linear and nonlinear applications of OPAMP (I.C-741).

Course contents:

Module-1: [4L]
Filters and Regulators: Capacitor filter, π-section filter, ripple factor, series and shunt voltage regulator, line and load regulation, 78xx and 79xx series, concept of SMPS.

Module-2: [4L]
Transistor Biasing and Stability: Biasing technique, Q-point & its Stability, Self Bias-CE configuration, Bias Compensation techniques, h-parameter model of transistors, Expression for voltage gain, current gain, input and output impedance, power gain, Emitter follower circuit.

Module -3: [5L]
Transistor Amplifier: Different coupling techniques, RC coupled amplifier, functions of all components, derivation of voltage gain, current gain, input impedance and output impedance, High frequency model of transistors (hybrid-π model), frequency response characteristics, Expression for lower and upper half frequencies, bandwidth, and concept of wide band amplifier.

Module -4: [5L]
Feedback Amplifiers & Oscillators: Feedback concept, negative & positive feedback, Voltage/Current & Series/Shunt Feedback Barkhausen criterion, RC Oscillators-Phase shift and Wein bridge oscillators, LC Oscillator-Colpitts, Hartley's and crystal oscillators.

Module -5: [4L]

Operational Amplifier: Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower/Buffer circuits.

Module -6: [5L]
Application of Operational amplifiers: Adder & subtractor circuit, practical integrator & differentiator circuit, Instrumentation Amplifier, Log & Anti-log amplifiers, multipliers, Precision Rectifier, Comparator & Schmitt Trigger, Voltage to current & Current to voltage converter.

Module -7: [3L]
Power amplifiers: Class A, B, AB, C, Conversion efficiency, Tuned amplifier.

Module -8: [2L]
Multivibrators : Astable ,Monostable, Bistable multivibrators; Astable and Monostable operation using 555 timer.

Module -9: [2L]
Special Function Circuits: VCO, PLL.

PROJECT DOMAIN

- Design and Development of regulated DC power supply.
- Design and Development of audio amplifier.
- Design and Development of function generator.

Text Books:

1. Boylested&Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI.
2. Gayakwad R.A -OpAmps and Linear IC's, PHI.
3. Sedra & Smith-Microelectronic Circuits- Oxford UP.
4. D. Roy Choudhury & B. Jain-Linear Integrated circuits, New Age Science Limited.
5. Franco-Design with Operational Amplifiers & Analog Integrated Circuits, 3/e, McGraw Hill.
6. J.B.Gupta- Electronic Devices and circuits, S.K. KATARIA & SONS.

Reference Books:

1. Millman&Halkias- Integrated El;ectronics, McGraw Hill.
2. Rashid-Microelectronic Circuits-Analysisand Design- Thomson (Cenage Learning)
3. Schilling &Belove-Electronic Circuit:Discrete& Integrated , 3/e , McGraw Hill
4. Razavi- Fundamentals of Microelectronic s- Wiley
5. Malvino-Electronic Principles , 6/e , McGraw Hill
6. Horowitz & Hill- The Art of Electronics;Cambridge University Press.
7. Bell- Operational Amplifiers and Linear ICs- Oxford UP
8. Tobey &Grame-Operational Amplifier: Design and Applications, Mc GrawHill.
9. Coughlin and Driscol-Operational Amplifier and Linear Integrated Circuits – Pearson Education

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EE 303.1	3	3	3	3	2	-	2	-	3	-	-	3
EE 303.2	3	3	3	3	2	-	2	-	3	-	-	3
EE 303.3	3	3	3	3	2	-	2	-	3	-	-	3
EE 303.4	3	3	3	3	2	-	2	-	3	-	-	3
EE 303.5	3	3	3	3	2	-	2	-	3	-	-	3
EE 303.6	3	3	3	3	2	-	2	-	3	-		3

Course Name: Mathematics- III
Course Code: M(EE) 301
Total Contact Hours: 44
Credit: 4

Prerequisite:
The students to whom this course will be offered must have the concept of (10+2) standard calculus, basic probability and differential equations.

Course Objectives:
The objective of this course is to disseminate the prospective engineers with advanced techniques for solving ordinary differential equations and basic techniques for solving partial differential equations. It also aims to equip the students with concepts and tools of calculus of complex variables, Fourier series and Fourier transform, and probability distribution as an intermediate to the advanced level of applications that they would find useful in their disciplines.

Course Outcomes (COs):
On successful completion of the learning sessions of the course, the learner will be able to:

CODES	BLOOM'S TAXONOMY	DESCRIPTIONS
M(EE) 301.1	Remembering	Recall the underlying principle and properties numerical analysis, Statistics, partial differential equation and ordinary differential equation.
M(EE) 301.2	Understanding	Exemplify the variables, functions and differential equations and find their distinctive measures using the underlying concept partial differential equation and ordinary differential equation, numerical methods and statistics.
M(EE) 301.3	Applying	Apply numerical methods used to obtain approximate solutions to intractable mathematical problems.
M(EE) 301.4	Applying	Solve partial differential equation using method of separation of variables and ordinary differential equation using techniques of series solution and special function (Legendre's and Bessel's).
M(EE) 301.5	Analyze	Interpret complex statistical findings using the understanding of inferential statistics.

Course Content:

MODULE I: ***Interpolation*** ***(4 Lectures)***

Difference Operators(Only Definition): Forward and Backward, Shift Operator, Newton forward interpolation, Newton backward interpolation, Lagrange's Interpolation.

MODULE II: ***Numerical Solution of Linear and Non-linear Equations*** ***(8 Lectures)***

Numerical Solution of a System of Linear Equations: Gauss elimination method, LU Factorization method, Gauss-Seidel iterative method.

Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi, Newton-Raphson method.

MODULE III: ***Numerical Integration and Numerical Solution of Differential Equation*** ***(10 Lectures)***

Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.

Numerical Solution of Ordinary Differential Equation: Taylor series method, Euler's method, Euler's modified method, fourth order Runge-Kutta method and Milne's Predictor-Corrector methods.

Numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.

MODULE IV: ***Statistics*** ***(12 Lectures)***

Basic Statistics: Basic statistics, measure of central tendency, mean, median, mode, dispersion, correlation coefficient and regression.

Sampling theory: Random sampling. Statistic and its Sampling distribution.Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems.

Estimation of parameters: Unbiased and consistent estimators. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson).Confidence intervals and related problems

MODULE V: ***Partial Differential Equation (PDE) and Series Solution of Ordinary Differential Equation (ODE):*** ***(10 Lectures)***

Solution of PDE: Method of Separation of Variables.

Solution of Initial Value & Boundary Value Problem: One Dimensional Wave Equation, One Dimensional Heat Equation, Two Dimensional Laplace Equation.

Series solution of ODE: General method to solve and related problems to Power series method**,** Bessel's Function, Legendre Polynomial.

PROJECT DOMAINS

- Mathematical modelling of any electrical system using PDE and ODE.
- Application of numerical methods in the field of Electrical Engineering.
- Statistical analysis of data related to different Engineering fields.

Text Books:

- Jain, M. K., Iyengar, S. R. K. and Jain, R. K. *Numerical Methods (Problems and Solution)*. New age International Publisher.
- Das, N.G. Probability and Statistics; The McGraw Hill Companies.
- Gupta, S. C. and Kapoor, V. K. Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- Raisinghania, M .D. Advanced Ordinary & Partial Differential. Equation; S. Chand Publication.
- Ross, S. L. Differential Equations, John Willey & Sons.
- Grewal, B. S. Higher Engineering Mathematics, Khanna Pub.
- Kreyszig, E. Advanced Engineering Mathematics, John Wiley & Sons, 2006.

Reference Books:

- Lipschutz & Lipson, *Schaum's Outline in Probability (2ndEd)*, McGraw Hill Education.
- Shastri, S. S. *Numerical Analysis*, PHI.
- Mollah, S. A. *Numerical Analysis*, New Central Book Agency Spiegel,
- M. R. *Theory and Problems of Probability and Statistics (Schaum's Outline Series)*, McGraw Hill Book Co.
- Goon, A.M., Gupta M .K. and Dasgupta, B. *Fundamental of Statistics*, The World Press Pvt. Ltd.
- Soong, T. T. *Fundamentals of Probability and Statistics for Engineers*, John Wiley & Sons Inc, 2004.
- Delampady, M. *Probability & Statistics*, Universities Press.
- Sneddon, I. N. *Elements of Partial Differential Equations*, McGraw Hill Book Co.

CO-PO Mapping:

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
M(EE) 301.1	3	1	1	-	-	-	-	-	-	-	-	1
M(EE) 301.2	3	2	1	-	-	-	-	-	-	-	-	1
M(EE) 301.3	3	2	2	-	-	-	-	-	-	-	-	1
M(EE) 301.4	3	2	2	-	-	-	-	-	-	-	-	1
M(EE) 301.5	3	3	2	3	-	-	-	-	-	-	-	1

Subject Name: Electrical Circuit Analysis Laboratory
Subject Code: EE391
Total Contact Hours: 30
Credit: 1.5

Pre requisite: Concepts of Basic Electrical Engineering.

Course Objective:
1. Provide knowledge for the analysis of basic electrical circuit.
2. Use the modern tools in analysis of electrical circuit.

Course Outcomes (COs): On successful completion of the learning sessions of the course, the learner will be able to:

EE391.1	Demonstrate transient analysis of electric circuits frequency response characteristics of Filter circuits
EE391.2	Analyze electric circuits, signals and algorithms using mathematical tools

List of Experiments:

- Familiarization with various MATLAB commands used in Electrical Engineering
- Transient response of R-L and R-C network: simulation with PSPICE/MATLAB /Hardware
- Transient response of R-L-C series and parallel circuit: Simulation with PSPICE/MATLAB / Hardware
- Study the effect of inductance on step response of series RL circuit in MATLAB/HARDWARE.
- Determination of Impedance (Z) and Admittance (Y) parameter of two port network: Simulation / Hardware.
- Frequency response of LP and HP filters: Simulation / Hardware.
- Frequency response of BP and BR filters: Simulation /Hardware.
- Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
- Amplitude and Phase spectrum analysis of different signals using MATLAB.
- Verification of Network theorems using hardware components.

CO-PO MAPPING

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EE391.1	M	H		L	H				L	L		
EE391.2	M		M	L	H				L	L		

Subject Name: Measurement and Instrumentation Laboratory
Subject Code: EE392
Total Contact Hours: 30
Credit: 1.5

Pre requisite: Concepts of different measuring system.

Course Objective: Familiarization with different electrical measuring system

Course Outcomes (COs): On successful completion of the learning sessions of the course, the learner will be able to:

EE392.1	Conduct experiment to measure of Resistance, Inductance, Capacitance, Power and Energy.

List of Experiments:

- Measurement of power in polyphase circuit.
- Measurement of power using instrument transformer.
- Measurement of capacitance using Schering Bridge technique as well as LCR meter.
- Calibration of Digital Energy Meter.
- Testing of energy Meter
- Measurement of capacitance using Anderson Bridge technique as well as LCR meter.
- Measurement of low resistance using Kelvin Double bridge.
- Measurement of high resistance and insulation resistance using Megger.
- Usage of DSO to capture transient like step change in R-L-C circuit.
- Current measurement using shunt, CT and Hall Sensor
- Measurement of capacitance by De sauty bridge
- Measurement of frequency by Wien Bridge.

CO-PO MAPPING

H: High, M: Medium, L: Low

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EE392.1	M			H					H	M		L

Subject Name: Analog Electronics Laboratory
Subject Code: EE 393
Total Contact Hours: 20
Credit: 1

Pre requisites: Knowledge in electrical circuits and electronic devices

Course Objective:

To provide the basic skills required to understand, develop, and design of various engineering applications involving Digital Electronic & Circuits.

To provide basic laboratory exposures for Analog Circuits and applications.

Course Outcome:

EE 393.1: Able to understand the fundamental concepts and techniques used in digital electronics.
EE 393.1: Able to understand and examine the structure of various number systems, De-Morgan's law, Boolean algebra and its application in digital design.
EE 393.1: Able to understand, analyse the analog circuits pertaining to applications like amplifier, oscillators and timer.
EE 393.1: Able to know how to interface digital circuits with ADC & DAC.

Any 8 Experiments has to be done

- Design of voltage regulator circuit using zener diode.
- Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
- Design of RC coupled amplifier & study of it's gain & Bandwidth using BJT.
- Design of RC Phase shift oscillator using BJT.
- Design of wien bridge oscillator using BJT.
- Study of class A & class B power amplifiers.
- Design of Integrator using OPAMP IC 741
- Design of Differentiator using OPAMP IC 741
- Study of V to I and I-V converter using OPAMP IC 741
- Design of Instrumentation Amplifier using OPAMP IC 741
- Study of timer circuit using NE555 & configuration for monostable & astable multivibrator.
- Study of voltage controlled oscillator.

CO-PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EE 393.1	3	3	3	1	3	1	1	1	-	-	1	3
EE 393.2	3	3	3	1	3	1	1	-	1	1	1	3
EE 393.3	3	3	3	3	3	2	2	1	-	1	2	3
EE 393.4	3	3	3	3	3	2	2	1	-	2	1	3

Subject Name: Environmental Science
Subject Code: MC 301
Total Contact Hours: 20
Credit: 2 Units

Pre requisites: Qualified B.Tech 1st year

Course Objective(s):

- Be able to understand the natural environment and its relationships with human activities.
- Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Be able to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome(s):

- To understand the natural environment and its relationships with human activities.
- To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
- Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Course contents:

1. General **6L**

Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy

Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography

Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)

Ecology & Ecosystem: Elements of ecology, definition of ecosystem-components types and function, Food chain & Food web, Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems

Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) , Hazardous waste(management and Handling) Rules.

2. Air pollution and control **6L**

Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant

Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog),

Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion

Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion

control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury),

3. Water Pollution **6L**

Classification of water (Ground & surface water)

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.

Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD

Lake: Eutrophication [Definition, source and effect].

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)

Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride

3.7 Layout of waste water treatment plant (scheme only).

4. Land Pollution **2L**

Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste

Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).

Waste management: waste classification, waste segregation, treatment & disposal

5. Noise Pollution **2L**

Definition of noise, effect of noise pollution on human health,

Average Noise level of some common noise sources

Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18 hr Index) .

Noise pollution control.

References/Books

- A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited
- Environmental Studies, Dr. J P Sharma, University Science Press
- Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO-PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
MC301.1	2	2	3	-	-	2	3	3	-	-	1	2

Subject Name: Basic innovations, Creativity & Aptitude
Subject Code: MC 381
Total Contact Hours: 20
Credit: 2 Units

Pre requisites: Knowledge of Basic Electrical and Basic Electronics Engineering

Course objectives:

Students will learn techniques for improving the flexibility and originality of their thinking and will explore approaches used by engineers and organizations to create and sustain high levels of innovation.

Course Outcome: At the end of this course, students will

MC381.1: Understand building blocks of innovation
MC381.2: Be familiar with processes and methods of creative problem solving: observation, definition, representation, ideation, evaluation and decision making
MC381.3: Enhance their creative and innovative thinking skills
MC381.4: Be familiar with creative and innovative thinking styles

Course Contents:

Creativity and innovations: Meaning of creativity, types of creativity, illustration of creative process, barriers to creativity, sources of new ideas, ideas into opportunities. [4 hours]

Creativity problem solving and Innovations: Techniques of creativity problem solving, basic heuristics directed towards creativity, principles and characteristics of brainstorming, Synectics and major analogies, value analysis and its components, process of value analysis. modules of innovation, how to innovate. [6 hours]

Hands-on activities to stimulate innovation: Student will prepare creative models through hardware and/or software simulation. [12 hours]

Aptitude test: Structured assessment for evaluating students' ability, talent and/or skill in executing certain unknown tasks. [4 hours]

Reference:

1. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall, 1995.
2. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill, 1995.
3. T. Kelley. The Art of Innovation. Doubleday, 2001.

CO-PO MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
MC381.1	H	M	M	L	M						L	L
MC381.2	M	M	H	L	L							M
MC381.3	H	H	H	H	H	H			H	L	M	H
MC381.4	H	H	H	H	H	M			L		M	H