ET301 Linear Integrated Circuits and Applications

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

Contents deal with the basic concepts of operational amplifier, linear & non-linear application of OP-AMP. It covers design and analysis of frequency selective and tuning circuits like oscillators, active filters, PLL and its use for communication applications. Along with switching applications like that of comparators, course content finds a due scope to learn IC based design of voltage regulators.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electronics engineering, electronic circuits and applications

COURSE OBJECTIVES:

The objectives of offering this course are to impart strong foundation of IC based design of circuits used in the area of:-

1. Power management
2. Signal conditioning
3. Analog and digital communication

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. Understand and design the basic circuits using op-amp and perform operations and their troubleshooting
2. Analyze the responses of IC based designed circuits in the area of power management, signal conditioning, analog and digital communication
3. Develop IC based project kits in above areas according to specifications

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
b	Design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	3
c	Design a component, system or process to meet the specifications and requirements within pragmatic constraints	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Operational Amplifier:
Block schematic of Op-amp and its characteristics, in-depth understanding of differential, intermediate and output stages, data sheet interpretation of op-amp IC 741, operational amplifier parameters, offset null techniques of op-amp features, measurement of op-amp parameters, effects of real operational amplifier parameters on circuit performance, frequency response and stability, frequency and phase compensation techniques.

Linear Applications of Op-amp:
Inverting amplifier, non-inverting amplifier and voltage follower, analog adder, averaging amplifier, integrator, differentiator, their frequency response compensation, analog computation, basic building blocks, basic linear differential equation, differential amplifier and instrumentation amplifier, bridge amplifier, voltage-to-current and current-to-voltage converters, analog multipliers, dividers, log/antilog amplifiers.

Non-linear Applications of Op-amp:
Comparators, their parameters and characteristics; op-amp as comparator and its applications, comparator IC 710, peak detectors, waveform generation circuits viz Schmitt's trigger, square-triangle wave oscillators, relaxation oscillators and pulse generators, timer IC 555 and its use as timer circuit, its applications like bistable, astable and monostable multivibrators, clippers and clampers, precision rectifiers.

Frequency Selective Circuits:
Active filters: types and responses, analysis and synthesis of first, second and higher order active filters, Butterworth's filters and their design

Frequency Tuning, Synthesis and MODEM circuits:
Analysis and design of R-C Phase shift and Wien bridge oscillators, voltage controlled oscillator IC 566, phase lock loop (PLL), operating principles, lock and capture range, PLL IC 565, PLL as amplitude and frequency modulation detection, frequency shift keying (FSK) decoder, frequency synthesiser.

Voltage Regulators:
Block schematic of a voltage regulated supply, series regulator using op-amp, voltage regulator IC 723 and its applications as positive/negative and fixed/adjustable voltage regulators, three terminal voltage regulators as positive/negative and fixed/adjustable voltage regulators, dual tracking regulators, switching regulator schematic.

Text Books:

1. Op-amps and Linear Integrated Circuits, R. Gayakwad, Prentice Hall of India, 4th edition, 2008.
2. Linear Integrated Circuits, D. Choudhari, S. Jain, New Age International (P) limited, 4th edition, 2010.

Reference Books:

1. Design with operational amplifiers and analog integrated circuits, S. Franco, Tata McGraw Hill, 3rd edition, 2002.
2. Op-amp and Linear Integrated Circuits Theory and Applications, J. Fiore, Delmar Thompson Learning, 1st edition, 2001.
3. Operational Amplifiers and Linear Integrated Circuits, R. Coughlin, F. Driscoll, PHI, 6th edition, 2001.
4. Integrated Circuits, K.R. Botkar, Khanna Publishers, 10th edition, 2010.

ET305 Linear Integrated Circuits and Applications Lab

Teaching Scheme: 02P, Total: 02 Credit: 01
Evaluation Scheme: 25 ICA + 25 ESE Total Marks: 50

Minimum twelve experiments shall be performed to cover entire curriculum of course ET301. The list given below is just a guideline.

1. Op-amp parameter measurement: input bias current, input offset current, Input offset voltage, slew rate of op-amp 741.

2. Implement inverting and non-inverting amplifier for a specific gain and observe input output waveforms. Measure practical gain and compare the same with theoretical.

3. Implement a unity gain voltage follower and observe input and output waveforms for different input signals.

4. Design and test active integrator and differentiator circuits for given Frequency. Apply different input signals & observe the output waveform.

5. Study the operation of half wave and full wave precision rectifier. Observe the input and output waveforms for both the circuits.

6. Design and test positive and negative clamper. Observe input and output waveforms for both the circuits.

7. Design and test Schmitt trigger circuit for given hysteresis. Measure the hysteresis voltage.

8. Design and test of square wave or triangular wave generator using Op-amp for given frequency. Observe the O/P waveforms. Measure the O/P frequency of the circuits.

9. Design and test timer using IC 555 in monostable and astable mode. Observe the o/p waveforms. Measure the o/p frequency of the circuits.

10. Design and test 555 in bistable mode. State its applications.

11. Design and test VCO using IC 566. Observe the o/p waveforms. Measure the frequency of the o/p waveforms.

12. Design and test PLL using IC 565 PLL for given lock and capture range. Observe the o/p waveforms. Measure the lock & capture range.

13. Design and test a zero crossing detector using IC 710. Plot input and output waveforms.

14. Design and test second order Butterworth LP or HP filter. Plot the frequency response.

15. Design and test BP Butterworth filter. Plot the frequency response.

16. Design and test any one RC oscillator using op-amp. Observe the output frequency and compare the same with theoretical.

ET302 CONTROL SYSTEM ENGINEERING

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course is designed to lay the foundation for further studies in areas such as communication, signal processing and power electronics systems etc. This course will explore the basic concepts of control system engineering. Students will understand and learn types of control system and their components, mathematical modelling of physical system using transfer function. Time and frequency response and design of the system, state space approach, controllers. In this course, more emphasis is given on analysis and design of system in continuous time.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic mathematics, electrical and electronics engineering, electric and magnetic circuits concepts, electric machines fundamentals.

COURSE OBJECTIVES:

The objectives of offering this course are
1. to learn and understand the need of automation of system.
2. to make strong foundation in types of feedback used in control System and its application.
3. to strengthen ability of students to analyze and design control systems.
4. to make students familiar with applications controllers in other areas of control system.

COURSE OUTCOMES:

On the successful completion of this course; student shall
1. understand open loop and closed loop feedback systems.
2. analyze control systems in time and frequency domain.
3. use of compensation techniques to stabilize control systems.
4. understand concept of state, state variables and state model.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
b	Design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	3
c	Design a component, system or process to meet the specification and requirements within pragmatic constraints.	3
d	Solve problem related to electronics engineering in interdisciplinary projects.	2
e	Solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Introduction to Control System Engineering:
Introduction, control systems: open loop, close loop system with examples, servomechanism, history and development of automatic control, digital computer control, application of control theory in non-engineering fields, the control problem. Mathematical models of physical system, differential equations of physical systems, transfer functions, block diagram algebra, signal flow graphs, conversion of block diagram algebra to signal flow graph, conversion of electrical system to signal flow graph. Feedback characteristics of control systems: feedback and non-feedback systems, reduction of parameter variations by use of feedback, control over system dynamics by use of feedback, control of the effects of feedback disturbance signals by use of feedback, linearizing effect of feedback, regenerative feedback. Control system and components: linear approximation of nonlinear system, controller components, sensors, actuators, stepper motor.

Time Response Analysis, Design Specifications and Performance Indices:
Standard test signals, time response of first order system, time response of second order system, steady state error and error constant, design specifications of second order system, design consideration of higher order systems, state variable analysis-Laplace transform technique. Concept of stability and algebraic criteria: concept of stability, necessary condition of stability, Routh-Hurwitz stability criterion, relative stability analysis, the root locus concept, construction of root loci, root contours, effect of addition of open loop poles, effect of addition of open loop zeros, design of lead and lag compensator using root locus.

Frequency Response Analysis:
Introduction, correlation between time and frequency response, basics of magnitude and phase plot, construction of bode plot, concept of lead and lag compensator using bode plot, polar plots, all pass and minimum phase systems. Nyquist stability criterion, assessment of relative stability using Nyquist criterion.

State Variable Analysis, Design and Controllers:
Introduction, concept of state, state variables and state model, state model of linear continuous time systems, solution of state equations, concept of controllability and observability. Lyapunov's stability criterion. Introduction to Controllers: On Off, P, I, D, PI, PD, PID, Introduction to linear quadratic optimal control, adaptive control.

Case Studies:
Cement plant: Objectives of automation system, automation strategies, raw mill automation, kiln automation, packing and dispatch automation, distributed control system, central control room, local control room, system architecture.
Irrigation canal management: monitoring, automation strategies, measurements, control and communication, decision support system at central computer.

Text Books:

1. Control System Engineering, I. J. Nagrath and M. Gopal, New Age International Publisher, 5th Edition, 2014.
2. Modern Control engineering, Katsuhiko Ogata, PHI, 5th edition, 2010.
3. Nise's Control System Engineering, Dr. Rajiv Gupta, Willey India Publication, 2011.
4. Computer Based Industrial Control, Krishant Kant, PHI, 2nd edition, 2010.

Reference Books:

1. Automatic Control Systems, B. C. Kuo, Prentice Hall of India, New Delhi, 4th edition.
2. Control systems, Samarajit Ghosh, Pearson publishers, 2nd edition, First Impression, 2012.
3. Schaum's Outline, Control System, Joshph J, Distefano III, Allen R. Stubberud, Ivan J. Williams, TMH, 3rd edition, 2012.
4. Control Systems Engineering, S. Palani, TMH, 2nd Edition, 4th reprint 2012.
5. Digital Control and State Variable Methods, M. Gopal, TMH, 4th edition, 2012.
6. MATLAB and Simulink for Engineers, Agam Kumar Tyagi, Oxford University Press, 1st edition, 2012.

ET 306 CONTROL SYSTEM ENGINEERING LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme: 50 ICA **Total Marks:** 50

Minimum twelve experiments (6 from each group A and B) shall be performed to cover entire curriculum of course ET302 using simulation software like MATLAB/Scilab, PSpice, etc. The list given below is just a guideline.

List:

Group A (Minimum 6 Experiments)

1. Synchros to observe angular displacement.
2. Determination transient response of RLC electrical network.
3. Stepper motor.
4. Motor speed and input characteristics.
5. Bidirectional motor speed control.
6. Tacho-generator.
7. Motor control using PWM method.
8. Position control of DC servo motor.
9. DC motor control in open loop.
10. DC motor control in close loop.

Group B (Minimum 6 Experiments, simulation based)

1. Study of different MATLAB/Scilab, PSpice tools.
2. Deriving transfer function, roots of characteristic equation, pole-zero plot.
3. Simulation of first and second order system for unit step input.
4. Simulations to determine the damping ratio, undamped natural frequency of oscillation, percentage overshoot to a unit step input.
5. Simulation of root locus.
6. Simulation of bode plot.
7. Simulation of magnitude & phase plot of lead/lag electrical network and design lead/lag compensator using root locus.
8. Simulation of magnitude & phase plot of lead/lag electrical network and design lead/lag compensator using Bode plot.
9. Simulation of magnitude & phase plot of lead-lag electrical network and design lead-lag compensator using bode plot
10. Simulation on state space analysis.
11. Simulation of controllers (P, I, D and its combination).

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

ET303 DIGITAL SIGNAL PROCESSING

Teaching Scheme: 03L+00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course is designed to introduce students to fundamental principles and techniques for analysis of discrete signals and systems. Students will understand and learn representation of discrete signal and system in time and frequency domain using DTFT, DFT and Z transform. In addition, students will understand and learn design of FIR and IIR filters. This course also introduces students to architecture of DSP processor and basics of implementation of discrete systems on DSP processor.

DESIRABLE AWARENESS/SKILLS:

Knowledge of Signals and Systems and fundamentals of complex numbers.

COURSE OBJECTIVES:

The objectives of offering this course are

1. to make strong foundation of discrete time signals and discrete systems.
2. to strengthen ability of students to analyze discrete time signals and discrete systems in time domain and frequency domain
3. to make students familiar with design of digital filters and its implementation on DSP processor

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. Represent and analyse discrete systems in time domain.
2. Analyze discrete signals and discrete systems in frequency domain using DTFT, DFT and Z transform
3. Design FIR and IIR filters and realize them in Direct form, cascade form and parallel form.
4. Understand architecture of DSP processor and its applications.
5. Simulate and implement various DSP techniques covered under this course while completing ET 307 Digital Signal Processing Lab.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
b	Design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	2
c	Design a component, system or process to meet the specifications and requirements within pragmatic constraints.	3
d	Solve problems related to electronics engineering in interdisciplinary projects.	1
l	Assist in research and development activities.	1

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Introduction to DSP:
Basic elements of DSP and its requirements, advantages of digital over analog signal processing, sampling of analog signals, concept of frequency in CT and DT sinusoids, mapping between analog frequencies to digital frequency, analytical treatment with examples, sampling theorem in time domain and its frequency domain implication (concept only), analysis of DT system using convolution sum, representation of discrete systems using difference equations, concept of non-recursive and recursive systems, solution of difference equations using direct method.

Frequency Analysis of Discrete Time Signals:
Discrete time Fourier transform – Definition and convergence conditions, energy density spectrum of aperiodic signals, properties of DTFT, Concept of frequency domain sampling , DFT, IDFT and relationship between DFT and DTFT, DFT as a linear transformation, properties of DFT , Use of DFT in linear filtering, efficient computation of DFT using Radix-2 FFT algorithm (DITFFT and DIFFFT).

Z-Transform and its application to LTI system analysis:
Need for Z-transform, definition of Z transform, relation between Z transform and DTFT, concept of RoC, properties of RoC, properties of Z transform, rational Z transform - pole locations and time domain behaviour, causality and stability considerations for LTI systems.
Inverse Z transform - power series method, partial fraction expansion method, unilateral Z transform and its application to solution of difference equations.

FIR filters:
Introduction to digital filters – definition, types (FIR and IIR), choice between FIR and IIR filters, frequency response of ideal and practical filters.
FIR filters –linear phase response and its implications, types of linear phase FIR filters, design of FIR filters using rectangular Window, limitations of rectangular window &Gibb's Phenomenon, other important window functions – triangular, Hanning, Hamming, Blackman & their comparison, frequency sampling method of FIR filter design (type I and type II).

IIR filters and filter realization:
IIR filters- Frequency response of analog & digital IIR filters, Design of IIR filters from analog filters - IIR filter design by impulse invariance method, Bilinear transformation method, warping effect, characteristics of Butterworth filters, IIR filter design using Butterworth approximation and Chebyshev approximation (type I), frequency transformations in analog & digital domain, filter realization using direct form, cascade form and parallel form, finite word length effects in design of FIR and IIR filters.

Digital Signal Processor and Applications of DSP:
Introduction, special features of digital signal processors, selection criteria for digital signal processor, architecture of TMS320C67xx, introduction to code composer studio, applications of DSP – Speech Processing (speech coding and decoding, speech recognition), digital music synthesis, musical sound processing for recording and digital radio.

Text Books:
1. Digital Signal Processing: Principles, algorithms and applications, John G. Proakis, Dimitris G. Manolakis, Pearson Prentice Hall, 4th edition, 2007.
2. Fundamentals of Digital Signal Processing, Lonnie C Ludeman, Wiley India Pvt Ltd, 1st edition, 2009.

Reference Books:

1. Digital Signal processing: Practical approach, Ifaeachor E.C, Jervis B. W., Pearson Education, 2nd edition, 2012
2. Digital Signal Processing, Dr.Shaila Apte, Wiley India Publication, second edition,2009
3. Digital Signal Processing: Fundamentals and applications, Li Tan, Jean Jiang, Academic press,2nd edition, 2013
4. Digital Signal Processing, A.Nagoor Kani, McGraw Hill Education, 2nd edition, 2012.

ET 307 DIGITAL SIGNAL PROCESSING LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme:25 ICA + 25 ESE **Total Marks:**50

Minimum twelve experiments (six from each group) shall be performed to cover entire curriculum of course ET303 using simulation software like MATLAB/Scilab/Octave/C. The list given below is just a guideline.

List:

Group A (Minimum 6 Experiments)

1. Implement the sampling theorem and aliasing effects by sampling an analog signal with various sampling frequencies.
2. Analysis of LTI system using convolution sum (without using standard function).
3. Spectral analysis of discrete signal using DFT.
4. To verify the properties of DFT. (Any two)
5. To study the circular convolution for calculation of linear convolution and aliasing effect. (Take two sequences of length 4. Write a program to find 4 point circular convolution and compare the result with 8 point circular convolution to study aliasing in time domain.)
6. To implement radix-2 FFT algorithm (DIT /DIF).
7. To plot the poles and zeros of a transfer function when the coefficients of the transfer function are given, study stability of different transfer functions.
8. To solve the difference equation and find the system response using Z transform (for non-relaxed LTI system).

Group B (Minimum 6 Experiments, out of which experiment no. 14 mandatory and any one is mandatory from experiment no. 15 and 16)

9. Design and testing of FIR filter using different windows. (Minimum 2 window functions)
10. Design and testing of FIR filter using frequency sampling method (type I /type II) .
11. Design and testing of IIR filter (Butterworth Approximation).
12. Design and testing of IIR filter (Chebyshev Approximation)
13. Effect of coefficient quantization on the impulse response of the filter using direct form I and II realization and cascade realization.(theory assignment)
14. To interface DSP processor kit with CRO/DSO and function generator.
15. To implement FIR filter on DSP processor kit.
16. To implement IIR filter on DSP processor kit.

Note:

- **ICA –**Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET304 COMMUNICATION SYSTEM THEORY

Teaching Scheme: 03L+00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course will explore the basic concepts of communication systems. In this course, more emphasis is given on analysis of performance of communication system with coding and modulation. This course is designed to lay the foundation for further studies in areas such as advanced communication systems.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electronics engineering, probability theorems and fundamentals of communication systems.

COURSE OBJECTIVES:

The objectives of offering this course are
1. to prepare mathematical background for communication signal analysis.
2.to understand and analyze the signal flow in a digital communication system.
3.to analyze error performance of a digital communication system in presence of noise and other interferences.
4.to understand information theoretic behavior of a communication system.

COURSE OUTCOMES:

On the successful completion of this course; student shall
1.perform the time and frequency domain analysis of the signals in a digital communication system.
2.perform information theoretic analysis of communication system.
3.evaluate performance of a communication system.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
a	apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	3
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Introduction:

The communication process, primary communication resources, sources of information, communication networks, communication channels, modulation process, analog and digital types of communications, sampling process, sampling theorem –time and frequency domain.

Random Processes:

Mathematical definition of a random process, stationary processes, mean, correlation and covariance functions, ergodic processes, CDF and PDF transmission of a random process through a linear time invariant filter, power spectral density, probability models-binomial and Poisson distribution, Gaussian distribution, Rayleigh distribution, central limit theorem, Parseval's theorem/Rayleigh energy theorem.

Continuous-Wave Modulation

AM, linear modulation schemes, frequency translation, FDM, angle modulation, frequency modulation, non-linear effects in FM systems, super-heterodyne receiver, noise in CW modulation systems, noise in linear receivers using coherent detection, noise in AM receivers using envelope detection, noise in FM receivers.

Pulse Modulation

PAM, other forms of pulse modulation, quantization process, PCM, noise considerations in PCM systems, linear prediction, differential pulse code modulation, adaptive DPCM, TDM, delta modulation

Baseband Pulse Transmission

Matched filter, error rate due to noise, inter-symbol interference, Nyqiest's criteria for distortion less baseband binary transmission, correlative-level coding, base band M-ary PAM transmission, optimum linear receiver, adaptive equalization.

Signal-Space Analysis

Geometric representation of signals, conversion of continuous, AWGN channel into a vector channel, likelihood functions, coherent detection of signals in noise: maximum likelihood decoding, correlation receiver, probability of error.

Text Books:

1. Communications Systems, Haykin S, 4th edition, John Wiley and Sons, 2001.
2. Principles of Communication Systems, Taub H. and Schilling D.L, Tata McGraw Hill, 2nd edition , 2001.

Reference Books:

1. Communication Systems Engineering, Proakis J. G. and Salehi M, Pearson Education, 2nd edition, 2002.
2. Communications Systems, A.Bruce Carlson, Mc Graw Hills, 4th edition, 2001
3. Digital and Analog Communication Systems, K.Sam Shanmugam, 4th edition, Wiley India 2006.
4. Communications Systems , Dr.Sanjay Sharma, S.K.Kataria and Sons, 5th Edition.

SH301 Industrial Management and Operation Research

Teaching Scheme: 03L; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE 1 + 15 ISE 2 +10 ISA +60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

COURSE DESCRIPTION:

The course is intended to provide understanding of management and its application in industry. This course introduces the student to the building blocks of management process. Students will analyze the various components of an organizational system. Students will learn to design organization structures keeping in view strategy, size, technology and environment. Students will study the fundamentals of linear programming. Students will understand the complex nature of operations research, define the problem, formulate and solve the model and to perform the follow-up procedures.

DESIRABLE AWARENESS/SKILLS:

Knowledge of human resources.

COURSE OBJECTIVES:

The objectives of offering this course are

- To understand the building blocks of Management process such as planning, organizing, staffing, leading and controlling of business activities.
- To enable students to analyze the various components of an organizational system
- To enable them apply the principles learnt to design organization structures keeping in view strategy, size, technology and environment
- To enable them to compare and evaluate management processes of different organizations
- To study the fundamentals of linear programming, game theory, queuing models.
- To understand the complex nature of operations research, problem, define the problem, formulate and solve the model and to perform the follow-up procedures.

COURSE OUTCOME:

On the successful completion of this course; student shall

1. understand the Globalization process and its impact on the management of business enterprises.
2. improve ability to utilize the principles taught in the course to decipher and understand the business systems, structure and processes
3. increase interest and ability to design and evaluate managerial structures, systems and processes.
4. appreciate the wide applicability of operations research technology from agriculture to defence, covering almost all domains of science, arts, commerce and technology.
5. build the optimum solution for numerous problems of operations research by systematic defining, formulating, analyzing, developing an optimum solution and further refining the solution.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
f	understand and adapt universal skills and culture without losing human and ethical values.	3
g	communicate (oral and written) effectively both individually and within multidisciplinary teams.	2
h	understand and apply contextual knowledge to assess and solve social, health, safety, legal cultural and environmental issues related to engineering practices in general and electronics engineering practices in particular.	1
I	recognize the need for and have the ability to engage in, perpetual learning by working on projects for which they have no prior experience and by adapting latest advancement in technology and concepts.	2
j	interpret and update with contemporary issues affecting engineering industry.	2
m	maintain quality, timeliness and continuous improvement.	3

1- Weakly correlated 2- Moderately correlated 3- Strongly correlated

COURSE CONTENTS:

Introduction to Management:
Definition and purpose, Contributions of F.W. Taylor and Henry Fayol to management theory, Systems approach to operation management, Functions of managers, Management and Society: Social responsibility of managers, Ethics of managing.

Planning:
Definition, purpose, types and steps in planning. Objectives- Nature of objectives. Concept in Management By Objectives (MBO), Process of MBO, Benefits and weakness of MBO and Some Recommendations, MBO in the Indian Context. Strategies, Policies and Planning Premises: Nature and Purpose of Strategies and Policies, Strategic planning process.

Decision making:
Importance and limitations of rational decision making, Rationality in decision making, Evaluation of alternatives, Selecting an alternative- three approaches, Programmed and Non-programmed decisions.

Organizing: The nature and purpose of organizing, formal and informal organization. Organization levels and Span of management, principle of span of management and the factors determining an effective span. The structure and process of organizing, matrix organization, authority and power, line & staff concepts, functional authority, benefits and limitations of staff, decentralization of authority, delegation of authority.

Staffing: Definition, selection, selection process, performance appraisal- purpose, criteria, managing change, organizational conflict and organizational development.

Leading: Definition, behavioural model, creativity and innovation, motivation and motivator, hygiene approach to motivation, special motivational techniques, ingredients of leadership, trait approaches to leadership, leadership behaviour and style, situational or contingency approaches to leadership, effective communication for good leadership, communication in enterprise.

Controlling: Basic control process, Critical control points and standards, Control as a feedback system, Feed forward control, Requirements for effective controls, Control techniques: Budget and Non-budgetary control devices.

Introduction to Operation Research:
Definition and purpose, methodology and application of OR to engineering and managerial problems. OR Models Features and Limitations,

Linear Programming:
Definition, mathematical formulation, standard form, Solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, optimal, Redundancy, Degeneracy. Linear Programming: Simplex method, variants of simplex algorithm – artificial basis techniques, duality, economic interpretation of dual, solution of LPP using duality concept, dual simplex method.

Non-Linear Programming:
Introduction, types, constrained and unconstrained optimization method, one variable and multivariable, steepest descent method, quadratic programming.

Project Management: Network construction, determination of critical path, project duration and floats. PERT - estimation of project duration and variance and crashing.

Queuing Theory: Queuing system and their characteristics, The M/M/I Queuing system, Steady state performance analyzing of M/M/1 queuing model.

Text Books:

1. Principles of Management, Harold Koontz, H. Weihrich, and A.R. Aryasri, Tata McGraw-Hill, New Delhi, 2004.
2. Operation Research an Introduction, Taha H A , Pearson India, 9th edition, 2014.
3. Operations Research Principles and practice, Ravindran, Philips and Soleberg , John Wiley & Sons, 2nd edition 2007.

Reference Books:

1. Essentials of Management, Harold Koontz and H. Weihrich, Tata Mc Graw-Hill, New Delhi, 2005
2. Management of Organizational Behaviour, Hersy, Paul and Kenneth Blanchard, PHI, 2003.
3. Introduction to Operation Research, Hiller and Libermann, McGraw Hill, 5th edition, 2000
4. Operations Research Theory and Application, J K Sharma, Pearson Education Pvt Ltd, 2nd edition, 2006

ET308 OBJECT ORIENTED PROGRAMMING LAB

Teaching Scheme: 01L + 04P, Total: 05 **Credits:** 03
Evaluation Scheme: 50 ICA + 50 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

This course explores concepts of C++ programming language and enable the students to apply them in the context of object oriented programming.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic C programming,.

COURSE OBJECTIVES:

The objectives of this course are to

1. introduce the students to the concepts of object oriented programming using C++ .
2. build object oriented programming application using C++.

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. understand the philosophy of object-oriented design and the concepts of encapsulation, abstraction, inheritance, and polymorphism.
2. design, implement, test, and debug simple programs in an object-oriented programming language.
3. demonstrate the class mechanism encapsulation and information hiding.
4. design, implement, and test "is-a" relationships among objects using a class hierarchy and inheritance.
5. able to develop the overloading and overriding methods in an object-oriented language.

RELEVANCE OF POS AND STRENGTH OF CO-RELATION:

PO No.	Program Outcomes	Level of Operation
a	Apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	3
e	Solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1 - Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Introduction to Object Oriented Programming: Introduction to procedural, object oriented limitations of procedural programming, need of object-oriented programming.

Classes and Objects: Defining a class, data members and methods, public, private and protected members, static data members, static member, constructors, destructors, friend function, and array of objects.

Operator Overloading: Need of operator overloading, overloading binary and unary operators, overloading using friends, Function Overloading, Dynamic memory allocation using new and delete operators.

Inheritance and Polymorphism: Concept and need, base and derived classes, friend classes, types of inheritance, static class virtual base class, polymorphism, virtual functions.

Files and Streams: Concept of a file, file operations, streams, opening and closing a file, detecting end-of-file, file modes, file pointer.

Laboratory Content:

Minimum eighteen experiments (Ten experiments from Group-A and eight experiments from Group-B) shall be performed to cover entire theory content of this course. The list given below is just a guideline.

Group-A:

1. Write s simple C++ program for object and class.
2. Write a C++ program for Arithmetic Operations like addition, subtraction, multiplication and Division.
3. Write a C++ program to display student information.
4. Write a C++ Program to Demonstrate the use parameterized constructor by passing different types of parameters to the constructor
5. Write a C++ program to calculate factorial of a given number using copy constructor.
6. Demonstrate the concept of overloading constructor functions using class and object
7. Write a C++ program to display the information of 10 employee using array of object.
8. Write a C++ program to overload unary operator using member function.
9. Write a C++ program to overload binary operator using member function.
10. Write a C++ program to overload unary operator using friend function.
11. Write a C++ program to overload binary + operator using friend function to calculate two complex numbers.
12. Write a C++ program to find the area of rectangle, triangle and sphere using function overloading.

Group-B:

1. Write a C++ program for run time polymorphism using virtual functions.
2. Write a C++ program to implement singly linked list using dynamic memory allocation.
3. Write a C++ program to implement doubly linked list and provide insertion, deletion and display operations.
4. Write a user defined function in C++ to read the content from a text file. Count and display number of blank spaces present in it.
5. Write a user defined function in C++ to count the number of lines present in a text file.

6. Write a C++ program to count number of character in a FILE.
7. Create a file having records of person with name, age, city and occupation. Write a C++ program to search a particular record of a person from file.
8. Consider a class **Number** having a function to accept and print a roll_no. , a class **Marks** having function to accept and print marks of two subjects; and a class **Student** having function to display total of two subjects. Write a C++ program to calculate total of 2 subjects for a student using multilevel inheritance.
9. Consider base classes **Area** having function to calculate area and **Perimeter** having a function to calculate perimeter; and derived class Rectangle. Use multiple inheritance to calculate area and parameter of rectangle.
10. Write a C++ program using single inheritance, multiple inheritance and hierarchical inheritance.

Text Books:

1. Object Oriented Programming With C++ , E Balagurusamy, Tata McGraw-Hill , 4th edition, 2008.
2. C++ The Complete Reference, Herbert Schildt, McGraw-Hill Education,5th edition, 2012.
3. Object-Oriented Programming in C++, Robert Lafore, Pearson Education India , 4th Edition, 2002.

Reference books:

1. Object-Oriented Programming with ANSI and Turbo C++, Ashok N. Kamthane, Pearson Education,7th impression, 2009
2. Let us C++, Yashvant Kanetkar , BPB Publications, 2nd edition, 2015.

Note:

- **ICA –**Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET351 ELECTROMAGNETIC FIELDS

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course is designed to lay the foundation for studies in areas such as microwave communication, antenna and wave propagation etc. This course will explore the basic concepts of electromagnetic fields and vector algebra. Students will learn and understand cartesian, cylindrical and spherical coordinate systems. They will learn to visualize in a three dimensional coordinate system. . In this course, more emphasis is given on understanding basics, visualizing the system and solving a large number of numerical problems.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic mathematics, vector algebra, visualization skills, and an aptitude to solve problems.

COURSE OBJECTIVES:

The objectives of offering this course are

1. to make strong foundation of electromagnetic engineering and microwave communication.
2. to strengthen ability of students to visualize a system in three dimensions and develop a problem solving attitude.
3. to make students familiar with concepts and applications of electromagnetic engineering.

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. Understand the basics of electromagnetic fields and be able to apply these basics in a variety of applications.
2. Develop visualization along three axes and develop thinking capability.
3. Develop the skill of understanding hidden messages in any mathematical equation.
4. Understand different laws such as faraday's law, biot –sovart law, understand Maxwell's equations and apply all these.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
a	apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	3
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Vector Calculus, Electrostatics and Transmission Lines:
Coordinate system, transformations of coordinate systems, coulomb's law, electric field intensity, field due to a continuous volume charge distribution, field of a line charge, field of a sheet of charge and volume charge densities, electric flux density , gauss's law and divergence theorem, work done, potential and potential gradient, dipole and its electric field, dipole moment, energy density in electrostatic field, introduction to transmission lines, concept of distributed elements, equations of voltage and current, standing waves and impedance transformation, applications of transmission lines, introduction to smith chart.

Conductor, Dielectrics and Capacitance:
Current and current density, current continuity equation, properties of conductors, boundary conditions, boundary conditions for perfect dielectric materials, capacitance, capacitance of a two wire line, Poisson's and Laplace's equations.

Magnetostatics:
Biot – Savart's law and its vector form, magnetic field due to infinitely long current carrying conductor, ampere's circuital law, curl , Stoke's theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potential , faraday's law, Maxwell's equations(in point form and integral form),uniform plane waves, representation of wave motion in free space, perfect dielectrics and lossy dielectrics(wave equations), Poynting theorem and power density, propagation in good conductor :skin effect, reflection of uniform plane waves, standing wave ratio.

Waveguides:
Parallel plane waveguide: transverse electric (TE)mode, transverse magnetic (TM) mode, cut off frequency, phase velocity and dispersion, transverse electromagnetic (TEM) mode, analysis of waveguide –general approach, rectangular waveguides, modes in rectangular waveguides, boundary conditions .

Antennas:
Radiation resistance ,radiation pattern, calculation of radiation resistance for short dipole, short monopole, half wave dipole and quarter wave monopole antennas, Directivity, Reciprocity between transmitting and receiving antennas, Hertzian dipole ,near field , far field ,total power radiated by hertz dipole, folded dipole antenna, Yagi-uda antenna.

Text Books:
1. Engineering Electromagnetics, William H.Hayt,Jr and John A.Buck.Tata McGraw-Hill, 7th edition, 2006.
2. Antenna and Wave Propagation, K. D. Prasad, Satya Prakashan, Tech Publications, 3rd edition, 2001.
3. Microwave Devices and Circuits, Samuel Y. Liao, Prentice Hall of India, 3rd edition, 1996.
4. Electromagnetism problem with solutions, Ashutosh Pramanik, Prentice Hall of India, 3rd edition, 2012.

Reference Books:
1. Engineering Electromagnetics, Nathan Ida, Springer, 3rd edition, 2015.
2. Engineering Electromagnetics, Narayana Rao, Prentice Hall, 6th edition, 2004.
3. Foundations for Microwave Engineering, R.E. Collin, McGraw-Hill, 2nd Edition, 1992.
4. Fundamentals of Electromagnetic Fields, A.U.Tinguria, Denett Publication, 1st edition 2006

ET352 AUDIO AND VIDEO ENGINEERING

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course is designed to explore fundamental principles and practical aspects of audio and video engineering. Students will learn and understand basic concept of sound recording and reproduction, monochrome and color television. Students will get comprehensive coverage of advanced TV system like HDTV, digital TV and different advanced broadcasting systems. Student will learn the connectivity in telecommunication networks by using switching systems.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic concepts of analog and digital communication.

COURSE OBJECTIVES:

The objectives of offering this course are

1. to provide students with a strong understanding of the fundamental principles and practical applications of audio and video engineering with latest updates.
2. to learn and understand the working of real life video system and the different elements of video system with encoding/decoding techniques.
3. to implement fundamentals of Audio systems and basics Acoustics.
4. to learn switching in telephony.

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. Understand the concept of basic television signal processing and telecommunication switching systems.
2. Identify globally accepted colour TV standards.
3. Demonstrate the need of audio and video compression techniques in real life.
4. Acquire knowledge of latest digital TV systems and applications.
5. Describe the attributes of acoustics, sound engineering and storage media. Use the latest techniques, skills, and modern tools necessary for engineering practices.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
c	Design a component, system or process to meet the specifications and requirements within pragmatic constraints.	2
d	Solve problems related to electronics engineering in interdisciplinary projects.	2
e	Solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	3
k	Manage the project under execution effectively and professionally using the techniques, skills, and modern engineering tools necessary for engineering practice.	1

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Methods of Sound Recording and Reproduction
Introduction to disc recording, magnetic recording, optical recording-CD and DVD. Monophony, stereophony, Hi-Fi (High Fidelity) system. PA system-Basics of acoustics, block diagram, requirement, characteristics, its planning for various uses. Introduction to blue ray disc format.

Basic Concept of Television
Scanning methods, horizontal and vertical synchronization. Introduction to camera tubes, aspect ratio, Kell factor, horizontal and vertical resolution, video bandwidth, positive and negative modulation, composite video signal. Television transmission-VSB transmission, TV Channels, TV Standard, TV Channels bands. Basic block diagram of monochrome TV receiver.

Color Television Receiver
Color fundamental, compatibility, frequency interleaving, color mixing, color camera tube, color purity. Concept of color picture tubes-static and dynamic convergence. Encoder,decoder and color different signals comparison. Different system concepts-PAL, SECAM, NTSC system. Color TV transmitter and receiver block diagram.

Advanced TV Systems and Techniques
Introduction to digital compression techniques, JPEG, MPEG techniques. Block diagram of digital TV-transmitter and receiver. Advanced displays - plasma, LCD, LED, organic LED. Introduction to HDTV (high-definition TV) transmitter and receiver.

Advanced Broadcasting Systems
Introduction to digital cable TV, conditional access system (CAS), DTH system, video on demand. Introduction to 3D DTV system, study of CCTV and digital terrestrial TV (DTV). Introduction to IPTV and mobile TV.

Telephony
Introduction to fax, videophone, satphone, video conferencing. Electronic space division switching-stored program control, centralised SPC, distributed SPC

Text Books:
1. TV and video Engineering, A. M. Dhake, McGraw Hill, 2nd edition, 2007
2. Modern Television Practise, R. R. Gulati, McGraw Hill, 2nd edition, 2002
3. Audio and Video Systems, R. G .Gupta, McGraw Hill, 2nd edition, 2010
4. Telecommunication Switching Systems and Networks, Thiagarajan Viswanathan, PHI Learning Private Limited, 36th printing, New Delhi, June 2012

Reference Books:
1. Television Engineering and Video Systems, R.G.Gupta, Gupta, McGraw Hill, 2nd edition, 2012
2. Basics Television and Video Systems, Bernard Grob, McGraw Hill , 5th Edition, 1998.

ET 357 AUDIO AND VIDEO ENGINEERING AND ELECTRONIC MEASUREMENT LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme: 50 ICA **Total Marks:** 50

Minimum twelve experiments (6 from group A and 6 from group B) shall be performed to cover entire curriculum of course ET352 and ET251. The list given below is just a guideline.

List:

Group A

1. Study of colour TV receiver.
2. Voltage and waveform analysis for colour TV.
3. Alignment and fault finding of colour TV using pattern generator .
4. Study of HDTV.
5. Study of digital TV.
6. Visit to TV transmitter/Studio.
7. Study of DTH and set top box.
8. Study of CD/DVD players.
9. Study of PA system with cordless microphone.
10. Study of FAX .
11. Visit to telephone exchange.

Group B

1. Measurement of reactive and resistive components with LCR-Q meter.
2. Measurement of V_{rms} signal with true RMS meter / DMM.
3. Measurement of frequency and phase shift using Lissajous pattern and testing of different components using CRO and DSO.
4. Measure and store the frequency and amplitude with the help of DSO.
5. Measurement of frequency and Time with the help of frequency counter.
6. Measurement of phase angle with the help of digital phase meter.
7. Measurement of motor speed using digital tachometer.
8. Generation and analysis of test signals with the help of Function generator.
9. Measurement of distortion and nature of distortion by Harmonic distortion analyzer.
10. Analysis of test signal with the help of Spectrum analyzer.
11. Measurement of distance with OTDR meter.
12. Measurement of various parameters with DATA logger.

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

ET353 ELECTRONIC MEASURMENTS

Teaching Scheme: 03L+00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course is designed to lay the foundation for further studies of the various measuring instruments. It includes analog instruments, digital instruments, generators, analyzers, and C.R.O.& data acquisition system. This course will explore the basic concepts of electronic measuring instruments specification and their applications. Students will understand and learn how to handle measuring instrument.

DESIRABLE AWARENESS/SKILLS:

Knowledge of Basic Electronics Engineering and Component Devices and Instrumentation Technology.

COURSE OBJECTIVES:

The objectives of offering this course are
1. to make strong fundamental of electronic measurement principles.
2. to strengthen ability of students to analyze signals in time domain and frequency domain by using different measuring instruments.
3. to make students familiar with applications of electronic measuring instruments in the world of work.

COURSE OUTCOMES:

On the successful completion of this course; student shall
1. understand the basic concept of measurement.
2. analyze the various parameters with the help of DSO and CRO.
3. analyze and measure the spectrum purity of multiplex signals.
4. analyze and measure total harmonic power present in test waves, temperature, pressure, humidity, wind speed, variation in light.
5. analyze the reflected light energy in fiber installation to determine the existence and location of breaks in the fiber, losses at spices and connector, and the total loss of the system.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
b	Design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	3
d	Solve problem related to electronics engineering in interdisciplinary projects.	2
e	Solve industrial problem related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic subsystem.	2
l	Assist in research and development activities.	1

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Basic Concepts of Measurement:
Introductions, general system configuration, static and dynamic characteristics, statistical parameters: arithmetic mean, average deviation, standard deviation, types of error, histogram, normal and gaussian distribution of errors.

Instruments For Basic Parameter Measurement:
Introduction, amplified dc voltage and current meters, ac voltmeter using rectifiers, true RMS-responding voltmeter, electronic multimeter, ac multimeter, digital multimeters, consideration in choosing analog voltmeter, component measuring instruments, Q meter, vector impedance meter, vector voltmeter, RF power and voltage measurement, digital phase meter, digital tachometer.

Oscilloscope:
Internal circuit of CRO, vertical amplifier, horizontal deflecting systems, triggered sweep and trigger pulse circuit, delay line and its types, dual beams CRO, dual trace CRO, sampling (VHF) oscilloscope, storage oscilloscope and digital read out oscilloscope, probes for CRO, digital storage oscilloscope

Measurement of Frequency and Time:
Objectives, self-evaluation, frequency and time, period measurement, frequency measurement, rough frequency measurements, absorption wavemeters, lecher wires, slotted line measurements, NIST radio broadcast and time/frequency services, study of broadcast services WWV,WWVH and WWVB, atomic frequency and time standards, basic frequency meters, using frequency meters, using frequency counters, transfer oscillators, crystal marker oscillators,.

Signal Generators and Analyzer :
Generators: Introduction, sine wave signal generator, frequency-synthesized signal generator, frequency divider, signal generator modulation, sweep-frequency generator, pulse, square wave generator, function generator, audio frequency signal generation.
Analyzer: Introduction, wave analyzers, Basic wave, frequency selective wave, heterodyne wave analyzer, harmonic distortion analyzer, spectrum analyzer, optical time-domain reflectometer.

Data Acquisition, Conversion and Transmission:
Introduction, objective of DAS, signal conditioning of the inputs, single channel and multi channel DAS, computer based DAS, digital to analog(D/A) and analog to digital(A/D) converters, data loggers, sensors based computer data system, electromechanical A/D converter, digital transducer, data transmission systems, advantages and disadvantages of digital over analog transmitter, TDM.

Text books

1. Electronics Instrumentation and Measurement Techniques, W. D. Cooper and A. D. Helfrick, Pearson education, 3rd edition 2014.
2. Elements of Electronic Instrumentation and Measurement, Joseph J. Carr, Pearson education , 4th impression 2011.

Reference Books

1. A course in Electrical & Electronics Measurements &Instrumentation , A.K.Sawhney, Dhanpat Rai& Sons, 19th edition, 2014.
2. Electronic Instrumentation, H. S. Kalsi, TMH, 3rd edition, 2012.

ET354 SEMICONDUCTOR POWER DEVICES AND DRIVES

Teaching Scheme: 03L+00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course is designed to lay the foundation for further studies in areas such as power electronics, its applications and advanced electric drives etc. This course will explore the basic concepts of semiconductor devices, its switching characteristics. Students will understand and learn various types of semiconductor devices, their switching characteristics, circuits, protection and applications. In this course, more emphasis is given on analysis and design of drives.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electrical engineering, electric and magnetic circuits concepts, electric machines fundamentals.

COURSE OBJECTIVES:

The objectives of offering this course are
1. to make strong foundation of semiconductor power devices and its application in drives.
2. to strengthen ability of students to analyze and design power electronic circuits.
3. to make students familiar with applications of semiconductor power devices in other areas of electric power control.

COURSE OUTCOMES:

On the successful completion of this course; student shall
1. Understand the switching characteristics of diodes, thyristors, BJTs, MOSFETS, IGBTs etc.
2. Understand thyristor triggering, commutation, protection circuits.
3. Understand rectifiers, choppers, inverters, converters circuits.
4. Understand working, analysis and design of DC drives.
5. Understand working , analysis and design of AC drives.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
b	Design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	3
c	Design a component, system or process to meet the specification and requirements within pragmatic constraints.	2
d	Solve problem related to electronics engineering in interdisciplinary projects.	2
e	Solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Power Devices:
Silicon Controlled Rectifier (SCR): Construction, principle of operation, electrical characteristics, parameters (numerical expected on latching current and pulse width calculation) two transistors model of SCR, derivation of anode current, turn on mechanism, turn off mechanism, turn on methods of a SCR: forward voltage triggering, thermal triggering, radiation triggering, dv/dt triggering, gate triggering, gate triggering circuits using R, RC, operating principle of UJT and UJT triggering circuit, turn off methods: natural commutation, forced commutation. Protection circuits of SCR (with numerical) – over voltage, over current protection, dv/dt and di/dt protection, non-linear surge suppressor, gate protection.
Other Power Devices: DIAC, TRIAC, IGBT, GTO, structure, working principle, electrical characteristics and applications.

Phase controlled Rectifiers:
Control techniques – phase angle control, extinction angle control, PWM control; single phase half wave controlled rectifier, single phase half controlled and full controlled bridge rectifier with R and R-L load and their analysis, performance factors of line commutated rectifiers. Three phase half and full controlled bridge rectifiers with R and R-L load and their analysis, operating modes (continuous and discontinuous conduction modes),effect of source impedance on single phase and three phase full controlled bridge rectifiers.

DC Chopper:
Basic chopper classification, control strategies – time ratio control and current limit control, operating principle of step down, step up chopper, step up/down chopper, chopper configuration– first quadrant, second quadrant, third quadrant and fourth quadrant operations. Thyristor chopper circuits – voltage and current commutated choppers. Jones chopper, Morgan chopper.

Inverters:
Introduction, classification of inverters, basic series and parallel inverters, single phase half and full bridge inverters with R and R–L load and their analysis, square wave, quasi-square wave and sinusoidal PWM switching, selection of frequency modulation ratio and amplitude modulation ratio. Harmonic reduction techniques using single pulse-width modulation, transformer connection, multiple commutations and harmonic filters. 3–Phase Bridge inverter – with balanced star resistive load, 120 degree and 180 degree conduction mode waveforms for line and phase voltages.

AC Regulators, Cyclo-converters and UPS:
AC Regulators: principle of phase control and integral cycle control, single phase half and full wave AC control with R and R-L load and their analysis.
Cyclo-convertors: single phase cyclo-convertors for R and R-L load using centre tapped and bridge configuration and their analysis.
UPS: Basic principle, different configurations/ types of UPS, off-line, on-line, line interactive, battery-Ah, back up time and battery charger rating calculations.

Drives:
Concept of electric drive, DC drives basic performance equations of dc motors. Single phase AC drives: single phase half wave converter drive, single phase semi converter drive, single phase full wave converter drive, single phase dual converter drive. AC drives, induction motor drives, speed control of induction motor.

Text Books:

1. Power Electronics, M. D. Singh and Khanchandani, TMH Publication, 2nd edition, 2007.
2. Power electronics, M. S. Jamil Asgher, Prentice Hall of India Pvt. Ltd, New Delhi,1st edition, 2005.
3. Power Electronics, P. S. Bhimbhra, Khanna Publishers Delhi, 4th edition, 3rd reprint, 2007.

Reference Books:

1. Power electronics, P. C. Sen, Tata McGraw Hill, 1st edition, 30th reprint, 2008.
2. Modern Power Electronics and AC drives, B K Bose, PHI, 1st edition, 2013.
3. Power electronics: circuits, devices and applications, M.H. Rashid, Pearson, 3rd edition, 2003.
4. MATLAB and Simulink for Engineers, Agam Kumar Tyagi, Oxford University Press, 1st edition, 2012.
5. Modeling and simulation using MATLAB- Simulink, Dr. Shailendra Jain, Wiley India Pvt Ltd.

ET 356 SEMICONDUCTOR POWER DEVICES AND DRIVES LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:**50

Minimum twelve experiments (8 from group A and 4 from group B) shall be performed to cover entire curriculum of courseET354 using simulation software like MATLAB SIMULINK, PSCAD, PSpice, ORCAD etc. The list given below is just a guideline.

List:

Group A (Minimum 8 Experiments / Minimum 8 turns)

1. V-I characteristics of MOSFET / SCR / TRIAC / IGBT.
2. SCR triggering methods R, RC, UJT and output waveforms for different firing angles.
3. Thyristor commutation methods.
4. Semi controlled rectifiers with R, RL load, input output waveforms and average output voltage verses firing angles.
5. Full controlled rectifiers with R, RL load, input output waveforms and average output voltage verses firing angles.
6. Step down chopper with output voltage verses duty cycle and frequency.
7. Step up chopper with output voltage verses duty cycle and frequency.
8. Series inverter with input output waveforms and efficiency.
9. Parallel inverter with input output waveforms and efficiency.
10. Bridge inverter with input output waveforms and efficiency.
11. AC voltage controllers with input output waveforms.
12. Cyclo-converters with input output waveforms.
13. DC drives.
14. AC Induction motor drives.
15. AC synchronous motor drive.

Group B (Minimum 4 Experiments)

1. Simulation of controlled rectifiers.
2. Simulation of DC choppers.
3. Simulation of inverters.
4. Simulation of DC drives.
5. Simulation of induction motor drive.
6. Simulation of synchronous motor drive.

Note:

- **ICA –**Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- ESE **–**End semester examination will be based on performing one of the experiments given and oral based on curriculum of **ET354.**

ET355 DIGITAL COMMUNICATION

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course will explore the basic concepts of digital communication. Students will understand and learn various concepts of digital communication systems and information theory. In this course, more emphasis is given on analysis of performance of communication systems with coding and modulation. This course is designed to lay the foundation for further studies in areas such as advanced communication systems.

DESIRABLE AWARENESS/SKILLS:

Knowledge of analog communication, probability theorems and fundamentals of communication systems theory.

COURSE OBJECTIVES:

The objectives of offering this course are to

1. understand building blocks of digital communication systems.
2. analyze error performance of a digital communication systems in presence of noise and other interferences.
3. understand theoretic behaviour of a communication systems.
4. understand various source coding techniques for data compression
5. understand various channel coding techniques and their capability.

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. perform information theoretic analysis of communication system.
2. design a data compression scheme using suitable source coding technique.
3. design a channel coding scheme for a communication system.
4. evaluate performance of a communication system.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
a	apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	3
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT:

Digital Data Transmission:
Base band digital communication system, line coding- NRZ, RZ (unipolar and polar), Manchester format, polar quaternary NRZ format, ISI, correlative coding , duo binary signalling-encoding and decoding, partial response signalling, scramblers and unscrambles, EYE diagram.

Carrier Modulation:
Introduction to carrier modulation, classification of digital modulation , coherent and non coherent detection, amplitude shift keying (ASK) and frequency shift keying (FSK) modulations, binary phase shift keying (BPSK) modulation, DPSK, QAM, M-ary systems quaternary phase shift keying QPSK, minimum shift keying (MSK) modulation.

Spread Spectrum Modulation:
Spread spectrum principles, Pseudo-noise (PN) sequences, direct-sequence and frequency hopping spread spectrum (DSSS and FHSS) systems, introduction to multiple access techniques FDMA, TDMA, and CDMA.

Information Theory :
Introduction to information theory, entropy and its properties, source coding theorem, Huffman coding, Shannon-Fano coding, run length encoding, discrete memory less channel, mutual information, examples of source coding-audio and video compression.

Error Control Coding :
Channel capacity, channel coding theorem, differential entropy and mutual information for continuous ensembles, information capacity theorem, linear block codes – basic definitions, matrix description of linear block codes, coding using generator matrix, Hamming codes, error detection and correction capability, parity check matrix, syndrome and error detection, cyclic codes – generation of code vectors in systematic and non-systematic form, generator matrix for cyclic codes, decoding of cyclic codes using syndrome.

Convolution Codes:
Encoder, practical convolution encoder, the code tree, the code trellis and state diagram. Decoding method-Viterbi algorithm, distance bounds for convolution codes, calculation of free distance using transfer function.

Text Books:

1. Analog and Digital Communication System, Taub & Schilling, McGraw Hill Publication, 2nd edition, New Delhi, 1991.
2. Analog and Digital Communication, B.P. Lathi, McGraw Publication, 2nd Hill edition, New Delhi, 1997.
3. Information Theory coding and Cryptography, Ranjan Bose, 2nd edition McGraw-Hill Publication, New Delhi,1998

Reference Books:

1. An Introduction to Analog and Digital Communications, Simon Haykin, John Wiley and Sons 2nd edition, 1989
2. Digital Communications – Theory and Lab Practice, K. N. Hari Bhat and D. Ganesh Rao, Pearson Education, 3rd edition 2010
3. Communication Systems, V. Chandra Sekar, Oxford University Press, 1st edition. 2012
4. Communication Systems- Analog and Digital, S.D. Sapre and R. P. Singh, Tata McGraw Hill, 2nd edition, , New Delhi, 1995.

ET358 DIGITAL COMMUNICATION LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA+25 ESE **Total Marks:** 50
ESE Duration: 3 Hrs

Minimum six experiments shall be performed from each group A and B to cover entire curriculum of course **ET355** out of which minimum two experiments are mandatory from Sr. No. 11 to 14. Experiment number 2 to 10 may be performed using hardware or using software/simulator. The list given below is just a guideline.

Group A

1. Perform line codes and draw output for given data for different line codes.
2. Perform Amplitude shift keying (ASK), plot output waveform for given data sequence.
3. Perform frequency shift keying (FSK) , observe change in frequency in the carrier by applying data.
4. Perform binary phase shift keying (BPSK) , show change in phase in the carrier and plot it.
5. Perform differential phase shift keying (DPSK),draw waveform of different stages.
6. Perform quadrature phase shift keying (QPSK), draw constellation diagram, draw waveform of different stages.
7. Perform quadrature amplitude modulation (QAM), observe change phase and amplitude in the carrier by applying data.

Group B

8. Perform Scrambler and Unscrambler.
9. Perform DS-SS-PSK ,draw PN sequence, and output signal.
10. Perform FHSS observe output with respect to data sequence.
11. Calculation of Information, Entropy and Rate using software
12. Perform Huffman coding using software.
13. Perform Shannon-Fano coding using software.
14. Design encoder for Hamming code and implement using software/simulator.

Note:

- **ICA –**Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format**(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET359 CIRCUIT SIMULATION LAB

Teaching Scheme:02P; Total: 02 **Credit:** 01
Evaluation Scheme:25 ICA + 25 ESE **Total Marks:**50
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This laboratory course emphasizes the understanding of the open source Electronics Design Automation (EDA) tools like Oscad. There are many EDA tools but only Oscad is capable of doing circuit design, simulation and layout design together. Oscad is free and open source EDA tool and that can be installed on Ubuntu 12.04 / 12.10 or windows operating system.

DESIRABLE AWARENESS/SKILLS:

Knowledge of Electronic Devices and Circuits, Electronic circuits and Applications, Linear Integrated Circuits

COURSE OBJECTIVES:

The objectives of offering this course are

1. to make students capable of developing circuit schematic, analyzing the results on open source circuit simulator like Oscad
2. to enable the students to design PCB layout on Oscad.
3. to enable the students to implement designed circuit on hardware.

COURSE OUTCOMES:

On the successful completion of this course; student shall be able to

1. compare open source and licensed operating systems and understand open source simulation tools.
2. develop circuit schematic in Oscad consisting of discrete components and integrated circuits.
3. analyze the results of these circuits in Oscad.
4. design PCB layout of such circuits in Oscad.
5. implement such circuits on hardware.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
b	Design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	2
c	Design a component, system or process to meet the specifications and requirements within pragmatic constraints.	3
l	Assist in research and development activities.	1

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Group A

(Minimum four experiments from this group, out of which Experiment no. 2 is mandatory)

1. Installation of Oscad on Ubuntu 12.04 /12.10 and windows.
    a. Compare open source, free version and license version operating system.
    b. Find the steps to install Open source Oscad on Ubuntu 12.04 / 12.10 andwindows operating system.

2. Study of architecture of Oscad.(2 turns)
    a. Describe the meaning of Electronic Design Automation (EDA) tool.
    b. Describe the advantages and disadvantages of Oscad.
    c. Use of Oscad in circuit making, simulation and PCB design.

3. Study of schematic creation, simulation and PCB design.
    a. Describe the steps to use Oscad in schematic creation, simulation and PCB design on Ubuntu or on windows operating system.
    b. Describe the procedure of AC and DC analysis.

4. Simulation of typical circuit using a) R C b) Diode.
    a. Develop circuit consist of RC network.
    b. Find voltage and current at each node of circuit and compare with the theoretical calculated value.
    c. Develop circuit consist of diode. Measure voltage and current of diode.
    d. Compare simulated result with the theoretical calculated values.

5. Simulation of typical circuit using a) Transistor b) MOSFET
    a. Describe operation and construction simple transistor amplifier.
    b. Simulate the circuit and find I_B, I_C, I_E, and V_{CE}.
    c. Compare simulated result with theoretical calculated values.
    d. Describe operation and construction of simple MOSFET based circuit.
    e. Compares all simulated node voltage and current with theoretical calculated values.

Group B

(Minimum four experiments from experiment no. 6 to 10, Experiment no. 11 is mandatory)

6. Simulation and PCB design of typical circuit using IC 555.
    a. Identify the timer 555 IC pin configuration and its use.
    b. Draw the typical circuit using timer 555 IC.
    c. Find out the time when output is high using RC combination.
    d. Find out the steps to create PCB layout.

7. Simulation and PCB design of typical circuit using Op-Amp 741 IC.
    a. Identify the Op-Amp 741 pin configuration and its use.
    b. Draw Inverting or Non-Inverting amplifier using IC 741.
    c. Find out the output voltage and gain of Op-Amp.
    d. Compare the simulated and theoretical calculated values.

e. Create PCB layout.

8. Simulation and PCB design of typical circuit using 74xx series IC.
   a. Describe various IC available in 74xx series
   b. Draw the circuit using 74xx series and verify the truth table.
   c. Create PCB layout.

9. Simulation and PCB design of typical circuit using two stage amplifiers.
   a. Describe operation and construction of simple two stage transistor amplifier circuit.
   b. Simulate the circuit and find IB, IC, IE, and VCE.
   c. Find the AC analysis and compare input and output wave form.
   d. Compare simulated result of IB, IC, IE, and VCE of each transistor with theoretical calculated values.
   e. Create PCB layout.

10. Simulation and PCB design of simple DC power supply. (DC power supply circuit include transformer- rectifier-filter- regulator 2 turns)
   a. Draw and describe circuit diagram of simple DC power supply.
   b. Describe the use of DC power supply.
   c. Measure the voltage and current at each stage of circuit.
   d. Create PCB layout.

11. Hardware Implementation of any of the one circuit from Group B. **(Two turns)**

Text Book:

1. Oscad- An open source EDA tool for circuit design, simulation, analysis and PCB Design, Kannan M. Moudgalya , Shroff Publication and distributors Pvt. Ltd, May 2013.
2. http://oscad.in

Notes:

- **ICA –**Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET 360 MINI PROJECT

Teaching Scheme: 02 PR; Total: 02 **Credits:** 02
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

COURSE DESCRIPTION:

The mini project is one of the most important single piece of work in the degree programme. It is introduced in curriculum to put into practice some of the techniques that have been taught to students in earlier years. It also provides the opportunity to students to demonstrate independence and originality, to plan and organise a large project over a long period. The mini-project topic should be selected to ensure the satisfaction of the need to establish a direct link between the techniques they learnt and productivity. Thus it should reduce the gap between the world of work and the world of study.

DESIRABLE AWARENESS/SKILLS:

Knowledge of concepts, principles and techniques studied in all earlier courses.

COURSE OBJECTIVES:

The objectives of offering this course are

- to develop ability to synthesize knowledge and skills previously gained and to put some of them into practice.
- to make students capable to select from different methodologies, methods and forms of analysis studied to produce a suitable system or sub-system.
- to inculcate ability to present the findings of their technical solution in a written report.
- to plan and organise a large project over a long period.

COURSE OUTCOME:

On successful completion of this course students shall

1. be able to apply the knowledge and skills previously gained into practice.
2. take appropriate decision wrt various parameters related to production of a system or sub-system.
3. demonstrate the leadership quality along with ability to work in a group.
4. prove the ability to present the findings in a written report or oral presentation.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
b.	design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	3
c.	design a component, system or process to meet the specifications and requirements within pragmatic constraints.	3
d	solve problems related to electronics engineering in interdisciplinary projects.	2
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

- The mini project shall be carried out in-house i.e. in the department's laboratories/centres by a group 2 – 4 students. In any case the group shall not consist of more than four students.
- The mini project shall consist of design and implementation of any suitable electronic system, sub system or circuit based on knowledge and skills previously gained.
- The mini project outline (a brief or condensed information giving a general view of mini project topic) on the selected topic should be submitted to the course coordinator for approval within one weeks from the commencement of the term.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation.
- **Mini project deliverables:** A mini project report as per the specified format (available on in the department and institutes website), developed system in the form of hardware and/or software. In addition, student shall maintain a record of attendance and continuous progress (log book in appropriate format available on institute/department's web site) duly signed by course coordinator and present as mini project deliverable along with report.

EVALUATION SYSTEM:

It includes Internal Continuous Assessment (ICA) and End Semester Examination (ESE).
Guidelines for ICA and ESE are given bellow.

Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by course coordinator.
- Course coordinator shall judge the students on the principle of continuous evaluation and contribution of individual student in the group.
- It shall be evaluated on the basis of deliverables of mini project and depth of understanding.
- Course coordinator shall maintain the record of continuous evaluation in appropriate format available on institute/department's web site.

End Semester Examination (ESE)

- The End Semester Examination for this course shall be based on demonstration of the system or sub system developed by the group of students, deliverables of mini project and depth of understanding (oral examination). It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET 362 INDUSTRIAL LECTURE-I

Teaching Scheme: 01 L; Total: 01 **Credit:** NA
Evaluation Scheme: NA **Total Marks:** NA

COURSE DESCRIPTION:

This course reflects on the importance of acquaintanceships and the interchange of needed information between practicing engineers in industry and students in educational institutions. There is a criticism, especially from practicing engineers, that existing engineering education is too theoretical and numerical with less orientation toward practical aspects. This course is designed to overcome this criticism. This course is intended to generate such interaction directly, through expert lectures by outstanding practicing engineers. This course will prove helpful to denote and understand the relations among the employers, employees, and other organisations.

DESIRABLE AWARENESS/SKILLS:

Listening, understanding and analysing ability along with the knowledge of concepts, principles and techniques studied earlier.

COURSE OBJECTIVES:

The objectives of offering this course are

1. to make students familiar with industrial environment i.e. to provide appropriate exposure to world of work.
2. to know and understand the industrial experience, attitudes, needs, and viewpoints of industrial expert to students.
3. to denote and understand the role of various parties' viz., employers, employees, and state in maintaining industrial relations..
4. to improve industry institute interaction.

COURSE OUTCOME:

On successful completion of this course students shall

1. become familiar with industrial environment/ world of work.
2. understand expectations of industry wrt expertise, attitude and viewpoint.
3. demonstrate the good inter personnel relations.
4. be able to work in industrial environment either as employee or self employed (entrepreneur) with comfort.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

PO No.	PO	Level of co-relation
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2
h	understand and apply contextual knowledge to assess and solve social, health, safety, legal cultural and environmental issues related to engineering practices in general and electronics engineering practices in particular.	1

i	recognize the need for and have the ability to engage in, perpetual learning by working on projects for which they have no prior experience and by adapting latest advancement in technology and concepts.	2
j	interpret and update with contemporary issues affecting engineering industry.	2
k	manage the project under execution effectively and professionally using the techniques, skills, and modern engineering tools necessary for engineering practice.	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT:

- There shall be minimum 6 lectures of 60 -90 minutes duration.
- The lecture shall include presentation, informal discussions with students and faculty, and laboratory tours (if required).
- Topics of Industrial Lectures shall be technical in nature and should not be the specific or extended part of the curriculum.
- Typically speakers should talk about:
  i. Their own career following (and sometimes including) university.
  ii. Interesting jobs/projects they have had worked on.
  iii. The areas of work they are currently involved in.
  iv. The type of work engineering graduates can expect.
  v. Current job opportunities that may be available for engineering graduates in general and electronics and telecommunication engineering graduates in particular.
  vi. Any suggestions for students with regard to job hunting / CV writing / interviews etc.
  vii. Latest technology used in the industry which is not the part of curriculum or routine training programmes.
  viii. Any other suitable topic/information which provides industrial exposure and improves entrepreneurship quality/ employability of the students.
- Course coordinator shall discuss with students on the content of lecture and may conduct oral or give written assignments to judge the depth of understanding of students.
- Students shall submit the report based on minimum six lectures giving summary of the lecture delivered.
- The summary should contain brief resume of the expert, brief information of his organization and brief summary of the lecture in the format provided by institute/department.
- Industrial Lecture deliverables: An industrial lecture report as per the specified format (available on the department and institute's website) and assignments given by course coordinator (if any).

(Note: List of renowned experts/Officials/Entrepreneurs from Industries/Government Organizations/Private Sectors/Public Sectors / R&D Labs etc shall be prepared by the committee appointed by HoD and shall be approved by principal. After approval from the principal, minimum six Industrial Lectures shall be arranged, which shall be delivered by experts to cover the various aspects of course content)

EVALUATION SYSTEM:

It includes Internal Continuous Assessment (ICA). Guidelines for ICA are given bellow.

Internal Continuous Assessment (ICA)

- The ICA shall be evaluated by course coordinator.
- Course coordinator shall judge the students on the principle of continuous evaluation and contribution of individual student.
- It shall be evaluated on the basis of deliverables of industrial lecture and depth of understanding (oral conducted by course coordinator).
- Course coordinator shall maintain the record of continuous evaluation (oral) and handover to HoD as the marks and credit are to be allotted in the VIIIth semester.