Syllabus of 3rd to 8th Semester

(to be effective from 2016-17 admission batch)

Autonomy Curriculum and Syllabus of B.Tech Programme
Implemented from the Academic Year 2016

Department of Electronics and Instrumentation Engineering(EIE)

2nd Year,3rd Sem

A.THEORY:

	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	BS	M 301	Mathematics – III	3	1	0	4	4
2	BS	M(CS) 301	Numerical Methods	3	0	0	3	3
3	PC	EI 301	Analog Electronic Circuits	3	0	0	3	3
4	PC	EI 302	Digital Electronic Circuits	3	0	0	3	3
5	PC	EI 303	Circuit Theory and Networks	3	1	0	4	4
6	PC	EI 304	Electrical & Electronic Measurement & Instrumentation	3	1	0	4	4
Total Theory							21	21

B.PRACTICAL:

	Field	Code	Subjects	Contact hours/week				Credit Points
				L	T	P	Total	
1	BS	M(CS)391	Numerical Methods Lab	0	0	3	3	2
2	PC	EI 391	Analog Electronic Circuits Lab	0	0	3	3	2
3	PC	EI 392	Digital Electronic Circuits Lab	0	0	3	3	2
4	PC	EI 393	Circuits and Networks Lab	0	0	3	3	2
Sessional:								
5	MC	MC381						0
Total practical							14	8
Total 3rd Semester							35	29

Paper Name: Mathematics-III
Paper Code: M 301
Contact: L-T-P: 3L-0T-0P
Total Lectures: 44L
Credits: 4

Prerequisite: Any introductory course on Calculus and Combinatorics.

Course Objective: The purpose of this course is to provide fundamental concepts of Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equation, Partial Differential Equations.

Course outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M 301.1: Recall the distinctive characteristics of mathematical approaches like Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equation, Partial Differential Equations.

M 301.2: Understand the theoretical workings of mathematical approaches like Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equations, and Partial Differential Equations to evaluate the various measures in related field.

M 301.3: Apply various principles of Fourier Series & Fourier Transform, Calculus of Complex Variables, Probability Distribution, Correlation & Regression, Ordinary Differential Equations, Partial Differential Equations to solve various problems.

MODULE I:

Fourier Series and Fourier Transform:

Sub-Topics: 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, Fourier Series for functions of period , Dirichlet's conditions, Sum of Fourier series. Examples. 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).Examples.

Fourier Transform:

Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives.Examples.Convolution Theorem (statement only), Inverse of Fourier Transform,Examples.
Discussions on application of the topic related to EIE

10L

MODULE II:

Probability Distributions: Definition of random variable.Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof).Examples. Definitions of Expectation & Variance, properties & examples. Some important discrete distributions: Binomial, Poisson. Continuous distributions: Normal. Determination of Mean, Variance and standard deviation of the distributions. Correlation &Regression analysis, Least Square method, Curve fitting.

Discussions on application of the topic related to EIE

10L

MODULE III:

Calculus of Complex Variable

Introduction to Functions of a Complex Variable, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. Construction of Analytic functions: Milne Thomson method, related problems.

Complex Integration.

Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples.Cauchy's theorem (statement only).Cauchy-Goursat theorem (statement only).Examples.Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function.Examples.Taylor's series, Laurent's series. Examples.

Zeros and Singularities of an Analytic Function & Residue Theorem.

Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m. Examples on determination of singularities and their nature. Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, Introduction Conformal transformation, Bilinear transformation, simple problems.

Discussions on application of the topic related to EIE

12L

MODULE IV:

Basic concepts of Partial **differential equation (PDE)**:

Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution: Separation of variables, Laplace & Fourier transforms methods.

Topic: Solution of Initial Value & Boundary Value PDE's by Separation of variables, Laplace & Fourier transform methods.

PDE I: One dimensional Wave equation.

PDE II: One dimensional Heat equation.

PDE III: Two dimensional Laplace equations.

Introduction to series solution of Ordinary differential equation (ODE): Validity of the series solution of an ordinary differential equation. General method to solve $P_o y''+P_1 y'+P_2 y=0$ and related problems to Power series method**.** Brief review on series solution of Bessel & Legendre differential equation. Concepts of generating functions.

Discussions on application of the topic related to EIE **12L**

Text Books:

1.Rathor, Choudhari,:Descrete Structure And Graph Theory.

2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics - Sultan Chand & Sons.

3.Lipschutz S: Theory and Problems of Probability (Schaum's Outline Series) - McGraw Hill Book. Co.

4. Spiegel M R: Theory and Problems of Probability and Statistics (Schaum's Outline Series) - McGraw Hill Book Co.

5. Goon A.M., Gupta M K and Dasgupta B: Fundamental of Statistics - The World Press Pvt. Ltd.

6. Spiegel M R: Theory and Problems of Complex Variables (Schaum's Outline Series) - McGraw Hill Book Co.

7. Bronson R: Differential Equations (Schaum's Outline Series) - McGraw Hill Book Co.

8. Ross S L: Differential Equations - John Willey & Sons.

9.Sneddon I. N.: Elements of Partial Differential Equations - McGraw Hill Book Co.

10. West D.B.: Introduction to Graph Theory - Prentice Hall

11. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.

12. Grewal B S: Higher Engineering Mathematics (thirtyfifthedn) - Khanna Pub.

13. Kreyzig E: Advanced Engineering Mathematics - John Wiley and Sons.

14. Jana- Undergradute Mathematics

15. Lakshminarayan- Engineering Math 1.2.3

16. Gupta- Mathematical Physics (Vikas)

17. Singh- Modern Algebra

18. Rao B: Differential Equations with Applications & Programs, Universities Press

19. Murray: Introductory Courses in Differential Equations, Universities Press

20. Delampady, M: Probability & Statistics, Universities Press

21. Prasad: Partial Differential Equations, New Age International

22. Chowdhury: Elements of Complex Analysis, New Age International

23. Bhat: Modern Probability Theory, New Age International

24. Dutta: A Textbook of Engineering Mathematics Vol.1 & 2, New Age International

25. Sarveswarao: Engineering Mathematics, Universities Press

26. Dhami: Differential Calculus, New Age International

CO-PO Mapping:

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

Name of the Paper: Numerical Methods
Paper Code: M(CS)301
Contact (periods/week): L-T-P: 3L -0T-0P
Credit point: 3
Number of lectures: 33L

Prerequisite: Concept of Calculus and Algebra.

Course Objective:

The purpose of this course is to provide basic understanding of the derivation and the use of the numerical methods along with the knowledge of finite precision arithmetic.

Course outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M(CS)301.1: Recall the distinctive characteristics of various numerical techniques and the associated error measures.

M(CS)301.2: Understand the theoretical workings of various numerical techniques and to solve the engineering problems.

M(CS)301.3: Apply the principles of various numerical techniques to solve various problems.

MODULE I: NUMERICAL METHOD I

Approximation in numerical computation: Truncation and rounding errors, Propagation of errors, Fixed and floating-point arithmetic.

(2L)

Interpolation: Newton forward/backward interpolation, Stirling & Bessel's Interpolation formula, Lagrange's Interpolation, Divided difference and Newton's divided difference Interpolation.

(7L)

Numerical integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3 rule, Weddle's Rule, Romberg Integration, Expression for corresponding error terms.

(5L)

Numerical solution of a system of linear equations: Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Seidel iterative method, Successive over Relaxation (SOR) method.

(6L)

MODULE II: NUMERICAL METHOD II

Solution of polynomial and transcendental equations: Bisection method, Regula-Falsi, Secant Method, Newton-Raphson method.

(5L)

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.

(6L)

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

(2L)

Text Books:

1. Shishir Gupta &S.Dey, Numerical Methods, Mc. Grawhill Education Pvt. Ltd.

2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta& Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis.Oxford and IBH Publishing
5. Jain, Iyengar ,& Jain: Numerical Methods (Problems and Solution).New age International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books.

References:

1. Balagurusamy: Numerical Methods, Scitech. TMH
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. SoumenGuha& Rajesh Srivastava: Numerical Methods, Oxford Universities Press.
5. Srimanta Pal: Numerical Methods, Oxford Universities Press.
6. Numerical Analysis, Shastri, PHI
7.Numerical Analysis, S. Ali Mollah. New Central Book Agency.
8.Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI
9.NumericalAnalysis,G.S.Rao,New Age International
10.Programmed Statistics (Questions – Answers),G.S.Rao,New Age International
11.Numerical Analysis & Algorithms, PradeepNiyogi, TMH
12.Computer Oriented Numerical Mathematics, N. Dutta, VIKAS
13.NumericalMethods,Arumugam,ScitechPublication
14.Probability and Statisics for Engineers,Rao,ScitechPublication
15.Numerical Methods in Computer Application,Wayse,EPH

CO-PO Mapping:

CO \ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
M(CS) 301.1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
M(CS) 301.2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
M(CS) 301.3	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**

Name of the Paper: Analog Electronic Circuits
Paper Code: EI 301
Contact (periods/week): L-T-P: 3L -0T-0P
Credit point: 3
Number of lectures: 35

Course Objective:

1. Provide a strong foundation on Linear Circuits.
2. Familiarize students with applications of various IC's.
3. Having a broad coverage in the field that is relevant for engineers to design Linear circuits using Op-amps.
4. Familiarize the conversion of data from Analog to Digital and Digital to Analog.

Course Outcome:

EI 301.1: Define significance of Op Amps and their importance.

EI 301.2: Circuit building using Analog IC's.

EI 301.3:In-depth knowledge of applying the concepts in real time applications.

EI 301.4: Able to use OP Amp to generate sine waveform, Square wave form, Triangular wave forms and design the analog to digital and digital to analog converter and vice versa.

Module I:

Small signal amplifiers: Introduction to Analog Integrated Circuits, BJT Modeling- hybrid model of transistors; Emitter follower circuits, High frequency model of transistors. FET Small signal analysis - Source follower

[3]

Module II:

Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier.

[4]

Feedback Amplifiers & Oscillators: Feedback concept, Voltage series-shunt, current series-shunt feedback
Configurations, Berkhausen criterion, Colpitts, Hartley's, Phase shift, Wien bridge and crystal oscillators

[5]

Module III:

Operational Amplifier: Introduction to Integrated Circuits, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), Block Diagram of OPAMP, Ideal OPAMP

[4]

Applications of Operational Amplifiers: analog adder, subtractor, integrator, differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Analog multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running Multivibrator , zero crossing detector [6]

Multivibrator – Monostable, Bistable, Astable multivibrators ; Monostable and astable operation using 555 timer.

[3]

Module IV:

Large signal Amplifiers: Introduction to power amplifiers (Class A, B, AB)

[1]

Power Supply:

Analysis for DC voltage and ripple voltage with C, L-C and C-L-C filters in Rectifier Circuit - Regulated dc power supplies- Line regulation, output resistance and temperature coefficient, Series and Shunt Voltage Regulation – percentage regulation, Fixed output voltage IC regulator 78xx and 79xx series , Adjustable output voltage regulator, LM 337 series power supply ICs , Concept of **Switched** Mode Power Supply` [6]

Text Books:

1. Millman Halkias – Integrated Electronics, McGraw Hill
2. Schilling & Belove—Electronic Circuit: Discrete & Integrated, 3/e, McGraw Hill
3. Ramakant A. Gayakwad —Op- Amps and linear Integrated Circuits, Pub: PHI
4. Boylested & Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI
5. "Operational Amplifiers and Linear Integrated Circuits" by Robert F. Coughlin, Frederick F. Driscoll

Reference Books:

1. Rashid-Microelectronic Circuits- Analysis and Design- Thomson(Cenege Learning)
2. Linear Integrated Circuits – D. Roy Choudhury & Shail B. Jain
3. Analog Integrated Circuits – J. B. Gupta

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
EI301.1	-	-	2	-	-	-	-	-	-	-	-	-	3	3
EI301.2	1	-	1	3	-	-	-	-	-	-	-	-	3	2
EI301.3	-	2	-	-	-	-	-	-	-	-	-	-	2	3
EI301.4	1	-	-	3	-	-	-	-	-	-	-	-	3	3

Name of the Paper: Digital Electronic Circuits
Paper Code: EI 302
Contact (periods/week): L-T-P: 3L
Credit point: 3
Number of lectures: 35

Course Objective:

1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
2. To introduce number systems and codes.
3. To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
4. To introduce the methods for simplifying Boolean expressions
5. Give students the basic tools for the analysis and design of combinational circuits and sequential circuits
6. To introduce the concept of memories, programmable logic devices and digital ICs.

7. To acquire the knowledge of Digital-to-Analog Conversion, Analog-to-Digital Conversion.

Course Outcome:

EI 302.1: On completion of this course, the students have a thorough understanding of the fundamental concepts and techniques used in digital electronics.

EI 302.2: To understand and examine the structure of various number systems and its application in digital design.

EI 302.3: The ability to understand, analyze and design various combinational and sequential circuits.

EI 302.4: Ability to identify basic requirements for a design application and propose a cost effective solution.

EI 302.5: Have knowledge on Programmable Logic devices and its usage.

Module1:

Introduction:

Digital system, Comparison between Analog and Digital system, Logic level, Element of Digital Logic, Functions of Digital logic.

Data and number systems:

Number system: Binary, Octal and Hexadecimal representation and their conversions;
Number Representation: Signed binary number representation with 1's and 2's complement methods, Fixed point - Floating point
Binary Codes: BCD- Gray code- Excess 3 code- Alpha Numeric codes – Error detecting and correcting codes- properties
Binary Arithmetic: Addition, subtraction, Multiplication, Division, Addition and subtraction by 1's and 2's complement, BCD addition and subtraction

[4]

Boolean algebra:

Theorems and operations, Boolean expressions and truth tables, Representation in SOP and POS forms Boolean functions; Minterm and Maxterm expansions Minimization of logic expressions by algebraic method, K-map method and Quine- McClauskey method
Various Logic gates- their truth tables and circuits; Design of circuits with universal gates. Exclusive-OR and Exclusive NOR and equivalence operations

[6]

Module II:

Design procedure–Adder: and Subtractor circuit: half and full adder and subtractor, BCD adder and subtractor, controlled invertor,
Convertors: BCD to excess-3 and vice versa, Binary to BCD, Gray to binary and viceversa.
Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and Checker.

[7]

Module III:

Sequential Logic:
Basic memory element-S-R, J-K, D and T Flip Flops-Truth table and Excitation table, Conversion of Flip-flop ,Various types of Registers and their design and application
Synchronous and Asynchronous counters, Irregular counter- counter design

[5]

Sequential Circuits Design: State diagrams and tables, transition table, excitation table, Examples using flip-flops. Analysis of simple synchronous sequential circuits, construction of state diagram, State Machine-Mealy and Moore machine

[5]

Module IV:

Memory Systems:
RAM-Static RAM and Dynamic RAM, ROM, EPROM, EEROM
Programmable logic device: programmable read only memory, programmable logic arrays and programmable array logic, Design using PLA, PAL,PROM

[2]

Logic families:
TTL, ECL, MOS and CMOS, their operation and specifications: Logic levels, propagation delay time, power dissipation fan-out and fan-in, noise margin.
Implementation of Logic gate using TTL,MOS

[2]

Different types of A/D and D/A :
Conversion techniques: analog-to- digital (successive approximation, Dual slope, flash) and digital-to-analog converters (weighted R, R-2R ladder and current steering logic). Characteristics of ADC and DAC (resolution, quantization, significant bits, conversion/settling time)

[4]

Text Books:
1. A.Anand Kumar, Fundamentals of Digital Circuits- PHI
2 Morries Mano- Digital Logic Design- PHI
3. R.P.Jain—Modern Digital Electronics
4. Digital Integrated Circuits -- Taub and Schilling . Mcgraw Hill

Reference Books:
1. Digital Fundamental, Floyd-PHI
2. Digital, Principle and Application, Leach Malvino,Mcgraw Hill

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2

EI302.1	**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**3**	**3**
EI302.2	**3**	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**
EI303.3	**3**	**3**	**2**	**2**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**
EI302.4	**2**	**2**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**2**	**1**
EI302.5	**2**	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**2**	**2**

Name of the Paper: Circuit theory and networks
Paper Code: EI 303
Contact (periods/week): L-T-P: 3-1-0
Credit point: 4
Number of lectures: 43

Pre-Requisite: Concept of Basic electrical

Course Objective:

1. To prepare the students to have a basic knowledge in the analysis of Electric Networks
2. To solve the electrical network using mesh and nodal analysis by applying network theorems
3. To analyze the transient response of series and parallel circuits and to solve problems in time domain using Laplace Transform.
4. To understand the concept of resonance in series and parallel circuits.
5. To design various types of filters.
6. To relate various two port parameters and transform them.

Course Outcome:

On completion of this Subject/Course the student shall be able to:

EI 303.1: Solve complex circuit problem by applying knowledge of circuit theorems.
EI 303.2: Analyze dynamic performance of the networks using Laplace Transform.
EI 303.3: Find out resonance of different circuit.
EI 303.4: Analyze two port networks using A,B,C,D and Z,Y Parameter Model.
EI 303.5: Design different types of filters.

Module1:

Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Source Transformation, Star-Delta conversation

[4]

Network equations: Kirchoff's Voltage Law & Current Law, Formulation of network equations, Loop variable analysis, Supermesh Analysis, Node variable analysis, Supernode Analysis

Network theorem: Superposition, Thevenin's, Norton's,Maximum power transfer, Compensation & Reciprocity theorem. Millman's theorem and its application. Solution of Problems with DC & AC sources.

[7]

Module II:

Laplace transforms: Concept of complex frequency, properties of Laplace Transform, Initial Value Theorem and Final Value Theorem, Concept of Convolution theorem and its application, Transformation of step, ramp, impulse, exponential, damped and undamped sine & cosine functions. Laplace Transform of Gate function & its application. Laplace transform of Periodic function. Inverse Laplace Transform, application of Laplace Transform in circuit analysis. [7]

Circuit Transients: Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions using AC & DC source. Solutions of Problems with DC & AC sources [5]

Module III:

Two port network analysis: Open circuit Impedance & Short circuit Admittance parameters, Transmission parameters, Hybrid parameters and their inter relations. Condition of Reciprocity & symmetry. Interconnection of two port networks. Solution of Problems with DC & AC sources.

[6]

Resonant Circuits: Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Solution of problems

[4]

Module IV:

Graph of Network: Concept of Tree, Branch, Tree link, junctions, Incident matrix, Tie-set matrix and loop currents, Cut-set matrix and node pair potentials, duality of networks, solution of problems.

[4]

Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems.

[4]

Filter Circuits: Analysis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems

[2]

Text Book:

1. Network Analysis, M.E.Van Valkenburg (Prentice H all)
2. Engineering Circuit Analysis, W.H.Hayt, J.E.Kenmerly, S.M.Durbin,(TMH)
3. Network and Systems, D.Roychowdhury,(New Age International)

References:

1. Network and Systems, Ashfaq Husain,(Khanna Book Publisher)

2. Modern Netwok Analysis, F.M.Reza & S.Seely, McGraw Hill.
3.Circuits and Networks: Analysis and Synthesis Paperback , A. Sudhakar, Shyammohan S. Palli (TMH)
4. Network Analysis And Synthesis, C L Wadhwa, ,(New Age International)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EI303.1	3	2	2	1	1	-	-	-	-	-	-	-	1	1
EI303.2	3	2	1	2	2	-	-	-	-	-	-	-	1	1
EI 303.3	3	2	2	1	1	-	-	-	-	-	-	-	1	1
EI 303.4	3	2	1	1	1	-	-	-	-	-	-	-	1	1
EI 303.5	3	2	3	1	1	-	-	-	-	-	-	-	3	2

Name of the Paper: Electrical & Electronic Measurement &Instrumentation
Paper Code: EI304
Contact (periods/week): L-T-P: 3-1-0
Credit point: 4
Number of Lectures: 45

Course objective:

1. To understand students how different types of electrical and electronics meters work and their construction and applications.
2. To provide an extensive knowledge about standards and units of measurements.
3. To provide knowledge for the calibration and standardization of various instruments.
4. To provide students with opportunities to develop basic skills in the design of measuring equipments.
5. To familiarize the students with the available software for virtual instrumentation.

Course Outcome:

On completion of this Subject/Course the student shall be able to:

EI 304.1: Use instruments measuring instruments according to the need of specific application.

EI 304.2: Calibrate and standardize the instruments.

EI 304.3: Design measuring instruments on requirement basis.

EI 304.5: To measure different parameters from the simulated instrumentation systems using virtual instrumentation.

Module I:

Introduction to Electrical & Electronic Measurement &Instrumentation
Static and dynamic characteristics of measuring instruments: Definitions of accuracy, precision, hysteresis, nonlinearity, sensitivity, speed of response, fidelity, static and dynamic error, Statistical analysis of errors [5]

Reliabity, MTTF, Bath tub curve [1]

Introduction to electrical voltmeters and ammeters: PMMC, MI, Electrodynamometer and Electrostatic instrument: Construction, Torque equation, Damping, range extension [7]

Module II:

Measurement of Resistance: Wheatstone bridge & Kelvin's Double bridge (DC Bridge), Loss of charge method, Meggar
Measurement of Capacitance: De Sauty's bridge & Schering bridge (AC Bridge)
Measurement of Inductance: Anderson bridge & Maxwell's inductance capacitance bridge (AC Bridge)
(*each bridge should cover: Bridge balance equation, Magnitude and phase balance of AC bridges, Phasor Diagram) [7]

Localization of cable fault: Murray and Varley loop methods [1]

Basic concept of Potentiometer, Wattmeter and Energy meter: [3]

Module III:

PLL including VCO: Block diagram, circuit diagram, operation, modes Charge amplifier, Programmable gain amplifier [3]

True RMS voltmeter, Digital Voltmeter, Average responding AC voltmeter and Peak responding AC voltmeters, Digital frequency meter including V to F, F to V [7]

Q meter [2]

Module IV:

Oscilloscopes and its applications: Oscilloscope Time Base, Triggering, Oscilloscope Controls, Oscilloscope Probes, Digital Storage Oscilloscope, Types of display devices. No of the lectures to be allotted for this section are [6]

Distortion Analyzer and Spectrum Analyzer [1]

Interference Signals and their eliminations [1]

Introduction to Virtual Instrumentation [1]

Text Books:

1. Golding E.W. & Wides F.C. : Electrical Measuring Instruments & Measurements ; Wheeler
2. Sawhney A K : A course in Electrical & Electronic Measurements & Instruments, Dhanpat Rai & Co.
3. Helfrick A.D. & Cooper W.D. : Modern Electronic Instrumentation & Measuring Instruments; Wheeler
4. Bell, David : Electronic Instrumentation & Measurement, Reston Publishers
5. D.C. Patranabis, Principles of Electronic Instrumentation, PHI
6. A. K. Ghosh, Introduction to Measurements and Instrumentation

References:

1. Harris, F. K. – Electrical Measurements, Wiley.
2. H.S. Kalsi, Electronic Instrumentation, Tata McGraw Hill
3. Reissland M.U.: Electrical Measurement, New Age International

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
EI 304.1	**3**	**3**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**1**
EI 304.2	**3**	**3**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**1**
EI 304.3	**3**	**2**	**3**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**1**
EI 304.4	**3**	**3**	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**3**	**1**	**1**

Name of the Paper: Numerical Methods Lab
Paper Code: M(CS)391
Contact (periods/week): L-T-P: 0L -0T-3P
Credit point: 2
Number of lectures: 33L

Prerequisite: Any introductory course on C/ Matlab.

Course Objective: The purpose of this course is to provide basic programming skills for solving the problems in numerical methods.

Course outcome:

On successful completion of the learning sessions of the course, the learner will be able to:

M(CS) 391.1: Apply the programming skills to solve the problems using multiple numerical approaches.

M(CS) 391.2: Analyze if the results are reasonable, and then interpret and clearly communicate the results.

List of Experiments:

1. Assignments on Newton forward /backward, Lagrange's interpolation, Sterling & Bessel's Interpolation formula, Newton's divided difference Interpolation.

2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule and Romberg Integration.

3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method.

4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method

5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.

6. Assignments on numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.

7. Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group/Python.

Analog Electronics Lab
Code :EI 391
Contacts : 3P
Credits : 2

Course Objective:

1. Understand the scope of modern electronics.
2. Describe models of basic components.
3. Design and construct simple electronic circuits to perform a specific function, e.g.,designing amplifiers, ADC converters etc.

4. Understand capabilities and limitations and make decisions regarding their best utilization in a specific situation.

Course Outcome:

EI 391.1: Verify the working of diodes, transistors and their applications.

EI 391.2: Build a common emitter/base/collector amplifier and measure its voltage gain.

EI 391.3: Explore the operation and advantages of operational amplifiers.

EI 391.4: To design different types of filters and apply the same to oscillators and amplifiers.

EI 391.5: Exploring the circuitry which converts an analog signal to

List of Experiments:

1. Study of ripple and regulation characteristics of full wave rectifier with and without capacitor filter

2. Construction of a R-C coupled amplifier & study of its input impedance, output impedance and frequency response

3. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator

4. Study a linear voltage regulator using regulator IC chip

5. Construction of analog adder and subtractor using opamp

6. Construction of integrator and differentiator using opamp

7. Construction of precision rectifier using opamp

8. Construction of a simple function generator using opamp

9. Construction of a Schmitt trigger circuit using opamp

10. Design and testing of Wien bridge oscillator

11. Study and analysis of Instrumentation Amplifier

12. Extramural Experiment

Digital Electronic Circuits Lab
Code :EI 392
Contacts : 3P
Credits : 2

Course Objective:

1. To reinforce learning through hands-on experience with design, construction, and implementation of digital circuits.
2. To train students with all the equipment which will help in improving the basic knowledge

Course Outcome:

EI 391.1: Have an ability to operate laboratory equipment.

EI 391.2: Have an ability to the designed digital circuits

EI 391.3: Have an ability to construct, analyse, and troubleshoot the digital circuits.

EI 391.4: Have ability to measure and record the experimental data, analyse the results and prepare a formal laboratory report

List of Experiments:

1. Realization of basic gates using Universal logic gates

2. Code conversion circuits- BCD to Excess-3 & vice-versa

3. 4-bit parity generator & comparator circuits

4. Construction of simple Decoder & Multiplexer circuits using logic gates

5. Design of combinational circuit for BCD to decimal conversion to drive 7segment display using multiplexer

6. Construction of simple arithmetic circuits-Adder, Subtractor

7. Realization of RS-JK & D flip-flops using Universal logic gates

8. Realization of Universal Register using JK flip-flops & logic gates

9. Realization of Universal Register using multiplexer & flip-flops

10. Realization of Asynchronous and Synchronous Up/Down counter

11. Design of Sequential Counter with irregular sequences

12. Realization of Ring counter

13. Extramural Experiment

Circuits and Networks Lab
Code : EI 393
Contacts : 3P
Credits : 2

Course Objective:

1. To acquaint students with the simulation software such as MATLAB to carry out design experiments as it is a key analysis software of engineering design
2. To generate different signals and transform those to s- domain using MATLAB
3. To verify various network theorem and other network aspects using SIMULINK.
4. To provide basic laboratory experience with analyzing the frequency response of different filters using simulation software.

Course Outcome: On completion of this Subject/Course the student shall be able to:

EI 393.1: Use the techniques and skills of modern engineering tools necessary for engineering practice.

EI 393.2: Identify, formulate and solve engineering problems with simulation.

EI 393.3: Find transient response of series /parallel R-L-C circuit using simulation software.

EI 393.4: Find frequency response of different filters using simulation software

List of Experiments:

1. Introduction to MATLAB
2. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
3. Verification of Network Theorems using simulation software
4. Determination of Laplace transform and inverse Laplace transformation using MATLAB
5. Transient response in R-L and R-C Network: Simulation/hardware
6. Transient response in R-L-C Series circuits Network: Simulation and hardware.
7. Determination of Impedance (Z) and Admittance(Y) parameters of two port network
8. Frequency response of LP and HP filters: Hardware
9. Frequency response of BP and BR filters
10. Evaluation of convolution integral for periodic & non-periodic signal using MATLAB
11. Extramural Experiment

Technical Skill Development
Paper Code: MC 381
Contact (periods/week): L-T-P: 2-0-0
Credit point: 0

Course Objective:

1. Developing Knowledge about basic signal concept.

2. Understanding the LTI system modelling using MATLAB

3. The knowledge about the application and use of mathematical transforms.

4. Development of the mathematical skills to solve problems involving convolution using MATLAB

Course outcome:

MC 381.1: Student will be able to Explain commonly used signals through mathematically

MC 381.2: Student will be able to determine the response of LSI system using convolution.

MC 381.3: Student will use the tool to analyse continuous-time and discrete-time Fourier series.

MC 381.4: Student will be able to develop the continuous-time and discrete-time signals and systems.

ModuleI:
Skill development for signal simulation and analysis using MATlab [14]

Text Book:

1. Linear System and Signals, 2nd Edition by B.P.Lathi, Oxford University Press

2. Signals and systems with MATlab computing and simulink modeling- Steven T. Karris, Orchard Publications

Mapping of CO- PO-PSO

CO Vs PO, PSO MAPPING FOR MC381															
COs for the course	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO4**	**PO5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**P1 0**	**P1 1**	**P1 2**	**PSO1**	**PSO 2**
MC381. 1	**Analyze the properties of different Continuous Time signals**	**2**	**2**	**1**	**3**	**-**	**2**	**1**	**1**	**1**	**1**	**2**	**-**	**1**	**1**
MC381. 2	**Demonstrate the properties of different Continuous systems**	**2**	**2**	**2**	**3**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**
MC381. 3	**Determine Continuous Time signals & systems in Time domain**	**3**	**1**	**2**	**1**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**2**
MC381. 4	**Investigate Continuous Time systems in the Frequency domain using Fourier Analysis tools**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**2**	**1**	**-**	**1**	**2**

2nd Year: 4th SEMESTER

A: THEORY:

	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	BS	PH401	Physics – II	3	0	0	3	3
2	PC	EI 401	Sensors and Transducers	3	1	0	4	4
3	PC	EI 402	Microprocessors and Microcontrollers	3	1	0	4	4
5	PC	EI403	Electromagnetic Theory and Transmission Line	3	0	0	3	3
6	PC	EI404	Signals & systems	3	0	0	3	3
Total Theory							17	17

B.PRACTICAL & SESSIONAL:

	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	BS	PH 491	Physics –II Lab	0	0	3	3	2
2	PC	EI 491	Sensors and Transducers Lab	0	0	3	3	2
3	PC	EI 492	Microprocessor and Microcontrollers Lab	0	0	3	3	2
4	PC	EI493	Electrical & Electronic Measurement & Instrumentation Lab	0	0	3	3	2
Sessional :								
5	HU	HU 481	Technical report writing & language practice laboratory	0	0	2	2	1
Total practical							14	9
Total 4th semester							31	26

Paper Name: Physics –II

Paper Code: PH 401

Total Contact Hours: 33

Credit: 3

Pre requisites: Knowledge of Physics up B. Tech. 1st year Physics-I course

Course Objective:

The Physics-II course will provide

- exposure to the physics of materials that are applied in electrical engineering
- an insight into the science & technology of next generation and related technicalities through quantum mechanics
- advanced materials for electrical engineering
- concept of fundamental particles and associated applications in semiconductors

Course Outcome

Course Outcome of Physics-II Course (Theoretical: PH 401)

At the end of the course students' would be able to

PH401.1: state

- Basic postulates of Quantum Mechanics
- Macro state and micro state for thermodynamic system.
- Thermodynamic probability and phase space
- Properties of Nano material.
- Polarization

- Bloch Theorem
- Assumptions of Kronig-Penny Model

PH401.2: explain

- Energy levels and energy states.
- Distribution functions of Classical and quantum statistics.
- Concept of quantum well, quantum wire and quantum dots.
- Quantum confinement.
- Different types of polarizability.
- Dielectric loss.
- Ferroelectric and Piezoelectric materials.
- Ferromagnetic Hysteresis Loop
- E-k diagram and Brillouin zone and crystal momentum
- Nuclear Binding Energy

PH401.3: apply the knowledge of

- Schrödinger equation in problems of junction diode, tunnel diode, 1-D potential box, 3-D potential box.

- Nano-range and various types of nano materials.

- Fermi Dirac statistics to metals and semiconductors.

- Local electric field and Lorentz field in Clausius-Mossotti equation.

- M, B , H and χ in realizing Curie law for different magnetic materials

- Weiss molecular field theory in realizing Curie- Weiss law for Ferromagnetic materials
- Soft and hard ferromagnets in different storage devices and other applications.

- Free electron theory in deriving Weidemann and Franz law,

- Kronig-Penny Model to classify different solid materials (metal, semiconductor, and insulator) based on characteristics of allowed and forbidden energy band.

- Hall Effect to interpret its application in various real life situations.

- Liquid drop model in Nuclear Fission and Fusion

PH401.4: Analyze

- Behavior of dielectric under alternating field.

- Hysteresis curve to describe properties of hard and soft ferromagnets.

- Outcome of negative effective mass value to realize existence of both electron and holes in certain solids.

PH401.5: to evaluate

- Under certain conditions quantum statistics collapses to classical statistics

- Diamagnetic, Paramagnetic and Ferromagnetic materials.

- Sommerfeld's energy quantization theorem to overcome the limitations of classical free electron theory (Drude's Theory)

Course contents

Module 1: Electric and Magnetic properties of materials (8L)

Module 1.01:Insulating materials:

Dielectric Material: Concept of Polarization, the relation between **D, E** and **P**, Polarizability, Electronic (derivation of polarizability), Ionic, Orientation & Space charge polarization (no derivation), behavior of Dielectric under alternating field (qualitative discussion only), Local electric field at an atom: Lorentz field, Lorentz relation; Dielectric constant and polarizability – Clausius-Mossotti equation (with derivation) ; Dielectric losses. ferroelctric and piezoelectrics (Qualitative study).

4L

Module 1.02: Magnetic materials and storage devices:

Magnetic Field & Magnetization M, relation between **B, H, M**. Bohr magneton, susceptibility, Diamagnetism- &Paramagnetism - Curie law (qualitative discussion), Ferromagnetism– Curie Temperature, Weiss molecular field theory (qualitative) & Curie-Weiss law, concept of θ_p , Hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets (storage devices) and Soft ferromagnets (Permalloys, Ferrites etc.) **4L**

Module 2: Quantum Mechanics-II (7L)

Formulation of quantum mechanics and Basic postulates- superposition principle, orthogonality of wave function, expectation value; operator correspondence, Commutator. Measurements in Quantum Mechanics-Eigen value, Eigen function, Schrödinger's equation as energy eigen value equation.

4L

Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum tunnelling (solve only $E<V_0$). **3L**

Module 3: Statistical Mechanics (6L)

Module 3.01: Basics of Statistical Mechanics:

Concept of energy levels and energy states, Microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level. **4L**

Module 3.02: Applications of Statistical Mechanics:

Qualitative study: Fermi level in metals, total energy at absolute zero and total number of particles.Fermi level for intrinsic and extrinsic semiconductors (pictorial representations on temperature dependence and doping concentration viz. p type, n-type).**2L**

Module 4:Elements of solid state physics (6L)

Module 4.01: Free electron theory (qualitative) - Electronic conduction in solids :Drude's theory, Boltzmann equation, Wiedemann Frantz Law, Idea of quantization of energy-Sommerfeld theory. 3L

Module 4.01: Band theory of solids: Bloch Theorem-statement only, Kronig-Penny model (qualitative treatment)- Energy-band (E-k) diagram, allowed and forbidden energy bands, Brillouin Zone (qualitative study), Concept of effective mass – electrons and holes, crystal momentum, Hall effect-applications. 3L

Module 5: Physics of Nanomaterials (3L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes.Application of nanomaterials(CNT, grapheme, electronic, environment, medical). 3L

Module 6: Nuclear energy as future energy (3L)

Nuclear Binding Energy, Liquid drop model, Concept of Nuclear Fission, Nuclear Fusion & Energy output , Nuclear Reactor. **3L**

Reference Books

1.Insulating Materials:Principles, Materials,Applications, Margit Pfundstein, Roland Gellert,Martin Spitzner& AlexanderRudolphi: BirkhauserVerlag AG; 1 edition (1 April 2008)

2. High Voltage and Electrical Insulation Engineering, RavindraArora, Wolfgang Mosch: Online ISBN:

9780470947906 DOI:10.1002/9780470947906, Series Editor(s): Mohamed E. El-Hawary

3. Physics of Oscillations and Waves, N.K. Bajaj ,Publisher: McGraw-Hill Education –Europe

4. Waves and oscillations, Dr.P.K Mittal & Prof Jai DEV ,AnandHarAnand publications

5. Fundamental of Statistical Mechanics: B Laud

6. Introduction to statistical mechanics : .Pathria

7. Fundamental of Statistical and Thermal Physics: .F. Reif

8. Electricity and Magnetism (In Si Units): Berkeley Physics Course - Vol.2, Edward M Purcell

9. Introduction to Electrodynamics- Griffiths David J.

10.The Feynman Lectures on Physics. 2 (2nd ed.)Feynman, Richard P, Addison-Wesley.

11.Etching of Crystals-Theory, Experiment and Application, K Sangwal

12. Nanostructure and Nanomaterials, B.K. Parthasarathy

13. Introduction toNanotechnology, B.K. Parthasarathy

14. Essentials of Nanotechnology, RishabhAnand

15. Nanomaterials Handbook(Advanced Materials and Technologies)-YuryGogotsi (Editor)

16. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

17. 1. Nuclear Physics,Irvin Keplan

18. Nuclear Physics, J.Pearson, University ofManchester, 2008

19**.** Nuclear and ParticlePhysics**,** Jenny Thomas **-**University College London **,**2000

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 401.1	3	1	-	-	-	-	-	-	-	-	-	1
PH 401.2	3	1	-	-	-	-	-	-	-	-	-	1
PH 401.3	3	2	-	-	-	-	-	-	-	-	-	1
PH 401.4	2	3										-
PH 401.5	2	3										1
PH 401	2.6	2	-	-	-	-	-	-	-	-	-	1

Sensors and Transducers
Paper Code: EI 401
Contact (periods/week): L-T-P: 3L -1T-0P
Credit point: 4
Total number of lectures: 40
Course Objective:

1. To deals with various types of Sensors & Transducers and their working principle.
2. To deal with Resistive, Capacitive and Inductive transducers.
3. To deals with some of the miscellaneous transducers.
4. To know the overview of different advance sensors.

Course Outcome:

EI 401.1: Students should be able to illustrate the fundamental principles of various types of sensors.

EI 401.2: Students should be able to compare the different types of transducers available.

EI 401.3: Students should be familiar with criteria to recommend appropriate sensors to perform engineering tasks and scientific researches.

EI 401.4: Students will be able to understand the design of different Sensors.

Module I:

Introduction to Measurement system, Block diagram,Static Characteristics, Dynamic characteristics, Basic Function, Error estimation, Sensitivity calculation, Resistive Transducer- Resistive potentiometer, Introduction to Strain gauge, Derivation of Gauge factor, Temperature compensation (2-wire,3-wire arrangement), Temperature compensation (use of dummy Gauge), Classification of strain gauge, Application of strain gauge 10L

Module II:

Capacitive Transducers, Sensitivity calculation, Applications, Piezoelectric Transducers, Piezo materials and devices, Peizo electric applications, Basic Principle of Inductive sensor, Mutual Inductance, LVDT, LVDT and its Applications; linear part of LVDT 8L

Module III:

Tachometers, Application of Tachometer and stroboscope, Seismic Accelometer, Proximity sensor, Operation of pneumatic load cell, Elastic Devices, Hall sensors, Radio Active sensors: Geiger counter, Scintillation detector 8L

Module IV:

IC temperature Sensor, Electrochemical Gas sensors, Fibre optic sensors, Thick film technology, MEMS sensors, Nano sensors, Sensors for intelligent systems, Introduction to Smart sensors, Sensor network ,Wireless Sensor networks 8L

TEXT BOOKS-

1. Patranabis. D, “Sensors and Transducers”, Prentice Hall of India, 1999.

2. John Brignell,"Intelligent Sensor Systems", CRC Press; 2nd Revised edition edition,1996

REFERENCES-

1. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000.
2. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
3. Murthy.D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2001.
4. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, DhanpatRai& Company Private Limited, 2007.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EI 401.1	2	3	1	2	-	-	-	-	-	-	-	-	2	2
EI 401.2	1	1	-	3	2	2	1	-	-	-	-	-	2	-
EI 401.3	1	2	3	1	2	2	-	-	-	-	-	-	-	3
EI 401.4	2	2	2	1	3	-	-	-	-	-	-	2	2	1

Microprocessors and Microcontrollers
Paper Code: EI 402
Contact (periods/week): L-T-P: 3L -0T-0P
Credit point: 3
Total number of lectures: 34

Course Objective:

1. To understand the architectures of 8085 & 8086 microprocessors and 8051 microcontroller.
2. To familiarize with the assembly level programming technique.
3. To understand interfacing of 8 bit microprocessor /microcontroller with memory and peripheral chips involving in system design.
4. To be able to design a microprocessor /microcontroller based system.

Course Outcome:

On completion of this course, students will be capable of

EI 402.1: Understanding the history and need of 8085/8086 microprocessors and 8051 microcontroller with their internal architecture and various addressing modes.

EI 402.2: Analyzing various instructions and programs.

EI 402.3: Applying the knowledge for communicating various real time applications through interfacing techniques

EI 402.4: Designing various systems based on microprocessors and microcontroller.

Module I:

Introduction to microprocessors:

Introduction to microprocessors, Evolution of microprocessors, The 8085 Internal architecture, Pin Diagram Instruction set and Assembly Language Programming. Addressing Modes.

7L

Module II

Microprocessor Related Operations:

The 8085 microprocessor: Timing diagrams, Stack and subroutine related operation, Counter and Time delay generation, Interrupt systems, DMA operation, Introduction to Serial Communication

7L

Module III

Peripherals interfacing techniques with 8085:

Interfacing memory, Interfacing I/O devices. Programmable peripheral devices (PPI) – Intel 8255, Programmable interval timer – Intel 8254, A/D and D/A converters **6L**

Module IV

Intel 8086/8088 Microprocessor:

Architecture, Register organization, Clock Generator, Resetting the microprocessor, Wait State Inserting, Bus Buffering, Pin details, Assembly Language Programming and Addressing Modes, Interrupts

6L

Module V

Introduction to single chip microcontrollers:

Intel MCS-51 family features, 8051/8031 architecture, pin configuration, I/O ports and Memory organization. Instruction set and basic assembly language programming. Timer/Counter and Serial Communication, Interrupts.

Assembly language programming using 8051:

Moving data, external data moves, code memory read only data moves, PUSH, POP, data exchanges

Logical instructions, Byte level, bit level instructions, ROTATE, SWAP instructions, Arithmetic instructions, Flags, incrementing, decrementing, addition, subtraction, multiplication, division, decimal arithmetic

Jump and Call instructions, Jump and Call ranges, subroutines and return instructions

MCS-51 applications: Square wave and pulse wave generation **6L**

Module VI

Introduction to PIC micro-controller:

Architecture, pin details, memory layout **2L**

TEXT BOOKS-

1. Douglas V. Hall – Microprocessors & Interfacing, Tata McGraw-Hill

2. Ramesh S. Gaonkar , Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989.

3. Ray & Bhurchandi – Advanced Microprocessors & Peripherals, Tata McGraw-Hill

4. Kenneth J. Ayala – The 8051 Microcontroller, Architecture, Programming and Applications, West Publishing Company

REFERENCES-

1. B.Ram , Fundamental of Microprocessor and Microcontrollers, Dhanpat Rai Publications.

2. Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley interscience publications, 1980.

3. Walter A. Tribel – The 8088 and 8086 Microprocessors, Pearson Education

4. Barry B. Brey – The Intel Microprocessors, PHI/Pearson Ed. Asia

5. Muhammed Ali Mazidi and Janice Gillispie Mazidi – The 8051 Microcontroller and Embedded Systems, Pearson Education Inc.

6. Ajay V Deshmukh – Microcontrollers Theory and Applications, Tata McGraw-Hill

7. Myke Predko, Programming and Customizing the PIC Microcontroller (Tab Electronics).

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
EI 402.1	3	2	2	2	2	2	1	1	1	1	1	3	1	1
EI 402.2	3	3	2	3	2	2	1	1	1	1	1	3	1	1
EI 402.3	3	2	3	2	2	2	1	1	1	1	1	3	1	1
EI 402.4	3	2	3	3	2	2	1	1	1	1	1	3	1	1

Electromagnetic Theory and Transmission Line
Paper Code: EI-403
Contact (periods/week): L-T-P: 3-0-0
Credit point: 3
Total number of lectures: 35

Course Objectives:

1. To acquire the knowledge of Electromagnetic field theory that make the student to get a theoretical foundation to be able in the future to design emission , propagation and reception of electromagnetic wave systems
2. To identify , formulate and solve the problems related to fields and electromagnetic waves propagation in a multidimensional frame
3. Understand the basic concepts of electric and magnetic fields
4. To provide the students with a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies
5. Understand the concept of conductors, dielectrics, inductance and Capacitance, Gain knowledge on the nature of magnetic materials. Understand the concept of static and time varying fields.

Course Outcomes:

EI403.1: Student will be able to understand and interpret the physical meanings of gradient, divergence and curl, vector calculus and orthogonal coordinates.

EI403.2: Student will be able to understand steady fields and different associated laws, its applications and physical significances of Maxwell's equations for static field.

EI403.3: Student will be able to understand the time varying fields and correlate the Poynting vector and Poynting theorem.

EI403.4: Student will be able to understand the thorough treatment of the theory of electro dynamics, mainly from a classical field theoretical point of view, and includes such things as electrostatics and magnetostatics, boundary conditions.

EI403.5: Student will be able to understand the wave equations, application of E.M. theory in transmission line, wave guide concept.

EI403.6: Student will be able to understand electromagnetic theory and explains universal concepts in three-dimension real world, i.e.,electro-magnetic wave propagation in free-space, dielectrics,conductors.

Module I

Introduction to the Electromagnetic Theory,Vector calculus – orthogonal Coordinate Systems, Curvilinear co-ordinate system (basics). Transformations of coordinate systems; Del operator; Gradient, Divergence, Curl – their physical interpretations; Divergence Theorem, Stoke's Theorem, Laplacian operator

6L

Module II

Coulomb's law, electric field intensity, charge distribution.; Gauss' law, flux density and electric field intensity.. Current Densities, Conductors, Poisson's & Laplace's equations, Uniqueness theorem, Biot-Savart law, Ampere's law, Relation between J & H, Vector magnetic Potential. Maxwell's equations for static field. Study of different Applications on static fields using MATLAB Programming

6L

Module III

Faraday's law & Lenz's law, Displacement Current, J C – J D Relation, Maxwell's equations for time varying field, Time harmonic fields, Maxwell's equations for time harmonic field, Wave Equation, Boundary Conditions between media interface; Uniform Plane wave; Wave Propagation in Lossy Dielectric, Loss-less Dielectric, Free space, good conductor, skin effect and skin depth. Poynting Theorem, Power flow, Poynting vector. Wave polarizations **9L**

Module IV

Transmission Lines: Concept of Lump parameters and Distributed parameters, Line Parameters, Transmission line equations and solutions, Physical significance of the solutions. Propagation constant, Characteristic Impedance; Wavelength; Velocity of Propagation, group velocity , phase velocity; Distortion-less Line, Reflection and Transmission coefficients; Standing Waves, VSWR, Input Impedance, Smith chart, Load Matching Techniques. **9L**

Module V

Transmission line at microwave frequency; brief of rectangular waveguide, circular waveguide, resonators, concept of cavity, Basics of Antenna

5L

Text Books:

1. Mathew N.O.Sadiku , Principles of Electromagnetics, 4th Edition

2. W.H. Hayt & J.A. Buck, Engineering Electromagnetics, 7th Edition, Tata- McGraw-Hill

3. Edminister , Theory anmd Problems of Electromagnetics , 2nd Edition, Tata-McGraw- Hill

References:

1. S.P.Seth, Elements of Electromagnetic Fields

2. Syed Hasan Saeed And Faiza narif Khan , Electromagnetic Field Theory

3. , G.S.N. Raju , Electromagnetics Field Theory & Transmission Lines, Pearson

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
EI 403.1	3	3	1	2	1	1	1	1	1	1	1	2	1	1
EI 403.2	3	3	1	3	1	1	1	1	1	1	1	2	1	1
EI 403.3	3	3	1	3	1	1	1	1	1	1	1	2	1	1
EI 403.4	3	3	1	3	1	1	1	1	1	2	1	3	1	1

EI 403.5	3	3	2	3	2	1	1	1	1	2	1	1	3	2
EI 403.6	3	3	2	3	2	2	1	1	1	1	1	1	1	1

Name of the Paper: Signals And Systems
Paper Code: EI-404
Contact (periods/week): L-T-P: 3-0-0
Credit point: 3
Number of lectures: 33

Pre requisite: First year courses (semester I & II)

Concepts in electrical and electronics circuits (Basic Electrical and Electronics Engg I & II).

Knowledge in algebra and calculus with problem solving capability (studied in Math-I).

Fundamental concepts on Fourier Transformation (studied in Mathematics-II)

Course Objectives:

- The scope of this paper is to introduce the fundamentals of signals & systems so that the students may understand the basic concepts of various systems and signal processing and the way the signals interact with the physical systems.
- Understanding of this subject is prerequisite to study the subjects control theory and DSP in upcoming semester.
- It is needful for development of fundamental concepts in communication engineering in general.

Course Outcome:

EI 404.1 : Student will be able to describe commonly used signals mathematically and understand he classification of signals and how to perform mathematical operations on the signal and system.

EI 404.2: Student will be able to classify systems based on their properties and determine the response of LSI system using convolution.

EI 404.3: Student will understand continuous-time and discrete-time Fourier series/transforms

EI 404.4: Student will understand the process of sampling and the effects of under sampling.

EI 404.5: Student will be able to apply Z- transform for analyze of continuous-time and discrete-time signals and systems.

Module -1 :

Introduction to signal and systems: Continuous and discrete time signals: Classification of Signals , Periodic aperiodic even , odd , energy and power signals. Deterministic and random signals , complex exponential and sinusoidal signals , periodicity , unit impulse , unit step ,Transformation of independent variable of signals: time scaling, time shifting. System properties: Linearity, Causality, time invariance and stability. Dirichlet's conditions,

8

Module -2 :

Signal Transformation: Determination of Fourier series coefficients of signal .Fourier transformation of continuous and discrete time signals and their properties. , concepts of correlation. Parseval's theorem; Convolution in time (both discrete and continuous) and frequency domains with magnitude and phase response of LTI systems.

Sampling Theorem: Representation of continuous time signals by its sample –Types of sampling, sampling theorem. 13

Module -3 :

Z-Transforms: Basic principles of z-transform - z-transform definition –, Relationship between z-transform and Fourier transform, region of convergence – properties of ROC – Properties of z-transform – Poles and Zeros – inverse z-transform using Contour integration - Residue Theorem, Power Series expansion and Partial fraction expansion

12

Text Books:

1. J.G.Proakis&D.G.Manolakis- Digital Signal Processing Principles, Algorithms and Applications, PHI.

2.A.V.Oppenheim, A.S.Willsky and S.H.Nawab -Signals & Systems, Pearson

3. S.Haykin&B.V.Veen, Signals and Systems- John Wiley

4. A.NagoorKani- Signals and Systems- McGraw Hill

References:

1. C-T Chen- Signals and Systems- Oxford

2. E WKamen&BS Heck- Fundamentals of Signals and Systems Using the Web and Matlab- Pearson

3. B.P.Lathi- Signal Processing & Linear Systems- Oxford

4. P.RameshBabu&R.Anandanatarajan- Signals and Systems 4/e- Scitech

5. S Ghosh- Signals and Systems- Pearson

6. Ashok Ambardar, -Analog and Digital Signal Processing- Thomson.

CO-PO Mapping:

COs for Course C3	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
EI404.1	3	2	3	2	-	-	-	-	-	-	-	1	2
EI404.2	3	2	3	2	-	-	-	-	-	-	-	1	2
EI404.3	3	1	3	2	-	-	-	-	-	-	-	1	3
EI404.4	3	1	2	2	-	-	-	-	-	-	-	1	3
EI404.5	3	1	2	3	-	-	-	-	-	-	-	1	3

Paper Name: Physics –II Lab

Paper Code: PH 491

Total Contact Hours: 33

Credit: 2

Pre requisites: Knowledge of Physics up B. Tech. 1st year Physics-I course

Course Objective:

The Physics-II course will provide

- exposure to the physics of materials that are applied in electrical engineering
- an insight into the science & technology of next generation and related technicalities through quantum mechanics
- advanced materials for electrical engineering
- concept of fundamental particles and associated applications in semiconductors

Course Outcome of Physics-II Course (Theoretical: PH 491)

At the end of the course students' would be able to

PH 491.1**: demonstrate**

- ✓ Dipolar magnetic behavior
- ✓ Action of capacitors
- ✓ Fermi levels and band gap in a semiconductor
- ✓ Function of Light emitting diode
- ✓ Magnetic and semiconductor storage devices
- ✓ Motion of electron under cross fields

PH 491.2**: conduct experiments using**

- ➢ Insulators, Semiconductors (extrinsic and intrinsic), Light emitting diodes
- ➢ Cathode ray oscilloscope
- ➢ Various types of magnetic materials

PH 491.3**: Function effectively as an individual, and as a member or leader in laboratory sessions**

PH 491.4**: communicate effectively**, **write reports and make effective presentation using available technology**

- ➢ on presentation of laboratory experiment reports
- ➢ on presentation of innovative experiments

Course contents:*At least 7 experiments to be performed during the semester

Experiments on Module 1: Electric and Magnetic properties of materials (8L)
1. Study of dipolar magnetic field behavior.
2. Study of hysteresis curve of a ferromagnetic material using CRO.
3. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.
4. Measurement of Curie temperature of the given sample.
5. Determination of dielectric constant of given sample (frequency dependent)/Measurement of losses in a dielectric using LCR circuits.

Experiments onModule 2: Quantum Mechanics-II (6L)

6. Determination of Stefan's radiation constant.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.

8. Measurement of specific charge of electron using CRT.

Experiments onModule 4:Solid state physics (9L)

9. Determination of band gap of a semiconductor.
10. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor
In addition to regular 7 experiments it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:
1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
2. Determination of thermal conductivity of a good conductor by Searle's mothod.
3. Study of I-V characteristics of a LED.
4. Study of I-V characteristics of a LDR
5. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH 491.1	3	2	-	-	-	-	-	-	-	-	-	1
PH 491.2	1	2	-	3	-	-	-	-	-	-	-	1
PH 491.3	1	2	-	-	-	-	-	-	3	-	-	1
PH (491.4	1	2	-	-	-	-	-	-	-	3	-	1
PH 491	1.5	2	-	3	-	-	-	-	3	3	-	1

Sensors and Transducers Lab
Code: EI 491
Contacts: 3P
Credits: 2

Course Objective:

1. To identify suitable instruments to meet the requirements of industrial applications
2. To learn about Resistive, Capacitive and Inductive transducers
3. It knows practically about the transducer used for the measurement of speed and pressure.
4. It deals with characteristics of transducers.

Course Outcome:

EI 491.1: To enable the students practically to know about transducers and about the types of transducers and various transducers used for the measurement of various physical quantities.

EI 491.2: Students should be able to analyse the measurement resultsby using each of the transducers.

EI 491.3: Students should possess a reasonable level of competence in the design, construction, and execution of a sensor based project.

EI 491.4: Students should be able to design a mini project as per their understanding and competence.

LIST OF EXPERIMENTS-

1. Displacement measurement by using a capacitive transducer.
2. Pressure and displacement measurement by using LVDT.
3. Study of a load cell with tensile and compressive load.
4. Torque measurement Strain gauge transducer.
5. Speed measurement using magnetic proximity sensor.
6. Speed measurement using a Stroboscope.
7. Study of the characteristics of a LDR.
8. Pressure measurement using Piezo-electric transducer
9. Study of the Characteristics of Hall-effect transducer
10. Extramural experiment

REFERENCES-

1. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 1999.
2. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000.
3. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
4. Murthy.D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2001.

Microprocessor and Microcontrollers Lab
Code :EI 492
Contacts : 3P
Credits : 2

Course Objective:

1. To enable the students analyze microprocessors and microcontrollers.

2. To grow programming concept using microprocessor.

3. To make students able to write programs, interface with peripherals and implement them in projects.

4. To be able to choice suitable microprocessors and microcontrollers for any design and implementations.

5. To be able to interfacing microprocessors and microcontrollers with peripherals device.

Course Outcome:

EI 492.1: Design microcontroller based innovative projects.

EI 492.2: To write any complex programs.

EI 492.3: To develop awareness for advantages and disadvantages using different series of microprocessors and microcontrollers.

LIST OF EXPERIMENTS-

1. Familiarization with 8085 and 8051 trainer kit components.
2. Program development using basic instruction set (data transfer, Load/ Sore, Arithmetic, Logical) using 8085 trainer kit such as

   a) Addition and subtraction

   b) Copying and shifting a block of memory

   c) Packing and unpacking of BCD numbers

   d) Addition of BCD numbers

   e) Binary to ASCII conversions

   f) String matching

   g) Multiplication of two numbers

   h) Sorting of array of numbers

3. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit, write subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc.
4. Study of 8051 Micro controller kit and writing programs as mentioned in section 2.
5. Extramural experiment

REFERENCES-

1. Ramesh S. Gaonkar, Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989.

2. Kenneth J. Ayala –The 8051 Microcontroller, Architecture, Programming and Applications, West Publishing Company

Electronic Measurement &Instrumentation Lab
Code : EI 493

Contacts : 3P
Credits : 2

Course objective:

1. To understand how different types of bridge circuits are to be operated

2. To understand about different types of static and dynamic characteristics.

3. To understand the operation of VCO and PLL

4. To understand the operation of Digital Storage Oscilloscope

5. To familiarize the calibration procedure of different electrical meters

Course outcome:

On completion of this Subject/Course the student shall be able to:

EI 493.1: Calibrate different electrical meters.

EI 493.2: Use Digital Storage Oscilloscope for measuring and storing different waveforms.

EI 493.3: Measure different static and dynamic characteristics of any measuring instrument.

List of Experiments:

1. Measure the resistivity of material using Kelvin Double Bridge
2. Measurement of Capacitance by De Sauty Bridge
3. Calibrate dynamometer type Wattmeter by potentiometer
4. Calibrate A.C. energy meter.
5. Measurement of Power using Instrument transformer
6. Study of Static Characteristics of a Measuring Instrument
7. Study of Dynamic Characteristics of a Measuring Instrument
8. Realization of a V-to-I & I-to-V converter.
9. Statistical analysis of errors in measurement.
10. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).
11. Familiarization with Digital Storage Oscilloscope.
12. Extramural experiment

Technical Report Writing & Language Practice
Code: HU481
Contact Hours/Week (P): 2
Credits: 1

Pre-requisite: A basic knowledge of listening and speaking skills and the ability to infer meaning from audio-video/online lessons.

Course Objective: By the end of the course the student should be able to

1. Understand and make use of a wide taxonomy of listening skills & sub-skills for comprehending & interpreting data in English
2. Speak in English, using appropriate vocabulary and pronunciation in contextualized situations
3. Understand and put into effective practice the pragmatics of Group Discussion
4. Understand and write a detailed technical report as per organizational needs
5. Understand and interact in professional presentations and interviews

Course outcome:

HU481.1: To maximize exposure and train students in the professional use of English in the globalized workplace.

HU481.2:To maximize listening and speaking skills training, including pronunciation.

HU481.3:To instill understanding of the basics of written communication and presentation in the organizational perspective.

Syllabus:

Module 1: The Need for a Language Laboratory [2L+2P]
(a)Introduction to the Language Lab
(b)Skill-building exercises in the lab

Module 2: Power Listening [2L+3P]
(a)Taxonomy of Listening Skills & Sub-skills [Aural Skimming, Scanning, Listening for Details, Note taking, Evaluative Listening, Empathetic Listening, Paralinguistic and Kinesic Inferencing]
(b)Audio-based Lessons
(c) Repairing Listening 'Gaps' through Learner Feedback

Module 3: Speaking Skills [2L+6P]
(a)The Need for Speaking: Content and Situation-based speaking
(b)Speaking Activities: [Just a Minute, Paired Role Play, Situational Speaking Exercises]
(c)The Pragmatics of Speaking—Pronunciation practice and learner feedback.

Module 4: Group Discussion [2L+6P]
(a)Teaching GD Strategies
(b)In-house video viewing sessions
(c) Group Activities [Topic Brainstorming, Situational Analysis, Frame Story]
(d)Extended Practice and feedback

Module 5: Writing a Technical Report[2L+6P]
(a)Organizational Needs for Reports and types
(b)Report Formats
(c)Report Writing Practice Sessions and Workshops

Module 6: SWOT Analysis [2L+3P]

(a)SWOT Parameters
(b)Organizational SWOT
(c) Case Study

Module 7: Presentation [2L+6P]
(a)Teaching Presentation as a Skill
(b)Speaking Strategies and Skills
(c)Media and Means of Presentation
(d)Extended Practice and Feedback

Module 8: Personal Interview [2L+3P]
(a)Preparing for the Interview: Interview Basics, Dressing and Grooming, Q & A
(b)Mock Interview sessions and feedback

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO.1	3	-	-	3	**-**	**3**	**-**	**-**	**3**	**3**	**-**	**-**
CO.2	2	3	2	3	**-**	**3**	**-**	**-**	**2**	**3**	**-**	1
CO.3	1	3	-	3	**-**	**2**	**-**	**-**	**2**	**3**	**-**	1

3rd Year,5th Sem

A.THEORY:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	HS	HU501	Environmental Science	2	0	0	2	2
2	PC	EI 501	Industrial Instrumentation	3	0	0	3	3
3	PC	EI 502	Analog & Digital Communication Theory	3	0	0	3	3
4	PC	EI 503	Control Engineering	3	0	0	3	3

5	PE	EI 504A / EI 504B/ EI 504C	Digital Signal Processing/ Microwave Engineering/ Antenna Theory & Propagation	3	0	0	3	3
Total Theory							14	14

B.**PRACTICAL& SESSIONAL:**

Sl. no	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	PC	EI 591	Industrial Instrumentation Lab	0	0	3	3	2
2	PC	EI 592	Analog & Digital Communication Lab	0	0	3	3	2
3	PC	EI 593	Control Engineering Lab	0	0	3	3	2
4	PE	EI 594A / EI 594B / EI 594C	Digital Signal Processing Lab / Microwave Engineering Lab/ Antenna & Propagation Lab	0	0	3	3	2
Sessional :								
5	**MC**	MC581	Technical Skill development-II	2	0	0	2	0
Total practical							14	8
Total 5th Semester							28	22

ENVIRONMENTAL SCIENCE
CODE: HU 501
STREAMS: AEIE, ECE, EE
CREDITS: 2L
TOTAL CONTACT HOURS: 22

Pre-requisite: Basic knowledge of Chemistry & Mathematics

Course Objective:

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

Course Outcome:

HU501.1 : Study the mathematics and calculations of population growth, material balance and sustainable development.
HU501.2 : Study the components and diversity of eco system.
HU501.3 : Study the fundamental knowledge of air pollution, calculations of earth's surface temperature, atmospheric window and lapse rate.
HU501.4 : Acquire fundamental knowledge of water pollution and its consequences knowledge and calculations regarding BOD, COD.
HU501.5 : Understand the basic concepts regarding noise and musical sound, decibel unit and its relation with sound intensity, reasons and consequences of noise pollution.
HU501.6 :Understand the concepts of land pollution and its remedies.

1.General 6L

1.1 Natural Resources: Forest Resource, water resource, mineral resource, energy resources (renewable, non-renewable, potentially renewable)
1.2 Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield
1.3 Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)
1.4 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
1.5 Environmental Management: Environmental impact assessment, Environmental laws and protection act of India, Different international environmental agreement.

2. Air pollution and control 6L

2.1 Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant
2.2 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),
2.3 Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion
2.4 Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion

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

3. Water Pollution **6L**

3.1 Classification of water (Ground & surface water)
3.2 Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.
3.3 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].
3.4 Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)
3.7 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**

4.1 Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste
4.2 Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).

5. Noise Pollution **2L**
5.1 Definition of noise, effect of noise pollution on human health,
5.2 Average Noise level of some common noise sources
5.3 Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18 hr Index) .
5.4 Noise pollution control.

References/Books

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

INDUSTRIAL INSTRUMENTATION
CODE: EI501
CONTACT: 3P
CREDITS: 3
TOTAL CONTACT HOURS: 35

Prerequisite: Knowledge of Sensor & Transducer

Course Objective:

1. To understand the importance of different industrial instruments.
2. To understand the working principle of different measuring instruments.
3. To measure different physical parameters like pressure, temperature, flow rate, level etc
4. To install the different instruments.

Course Outcome:

EI501.1: Able to explain working principle of different measuring instruments

EI501.2: Able to Describe the specification of different instruments and advantages and disadvantages.

EI501.3: Able to Measure different physical parameters like pressure, temperature, flow rate, level etc

EI501.4: Able to install the instrument

Module I : Measurement of Pressure and Vacuum : [5L]

Manometers – U tube, Inclined Tube and Well type Manometers, Characteristics of Elastic Pressure Sensor, Bourdon Tube Pressure Gauge, Diaphragm, Bellows, Capsule Gauge, Differential Pressure Gauge, Pressure Switch, DP transmitters, McLeod Gauge, thermal conductivity gauge, ionization gauge.

Module II : Flow rate Measurement: [11L]

Types of Flow, Reynolds's number, Bernoulli's Equation, Calibration of flow meters,
Head type flow measurement – analysis and calculation - orifice, venturi, pitot tube, flow nozzle,
Variable Area Flowmeters – Glass and metal tube rotameters,
Mass flow meters : Coriolis, Thermal, Impeller type,
Electromagnetic type, Ultrasonic type, Positive displacement type

Module III : Level Measurement: [5L]

Gauge glass, Bi-Colour, Magnetic and Reflex Level Gauge, Float and displacers type instruments, Hydrostatic type level measurement, Capacitive type level instrument, Ultrasonic and Microwave type level instruments

Module IV : Temperature Measurement: [9L]

Temperature scale, Thermometers: Liquid, vapour and gas filled: construction details and comparison, Bimetal elements, Thermostats,
RTD: review of materials, construction, types; measuring circuits, ranges, errors and minimization of errors,
Thermocouples: types, thermoelectric power, circuits, ranges, errors, cold junction compensation, compensating cables, Linearization techniques of thermocouples, Thermopile, thermowell. Thermistors,

Radiation Thermometer sensors: spectral and other characteristics, Pyrometers.

Module V: **[5L]**

Installation of pressure measuring instruments and Temperature elements

Pneumatic Instrumentation : Flapper nozzle system - pneumatic force balance and motion balance system , Pneumatic Transmitter.

Hazardous Area Instrumentation: Basic Concept

Text Books:

1. D. Patranabis, 'Principles of industrial Instrumentation', TMH, New Delhi, 2nd Ed
2. S.K.Singh:'Industrial instrumentation And Control' TMH, New Delhi, Third edition,
3. Arun Kumar Ghosh: 'Introduction to Measurement & Instrumentation', PHI, New Delhi, 4th edition.
4. K.Krishnaswamy, S.Vijayachitra: 'Industrial Instrumentation',New age International Publishers, 2nd edition.
5. B. G. Liptak: 'Instrument Engineers Handbook', vol-I and vol-II, Chilton Book Co. Philadelphia
6. Ernest O. Doeblin, 'Measurement Systems – Application and Design', Tata-McGraw Hill
7. 7.S.K.Sen, 'Measurement Techniques in Industrial Instrumentation',New Age International.
8. **CO-PO matrices of courses HU501**

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EI501.1	3	2	3	**-**	**-**	**-**	3	**-**	**-**	**-**	1	2
EI501.2	**-**	**-**	1	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-
EI501.3	2	-	2	**-**	1	**-**	**2**	**-**	**-**	**-**	**-**	-
EI501.4	-	-	2	**-**	-	**2**	**2**	**-**	**-**	**-**	**-**	-

ANALOG & DIGITAL COMMUNICATION THEORY
CODE: EI502
CONTACT: 3L
CREDITS: 3
TOTAL CONTACT HOURS: 34

Prerequisite: Signals and Systems, Analog and digital electronic circuits

Course Objectives:

1. To understand the building blocks of communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a communication system.
4. To analyze error performance of a communication system in presence of noise and other interferences.
5. To understand concept of spread spectrum communication system.

Course Outcome

C502.1: Able to analyze the performance of a baseband and pass band communication system in terms of error rate and spectral efficiency.
C502.2: Able to perform the time and frequency domain analysis of the signals in a communication system.
C502.3: Able to select the blocks in a design of communication system.

C502.3: Able to analyze Performance of spread spectrum communication system.

Module I: Elements of communication system: [10L]

The basic elements of a communication system, Concept of transmitter and receiver, origin of noise and its effects in communication system, Concept and effects of SNR and its importance in system design.
Linear (AM) modulation, Generation and demodulation of AM wave. Concept of DSBSC, SSBSC and brief discussion of VSBSC. Concept of QAM.
Basic principle of nonlinear (FM, PM) modulation and their relations. Generation and demodulation of FM waves.

Module II: Sampling and Pulse Modulation techniques: [8L]

Sampling theorem, sampling rate, impulse sampling, natural & flat topped sampling, reconstruction of signal from samples, Concept of Aliasing and anti-aliasing filter.
Quantization noise, Uniform quantization, Non-uniform quantization, A-law and μ-law.
A/D and D/A conversion techniques, Concept of Bit rate, Baud rate, M-ary encoding.
Analog pulse modulation-PAM, PWM, PPM.
Fundamentals of PCM, Block diagram of PCM, basic concept of Delta modulation, Adaptive delta modulation.
Introduction to DPCM.
Different types of multiplexing: TDM, FDM.

Module III: Digital Transmission: : [8L]

Basic concept of Digital communication, comparative study of digital communication and analog communication.
Encoding, coding efficiency. Line coding & its desirable properties, Different types of line coding: NRZ & RZ, AMI, Manchester coding and their spectra.
Base band pulse transmission, optimum filter, Matched filter and correlation filter, Inter Symbol Interference (ISI), Eye pattern, Signal power in binary digital signal.

Module IV: Digital carrier modulation & demodulation technique: [4L]
Introduction to the digital modulation techniques- ASK. FSK, PSK, BPSK, QPSK, M-ary PSK and their comparisons.
Basic concept of spread spectrum modulation and CDMA.

Module V: Introduction to coding theory: [4L]
Introduction, Measurement of Information and its unit, Entropy, Mutual information, Information rate, Basic principle of error control & error correction coding.

Text Books:
1. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford University press
2. An Introduction to Analog and Digital communication, Simon Haykin, Wiley India.
3. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
4. Principle of digital communication, P. Chakrabarti, Dhanpat Rai & Co.
Reference Books:
1. Digital and Analog communication Systems, Leon W Couch II, Pearson, Education Asia.
2. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, S. K. Kataria & Sons
3. Principles of Communication Systems, Taub and Schilling, Tata McGraw-Hill Education

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
EI502.1	-	-	2	-	-	-	-	-	-	-	-	-	3	3
EI502.2	1	-	1	3	-	-	-	-	-	-	-	-	3	2
EI502.3	-	2	-	-	-	-	-	-	-	-	-	-	2	3
EI502.4	1	-	-	3	-	-	-	-	-	-	-	-	3	3

CONTROL ENGINEERING
CODE: EI 503
CREDITS: 3
TOTAL CONTACT HOURS: 30
Prerequisite:

1. Knowledge of Signals & Systems
2. Basic Elements & Laws of circuits and Networks
3. Laplace Transformation and its application in different networks

Course Objective:

1. To construct the model of a physical dynamical system by a linear time invariant ordinary differential equation.
2. To analyze the under-damped, over-damped and critically damped cases of a second order system in time domain.
3. To illustrate the effects of poles and zeros location in the s-plane on the transient and steady state behavior of a system.
4. To determine the system stability in frequency domain.
5. To explain the effects of Lead, Lag and Lag-Lead compensator on second order system.

Course Outcome:

The students will be:

EI503.1. Able to apply Laplace transform and state space techniques to model dynamic systems.
EI503.2. Able to understand of the fundamentals of control systems.
EI503.3. Able to determine the time domain responses of first and second-order systems.
EI503.4. Able to analyze the system behavior in frequency domain.
EI503.5. Able to manipulate the system stability using compensator.

Module I: **[11L]**

Introduction to Elementary control concepts:-Brief introduction, Applications area. Open loop and close loop system and their comparison. Mathematical Model of Physical Systems:- Introduction, Differential equation representation of physical systems, Transfer function concepts, Block diagram algebra, Signal flow graphs :- Mason's gain formula. Time Response Analysis: - Introduction, Review of standard test signals-Step , Ramp , Impulse , sinusoid .Time response of first order system, Design specifications of first order systems, Time response of second order systems, Design specifications of second order systems.

Module II: **[8L]**

Stability Analysis in Time Domain: The concept of stability, Assessment of stability from pole positions, Necessary conditions for stability, Routh Stability Criterion, Relative stability analysis, Illustrative examples. Root Locus Technique: Introduction, The root locus concept, Root locus construction rules, Root contours, Advantages & limitations, Relative stability analysis using root locus.

Module III: **[11L]**

Frequency Response Analysis: Introduction, Performance Indices ,Frequency response of second order systems, Polar plots, Bode plots, All pass systems, Minimum-phase and Non-minimum-phase systems,

Assessment of relative stability – Gain Margin and Phase Margin, examples. Stability Analysis in Frequency Domain: Introduction, A brief review of Principle of Argument, Nyquist stability criterion, Illustrative examples. Introduction to Design: The design problem, Concepts of cascade and feedback compensation, Realization of basic compensators- Lead, Lag, Lag-Lead compensator. State variables: Concepts of state, state variables and state model, State models of linear continuous-time systems, Concept on Controllability and Observability.

Text Books :

1. Modern Control. Engineering. Fifth Edition. Katsuhiko Ogata
2. CONTROL SYSTEMS: ENGINEERING, 5th Edition [I. J. Nagrath, M. Gopal]
3. Automatic Control Systems [Farid Golnaraghi, Benjamin C. Kuo]
4. Nagoor Kani. Edition, 2. Publisher, RBA Publications
5. Automatic Control Engineering, 5th Edition by Raven, Francis H at Biblio
6. Control Engineering: Theory and Practice [M. N. Bandyopadhyay]

Reference Books :

1. Book. Modern Control Engineering. Marcel Dekker, Inc. New York, NY, USA ©2001
2. Classical Feedback Control by B. Lurie and P. Enright

CO and PO Mapping:

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO 1	PSO 2
EI503.1	**3**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
EI503.2	**1**	**2**	-	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
EI503.3	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
EI503.4	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
EI503.5	**3**	**-**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**PSO 1**	**PSO 2**

EI 504A : DIGITAL SIGNAL PROCESSING
CONTACT: 3L

CREDITS: 3
TOTAL CONTACT HOURS: 34

Prerequisite: Analog Electronics circuit, Signals & Systems, Analog Filters

Course Objective:

1. To develop the knowledge on signals used in digital signal processing.
2. To impart the knowledge of the principles of discrete-time signal analysis to perform various signal operations
3. Apply the principles of Fourier transform analysis to describe the frequency characteristics of discrete-time signals and systems
4. To study various sampling techniques and different types of filters
5. To learn the use of computer programming tools to create, analyze process and visualize signals and to plot and interpret magnitude and phase of LTI system frequency responses
6. To understand the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.

Course Outcome:

The students will be able to:

EI 504A.1: Apply the knowledge about continuous and discrete time signals

EI 504A.2: Understand the Fourier Transform, and examine the process of Quantization and the effects of finite register length

EI 504A.3: Understand and implement DFTs on long data sets such as speech signals and images.

EI 504A.4: Develop different types of FIR & IIR filter structures and their implementations

EI 504A.5: Use of FFTs for efficient implementation of linear convolution

EI 504A.6: Excel in fields such as speech processing, audio signal processing, digital image processing, video and audio compression.

Module I:

LTI systems: [6L]

Concept of signals & systems, digital signal processing and its relevance to digital communication.

Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non recursive systems.

Module II:

Discrete Time Fourier Transform(DTFT): [2L]

Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain.

Discrete Fourier Transform: [8L]

Concept and relations for DFT/IDFT; Relation between DTFT & DFT; Twiddle factors and their properties; DFT/DFT as linear transformation and matrices ; Computation of DFT/IDFT by matrix method; Properties of DFT – periodicity, linearity, time reversal,circular time & frequency shift, symmetry, circular symmetry,duality, multiplication of two DFTs,circulation convolution, circular correlation ; Computation of circular convolution by graphical; Linear filtering using DFT, aliasing error, filtering of long data sequences- Overlap-Save and Overlap-Add methods.

Fast Fourier Transforms: [4L]

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.

Module III:

Filter design: [6L]

Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transform. Concept of Chebyshev filters and comparison with Butterworth filter. Design of linear phase FIR filters -no. of taps, rectangular, Hamming and Blackman windows. Effect of quantization. Some examples on practical filters.

Multirate Digital Signal Processing: [2L]

Introduction to multirate digital signal processing, Sampling rate conversion, multistage interpolator & decimator, digital filter banks.

Module IV:

Digital Signal Processor: [6L]

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs.

Text Books :

1. Digital Signal Processing–Principles,Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. Digital Signal processing – A.V. Oppenheim,R.W.Schafer, Prentice Hall
5. Discrete-time Signal processing – A.V. Oppenheim,R.W.Schafer, John R. Buck, Prentice Hall

Reference Books :

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing; A Hands on Approach, C. Schuler & M.Chugani, TMH Publishing Co.
4. Digital Signal Processing,A. Nagoor Kani, TMH Education
5. Digital Signal Processing S. Poornachandra & B. Sasikala, MH Education
6. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
7. Texas Instruments DSP Processor user manuals and application notes.
8. Digital Signal Processing: A MATLAB-Based Approach, V.K.Ingle and J.G.Proakis, Cengage Learning
9. Modern Digital Signal Processing,V. Udayashankara, PHI Learning

CO Mapping with POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EI 504A.1	3	3	1	1	1	1	1	1	1	1	1	1	1	3
EI 504A.2	3	3	1	2	1	1	1	1	1	1	1	1	1	3
EI 504A.3	3	3	1	3	3	3	1	1	1	1	1	1	2	3
EI 504A.4	3	3	3	3	1	2	1	1	1	1	1	1	3	3
EI 504A.5	3	3	3	3	3	1	1	1	1	1	1	1	3	3
EI 504A.6	3	3	3	3	3	3	3	3	3	3	3	3	3	3

EI 504B: RF & MICROWAVE ENGINEERING
CONTACT: 3P
CREDITS: 3
TOTAL CONTACT HOURS: 34

Prerequisite: Analog Electronics circuit, Electrical and Electronic measurement systems, Transmission Line, Planar Transmission Line, Study of passive filter.

Course Objective:

1. To distinguish the RF & Microwave spectrum, Planar transmission lines and High frequency circuit elements.
2. To determine the Microwave passive components and Scattering matrix representation.
3. To illustrate the Microwave tubes, Semiconductor Microwave Devices.
4. To justify the microwave sensor and typical microwave test bench.

Course Outcome

EI504B.1: Able to understand and analyze Planar transmission lines and High frequency circuit elements.

EI504B.2: Able to illustrate the construction and working principle of Microwave tubes, Semiconductor Microwave Devices and their typical characteristics and applications.

EI504B.3: Able to understand the application of microwaves as a Duplexer, Radar etc.

EI504B.4: Able to demonstrate the measuring techniques of microwave devices such as Detector, Power meter and sensors, Slotted line, Spectrum analyzer, Mixer, Network analyzer.

Module I: Two Port RF Networks and Matching Techniques: [6L]
Introduction to RF & Microwave signal, Spectrum bandwidth and its necessity in communication system, Formulation of S- parameters, properties of S- matrix , S- matrices of series and shunt elements; Simulation of lumped elements; Impedance matching network design using lumped elements and quarter wave transformer microstrip line.

Module II: Microwave Passive Devices: [8L]
Microwave passive components and their S matrix representation: Waveguide attenuators, phase shifters, directional couplers, Magic tee, hybrid ring, circulators, isolators, filters design (maximally flat and equal ripple)using insertion loss method from low pass prototype design.

Module III: Microwave Active Devices [10L]
Vacuum Tubes*:* High frequency limitations; Principle of two cavity Klystron, Reflex Klystron, Traveling Wave Tube, Magnetron (only operating principles and applications).
Microwave Semiconductor Devices:

Principles of detector and varactor diodes, Construction and Operating principles of Gunn diode, IMPATT diode, PIN diode- characteristics and applications, Operating principles of microwave bipolar transistor, microwave field effect transistor (MESFET).

Module IV: Applications of Microwaves [5L]

Radar systems-range equation, duplexer, pulse and CW radar; Principle of microwave communication, path loss; Industrial applications of microwaves- heating, thickness measurements, diathermy.

Module V: Instrumentations and Measurement Techniques: [5L]

Detector, Power meter and sensors, Slotted line, Spectrum analyzer, Mixer, Network analyzer, Microwave measurements: VSWR, power- low, medium, and high; frequency and wavelength; impedance, attenuation, and Q.

Text Books :

6. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc GrawHill Inc., 3rd Edn.2015.
7. Samuel Y Liao, "Microwave Devices & Circuits" , Prentice Hall of India, 2006.
8. D.M.Pozar, "Microwave Engineering.", John Wiley & sons, Inc., 2006.

Reference Books :

7. Robert E.Colin, 2ed "Foundations for Microwave Engineering", McGraw Hill, 2001M.
8. M.Radmanesh, RF & Microwave Electronics Illustrated, Pearson Education, 2007.

CO Mapping with POs & PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EI504B.1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	2	2
EI504B.2	**1**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	2	3
EI504B.3	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	2	3
EI504B.4	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	3	2

PAPER NAME: ANTENNA THEORY & PROPAGATION
PAPER CODE : EI 504C
CONTACTS : 3L/WEEK
CREDITS :3
TOTAL CONTACT HOURS :34

Prerequisite:

Basic concept of electromagneticwave, Maxwell's equation in differential and integral form and its interpretation. Vector calculas.

Course objectives:

1. To understand the fundamentals of antenna and its characteristics.
2. To understand the difference between different types of antenna and their characteristics
3. To understand radio wave propagation phenomena in communication systems
4. To understand the fundamentals of electromagnetic radiation with application to antenna theory and design

Course Outcome:

After successful completion of this course, students should be able to:

EI 504C.1: To analyze the fundamentals of antenna theory.
EI 504C.2: Understand the different types of antennas and the radiation mechanism.
EI 504C.3: To expose students to examples of applications and various antenna types.
EI 504C.4: Identify the atmospheric and terrestrial effects on radio wave propagation

Module -I [7L]

A. Antenna Introduction: Radiation of EM waves and introducing Antenna, Antenna in communication system; Its application.[2]

B. Antenna Characteristics: Radiation Pattern, Beam Width; Isotropic ,Omnidirectional radiation, Radiation Resistance and efficiency; Directivity and Gain; Impedance, VSWR, Polarization; Effective height and Receive Aperture; Noise Temperature of Antenna. [3]

C. Link Budget; Radiation Hazards. [2]

Module-II [7L]

A. Radiation fields of a Hertzian dipole(electric);Radiation fields and Characteristics of $\lambda/2$ dipole; discussion on $\lambda/4$ monopole antenna; Current distribution and Radiation patterns of center-fed dipoles of length λ, $3\lambda/2$ and 2λ. Design of dipole antenna, Folded dipole, Yagi-uda Array [4]

B. Antenna Arrays: electric Field due to 2 element arrays, Pattern Multiplication; Uniform Linear Array: End fire and Broad side; Planar array;Phased array. [3]

Module-III [10L]

A. Characteristics , Properties: Travelling Wave Antenna, Helical Antenna, Loop Antenna, Electrically Short Antennas, Broad Band Antenna (Log periodic Antenna), Microstrip Patch Antenna (Broadband MSA). [6]

B. Radiation from an aperture: Sectoral and Pyramidal Horn Antennas, Parabolic and Corner Reflectors and feed systems. [4]

Module-IV [10L]

A. Different types of EM wave propagation:Ground wave, Ionospheric wave, Skywave Ground and their expression , Field strength dependence on physical factors. Virtual Height, Critical Frequency, MUF, Skip distance, Sporadic Reflections. Space wave propagation: Tropospheric Scatter, Ducting Super refraction, Sub refraction. [6]

B. Effects on atmospheric precipitations- Rain, Fog, Snow, Ice, and other atmospheric gases;Friss Transmission Formula, SNR of a Radio Link. Physical (Medium) effects on Radio wave Propagation: Absorption, Refraction and Radio Horizon, Diffraction, Multipath Propagation and fading, Noise, Doppler effect. [4]

Text Books

1. Antenna Theory-Analysis and Design, Third Edition, C.A.Balanis, Wiley-India, 2005
2. Antenna and Wave Propagation, First Edition, Sisir K Das and Annapurna Das, Tata-McGraw-Hill Education Pvt.
Ltd., 2013
3. Jordan E.C. & Balmain K.G. " Electromagnetic Waves and Radiating systems ", Prentice Hall of India
4. Engineering Electromagnetics, 7thEdition-W.H.Hayt & J.A.Buck, Tata-McGraw-Hill

Reference Books

1. Fields & Waves in Communication Electronics, S. Ramo, J. R. Whinnery & T. Van Duzer, John Wiley
2. Electromagnetic Waves, R K Shevgaonkar,– Tata-McGaw-Hill
3. Electromagnetics, 2ed Edition – J A Edminister, Tata-McGraw-Hill.
4. Engineering Electromagnetics, 2ed Edition - Nathan Ida, Springer India
5. Microwave Engineering, 3rd Edition, Annapurna Das and Sisir K Das, Tata-McGraw-Hill Education Pvt. Ltd., 2015
6. Elements of Electromagnetics, 4th Edition, Matthew O H Sadiku, Oxford University Press

CO-PO –PSO Mapping

Course Outcome	Programme Outcome													
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
EI504C.1	3	-	3	-	2	2	-	2	2	-	-	1	3	3
EI504C.2	-	3	-	-	3			3	2	-	1	1	3	2
EI504C.3	3	-	3	-	3	2		2	2	-	-	2	3	3

EI504C.4	-	-	3	-	3	3		2	2	-	1	1	3	2

PAPER NAME: INDUSTRIAL INSTRUMENTATION LAB
PAPER CODE : EI 591
CONTACT (PERIODS/WEEK): L-T-P: 0-0-3
CREDITS : 2

Course Objectives:

1. To understand the importance of calibration of different industrial instruments.
2. To measure different physical parameters like pressure, temperature, flow rate, level etc
3. To understand the working principle of different measuring instruments
4. To choose the suitable instrument for desired measuring parameter.

Course Outcomes:

EI 591.1: Able to calibrate different instruments.
EI 591.2: Able to measure different industrial parameter like pressure, temperature, flow,level etc.
EI 591.3: Able to understand the working principle of different instruments
EI 591.4: Able to choose the suitable instrument for desired measuring parameter.

Experiments:

1. Calibration of Pressure Gauge using Dead Weight Tester
2. Study of Thermocouple characteristics and Measurement of Temperature .
3. Study of Thermistor characteristics and Measurement of Temperature.
4. Study of RTD characteristics and Measurement of Temperature.
5. Measurement of temperature using AD590
6. Measurements of flow rate and velocity of fluid flow by head type flow meter.
7. Measurements of flow rate and velocity of fluid flow by Variable Area type flow meter
8. Measurement of level using capacitive type level instrument.
9. Measurement of moisture using moisture analyzer
10. Measurement of viscosity

ANALOG & DIGITAL COMMUNICATION LAB
CODE: EI 592
CONTACT (PERIODS/WEEK): L-T-P: 0-0-3
CREDIT: 2
Course Objective:

The course objectives are to enable the students to

1. Understand the fundamental concepts of communication systems.
2. Understand and compare different analog modulation schemes.
3. Understand and compare different digital modulation schemes.
4. Understand the design tradeoffs and performance of communications systems.
5. Learn about practical communication systems

Course Outcome:

EI592.1: To learn signal and linear time invariant system properties.

EI592.2: Study, design, and build modulation systems examining trade-offs in different communication systems.

EI592.3: To be able to perform experiments in converting analog information into digital data via sampling, quantization, and coding.

EI592.4: To be able to choose necessary modulation technique for specific signal transmission.

Experiments: -

1. Observation of modulation index in Amplitude modulation and construction of envelope for different values of modulation index.
2. Observation and generation of Double Side Band Suppressed Carrier (DSB-SC) signal.
3. Observation and generation of Single Side Band Suppressed Carrier (SSB-SC) signal.
4. Observation of Frequency Modulation & Demodulation and calculation of modulation index.
5. Generation of Time Division Multiplexing (TDM) & Demultiplexing interlacing several sampled signal using PAM.
6. To interpret Pulse Amplitude Modulation (PAM) and demodulation for various modulating voltages.

7. Generation of Pulse Width Modulation (PWM) and demodulation for various modulating voltages.
8. To analyze a FSK modulation system and interpret the modulated and demodulated waveforms.
9. Extramural experiments related to analog and digital communication.

CONTROL ENGINEERING LABORATORY
CODE: EI 593
CONTACT (PERIODS/WEEK): L-T-P: 0-0-3
CREDITS: 2
Prerequisite:
Use of MATLAB with SIMULINK for control system analysis and design**.**

Course Objective:

1. Will have a strong knowledge on MATLAB software..
2. They get the basic knowledge on practical control system and Design applications.
3. They get the knowledge of stability analysis of different control systems.

Course Outcome:
The students will be able to:

EI 593.1: Apply formulate transfer function for given control system problems.
EI 593.2: Demonstrate an understanding of the fundamentals of control systems.
EI 593.3: Determine time response of given control system model.
EI 593.4: Analyze the system behavior through Root Locus, Bode plots & Nyquist plot for a given control system model.

List of Experiments:
1. Familiarization with MATLAB & SIMULINK control system toolbox.

2. Study of impulse, step, ramp & sinusoidal response for first and second order system with unity feedback and calculation of parameters for different system designs.

4. Modelling of a first order system and its response analysis.

5. Modelling of a second order system and its response analysis.

6. Simulation of impulse response for types 0, 1 and 2 with unity feedback using MATLAB.

7. Determination of root-locus, using MATLAB toolbox for a given second order transfer function and analysis of result.

8. Bode plot, using MATLAB toolbox for a given second order transfer function and analysis of result.

9. Nyquist plot using MATLAB toolbox for a given second order transfer function and analysis of result.

10. Study of position control system (AC/DC).

PAPER NAME:DIGITAL SIGNAL PROCESSING LAB
PAPER CODE :EI 594A
CONTACT: 3L
CREDITS: 3
CONTACT (PERIODS/WEEK): L-T-P: 0-0-3

Course Objective:

1. The course aims at practical experience with the simulation and development of basic signal processing algorithms.

2. This imparts knowledge using standardized environments such as MATLAB and general-purpose DSP development kits.

3. The experiments cover fundamental concepts of digital signal processing like sampling and aliasing, internal arithmetic operations, digital filter design and implementation, signal generation.

4. It also delivers knowledge on different algorithms associated with filtering of long data sequences.

Course Outcome:
After completion of the laboratory course students will be able to:

EI594A.1: Analyze various signals in transform domain.

EI594A.2: Develop various DSP Algorithms using MATLAB functions .

EI594A.3: Enable students to analyze and design different signals using MATLAB EI594A.4: Understand and verify the properties of DFTs/IDFT .

EI594A.4: Apply knowledge to verify the different algorithms associated with of digital filter design for various applications.

Experiments:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations using MATLAB.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, Differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
8. Implementation of FFT of given sequence.
9. Implementation of LP & HP FIR filter for a given sequence.
10. Hardware Laboratory :
    Writing & execution of small programs related to arithmetic operations and convolution using Assembly Language of TMS320C 5416/6713 Processor

PAPER NAME: RF & MICROWAVE ENGINEERING LAB
PAPER CODE: EI 594B
CONTACT: 3P
CREDITS: 2
CONTACT (PERIODS/WEEK): L-T-P: 0-0-3

Course Objective:

1. To understand the function and design of the major components in a wireless transceiver: oscillator, antenna, filter, and mixer.
2. To analyze passive and active devices in microwave subsystems.
3. To provide practical analysis of transmission lines and microwave circuits, hands-on training on engineering tools.
4. To obtain engineering design experience through team-based design projects.

Course Outcome:

EI594B.1: Able to Define, identify and list out special type transmission line, its characteristics in microwave frequencies and concept of load.

EI594B.2: Able to recognize, memorize, categorize, arrange and implement suitably the various microwave passive devices with the utilization of engineering mathematics.

EI594B.3: Able to analyse and use the various sources of microwave energy and the characters of its operation.

EI594B.4: Able to use, compute, solve, demonstrate and apply various hardware, software tools and measuring instruments in the field of Radio Frequencies, for the betterment of communication engineering, medical science and various domestic and commercial engineering.

Experiments:

1. Measurement of unknown impedance using shift in minima technique using a waveguide test bench/ Measurement of the susceptance of an inductive and or a capacitive window using shift in minima technique using a waveguide test bench
2. Study of the characteristics of a Reflex Klystron oscillator
3. Study of Gunn-oscillator Characteristics using X-band waveguide test bench.
4. Measurement of coupling factor, Directivity, Insertion loss and Isolation of a Directional coupler using X-band waveguide test bench set up.
5. Scattering matrix of a magic tee / E-plane tee / H-plane tee using waveguide test bench at X-band.
6. Experimental/Simulation Study of filter (LPF, HPF,BPF) response.
7. Measuring of dielectric constant of a material using waveguide test bench at X-band.
8. Study of Spectrum analyzer.

PAPER NAME: ANTENNA THEORY & PROPAGATION LAB
PAPER CODE : EI 594C
CREDITS :3
CONTACT (PERIODS/WEEK): L-T-P: 0-0-3

Course Objective:

1. Determination of the fields radiated from antennas; wire antennas; array antennas; antenna radiation pattern; antenna directivity.
2. To learn the basic working principle of antenna
3. To understand the various methods involved in the measurement of antenna parameters

Course Outcome:

EI 594C.1: Basic knowledge of radiation pattern, smith chart, azimuth and elevation plane, broadside and endfire radiation
EI 594C.2: Able to define, analyze and draw the radiation pattern of dipole antenna, Half wave dipole antenna, folded-dipole antenna
EI 594C.3: Able to define, analyze and draw the radiation pattern of N-element Yagi-Uda antenna

EI 594C.4: Basic understanding of performance parameter- Pyramidal Horn Antenna., Log Periodic antenna, broad side antenna array, end-fire antenna array

EI 594C.5: Able to do research and development with the utilization of engineering mathematics.

Experiments:

1. Radiation Pattern of dipole antenna.
2. To study and plot the radiation pattern of Half wave dipole antenna
3. Radiation Pattern of a folded-dipole antenna.
4. Radiation pattern of a 3-element Yagi-Uda Antenna.
5. Radiation pattern of a 4-element Yagi-Uda Antenna.
6. Radiation pattern, Gain, Directivity of a Pyramidal Horn Antenna.
7. To study and plot the radiation pattern of Log Periodic antenna
8. To study and plot the radiation pattern of broad side antenna array .
9. To study and plot the radiation pattern of end fire antenna array
10. Study of Spectrum Analyzer

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PAPER NAME: DESIGN AND DEVELOPMENT OF IOT BASED INSTRUMENTATION SYSTEM
PAPER CODE:MC581
CONTACT: 2P
CREDITS: 0
TOTAL CONTACT HOURS: 20

Prerequisite:

1. Microprocessor, Microcontroller & Computer Networking

Course Objective:

1. To introduce IOT Devices.
2. To acquire the basic knowledge to design & develop IOT Devices.
3. To Understand State of the Art – IoT Architecture.
4. To Understand Hardware platforms and operating systems commonly used in IoT systems.

Course Outcome:

After the completion of the course, the students will be

MC581.1: Able to understand the building blocks of IoT technology .

MC581.2: Able to understand the application areas of IOT ·

MC581.3: Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks ·

MC581.4: Able to use processors & peripherals to design & build IoT hardware.

Module I: Introduction to IoT: [5L]

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models, Machine-to-Machine Communications

Module II: Network & Communication aspects [4L]

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery

Module III: Developing IoTs [6L]

Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino. Introduction to Python programming, Introduction to Raspberry Picture, developing sensor based application through embedded system platform, Implementation of IoT with Raspberry Pi

Module IV: Data handling & Domain specific applications of IoT [5L]

Data Handling and Analytics, Cloud Computing, Sensor cloud, Fog computing. Applications: Smart Cities and Smart Homes, Smart Grid, Industrial Io

Text Books : 1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)

2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)

CO-PO-PSO mapping:

CO Vs PO, PSO MAPPING FOR MC581															
COs for Course C3	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
MC581 : 1	The students have ability to understand the building blocks of IoT technology	2	2	2	2	2	1	1	1	1	1	1	1	2	2
MC581 : 2	The students have ability to understand the application areas of IOT	2	3	3	1	2	2	2	1	1	2	1	2	1	2
MC581 : 3	The students have ability to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.	3	3	1	3	3	2	1	1	1	2	1	2	2	2

MC581 : 4	The students have ability to use processors & peripherals to design & build IoT hardware	3	3	2	3	3	2	1	1	1	1	1	1	2	2

3rd Year ,6th Semester

A: THEORY:

Sl.	Field	Code	Subjects	Contact hours/week				Credit
				L	T	P	Total	
1	PC	EI 601	Process Control-I	3	0	0	3	3
2	PC	EI 602	Bio Medical Instrumentation	3	0	0	3	3
3	PE	EI 603A / EI 603B/ EI 603C	Power Electronics / Industrial Drives/ Advanced Sensors	3	0	0	3	3
4	PE	EI604A / EI 604B	Optoelectronics & Fibre Optic Sensors/ Soft Computing	3	0	0	3	3
5	OE	CS(EI)615A / CS(EI)615B/ CS(EI)615C	Data Structures & Algorithms / Database Management System / Software Engineering	3	0	0	3	3
Total Theory							15	15

B.PRACTICAL:

Sl.	Field	Code	Subjects	Contact hours/week				Credit
				L	T	P	Total	
1	PC	EI 691	Process Control Lab	0	0	3	3	2
2	PE	EI 693A / EI 693B/ EI 693C	Power Electronics Lab / Industrial Drives Lab/ Advanced Sensors Lab	0	0	3	3	2
3	OE	CS(EI)685A / CS(EI)685B/ CS(EI)685C	Data Structures & Algorithms Lab /Database Management System Lab / Software Engineering Lab	0	0	3	3	2
Sessional :								

4	PW	EI 681	GD & Seminar	0	0	3	3	3
5	PW	EI 682	Mini Project	0	0	3	3	3
Total practical							15	12
Total 6th semester							30	27

PROCESS CONTROL-1
CODE: EI601
CONTACT: 3L
CREDITS: 3
TOTAL CONTACT HOURS: 33

Prerequisite: Knowledge of Control Theory
Course Objective:

This course helps the student
1. To have a knowledge on basic process control loop & characteristics
2. To understand the different controller modes
3. To know about methods of tuning of controllers
4. To have a knowledge of final control element & different actuators
5. To apply the knowledge of Cascade, Ratio, Feed forward control to control a complex process
6. To provide knowledge levels needed for PLC programming and functioning.

Course Outcome:
Upon successful completion of the course students will be able to:
EI 601.1: Design a controller by applying the knowledge of different control action
EI 601.2: Calculate controller parameters by applying different tuning methods
EI 601.3: Describe different advanced control strategy
EI 601.4 State the operation and use of final control element
EI 601.5 Develop ladder logic programs and understand basics of DCS
Module I: [10]
General Review of Process, Process Control and Automation. Servo and Regulatory Control, Basic process Control loop block diagram. Characteristic parameters of a process – Process Quantity, Process Potential, Process Resistance, Process Capacitance, Process Lag, Self Regulation Characteristics and functions of

different modes of control actions : Schemes and analysis of On-Off, Multistep, Floating, Time Proportional, Proportional, Integral, Derivative, PI,PD & PID control Electronic PID controller design, Pneumatic Controllers - brief analysis

Module II:[5]

Process Reaction Curves, Controllability - using (i) deviation reduction factors (ii) gain bandwidth product, State Controllability ,Tuning of Controllers: both Closed and Open loop methods (Ziegler – Nichols, Cohen – Coon, PRC method and 3-C method of parameter adjustment)

Module III:[10]
Different control strategies - schemes, brief analysis and uses

(i) Ratio control

(ii)Cascade control

(iii)Feedforward control

(iv)Multivariable control

Final Control Element: Actuators (Pneumatic Actuators, Electrical Actuators) and Control Valves (Globe, Ball, Butterfly, Gate, Pinch), Different Parts, Fail Position, Valve characteristics, Cv, Single & Double Seated Valves, Valve sizing, Valve selection, Cavitation, Flashing, Noise

Control Valve Accessories – Air Filter Regulator, I/P Converter

Brief study of Safety Valves and Solenoid valves

Module IV:[8]
Introduction to Programmable Logic Controllers (PLCs) – Basic Architecture and Functions; Input-Output Modules and Interfacing; CPU and Memory; Relays, Timers, Counters and their uses; PLC Programming and Applications.

Introduction to DCS: overview, block diagram

Books:

1) D. Patranabis, Principles of Process Control, TMH, New Delhi, 2nd Ed.
2) D. P. Eckman, Automatic Process control, John Wiley, New York
3) Surekha Bhanot, Process Control Principal & Application, Oxford
4) B. W. Bequette, Process Control – Modeling, Design and Simulation, PHI
5) D. R. Coughanowr, Process Systems Analysis and Control, McGraw Hill
6) G. Stephanopoulos, Chemical process Control, PHI
7) C. D. Johnson, Process Control Instrumentation Technology, PHI
8) B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia

CO-PO matrices of courses EI601:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
EI 601.1	3	2	2	**1**	**2**	**-**	1	**-**	**1**	**-**	2	2	2	1
EI 601.2	**3**	**2**	1	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	2	1	2
EI 601.3	2	1	1	**-**	1	**-**	**1**	**1**	**-**	**-**	**2**	-	1	1
EI 601.4	1	1	-	**-**	-	**-**	**-**	**-**	**-**	**-**	**1**	-	1	1
EI 601.5	3	-	3	**2**	1	**-**	**-**	**-**	**-**	**-**	**2**	2	2	2

BIOMEDICAL INSTRUMENTATION
CODE: EI602
CONTACT: 3P
CREDITS: 3
TOTAL CONTACT HOURS: 35

Prerequisite: Sensors & Transducers, Signal Processing

Course Objective:

1. To understand the various systems of the human physiology and signals of biological origin obtained from various systems,

2. To analyse various biosensors, transducers and bio-potential electrodes used to acquire various bio-potentials.

3.To understand various methods of measurement of blood pressure, blood flow, heart sounds and pacemaker

4. To familiarize with various amplifiers for measuring biopotentials.

5. To acquire knowledge about Electrical safety of medical devices and their protective measures.

Course Outcome:

EI602.1: Able to understand the detailed physiology of various human anatomical systems.
EI602.2: Able to identify proper transducer for acquisition of a particular bioelectric potential.
EI602.3: Able to measure various bioelectric potentials.

EI602.4: Able to analyse various biological conditions from the measured bioelectric potentials.
EI602.5: Able to design biotelemetry systems for acquiring bioelectric potentials from long distance.

Module I: Physiology of various anatomical systems: **[4L]**
Introduction to the physiology of cardiac, nervous, muscular and respiratory systems

Module II: Bioelectric potential and measuring transducers: **[8L]**
Bioelectric potentials: Definitions, types, range, basic characteristics. resting and action potential
Different types of transducers and electrodes: construction, selection for acquiring various bio-potentials

Module III: Measurements on cardiovascular and respiratory system **[11L]**
Blood pressure - characteristics of blood flow - Heart sounds - ECG - Measurement of blood pressure, blood flow, heart sounds and Cardiac pace-maker: types and its detail instrumentation.

Module IV: Electrical activities in brain and muscles: **[2L]**

Electromyography and Electroencephalograph: characteristics, measurements and signal analysis.

Module V: Medical Imaging Techniques **[4L]**

Ultrasound imaging and IR Imaging: image acquisition technique and analysis, MRI
Module VI: Biotelemetry **[3L]**
Transmission and Reception aspects of Biological signals over long distances.

Module VII: Measurement Errors and safety issues **[3L]**
Errors in bio-potential measurement, types and methods to minimize errors
Electrical- Safety codes and standards, basic approaches to protection against shock, power distribution protection, equipment protection

Text Books:

1. Cromwell L – Biomedical Instrumentation and Measurement, Pearson
2. Khandpur R.S., Hand book of Biomedical Instrumentation, Tata McGraw Hill
3. Webster J S – Medical Instrumentation – Application and Design
4. Astor B R – Introduction to Biomedical Instrumentation and Measurement, McMillan.
5. Chatterjee Miller – Biomedical Instrumentation, Cengage Learning

CO-PO Matrices of the course EI602:

	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P1 1	P12	PSO1	PSO2
EI602.1	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**

EI602.2	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**
EI602.3	**3**	**3**	**2**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
EI602.4	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**
EI602.5	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**3**

POWER ELECTRONICS
CODE: EI603A
CONTACTS: 3L
CREDITS: 3
TOTAL CONTACT HOURS: 33

Prerequisite: Knowledge of analog electronics & circuit theory.

Course Objective:

1. To understand the constructional features and characteristic of power semiconductor devices

2. To understand the working principle and switching operation of different semiconductor devices.

3. To prepare the students to analyze and design different power converter circuits.

4. To implement the different power supply modules.

Course Outcome:

EI603A.1: Acquire knowledge about fundamental concepts and techniques used in power electronics.

EI603A.2: Ability to express characteristics of SCR, BJT, MOSFET and IGBT.

EI603A.3: Express the design and control of rectifiers, inverters.

EI603A.4: Ability to analyze various single phase and three phase power converter circuits and understand their applications.

EI603A.5: To develop skills to build, and troubleshoot power electronics circuits like SMPS, Intelligent power module, etc's.

Module I: Power Semiconductor Devices & switching devices: [8L]

Rectifier diodes, fast recovery diode and Schottky barrier diode, BJT, Thyristor (SCR), TRIAC, GTO, MOSFET, IGBT and MCT.

Module II: Thyristor triggering & commutation techniques: [6L]

UJT and RC triggering circuit, resonant commutation, self commutation, auxiliary commutation, Complementary commutation.

Module III: Converters: [11L]

Rectifiers: Single phase and three phase controlled bridge rectifiers, DC to DC converters (Choppers): principle of step up and step down converters, DC to AC converters (inverters) : Single phase and three phase inverters, Cycloconverters : Single phase to single phase and three phase to single phase circuits, blocked group operation, circulating current mode.

Module IV: Applications: [8L]

Modern trends in industrial drives and control; AC motor drives in transportation system and traction; induction heating, electronic ballast, UPS, Intelligent power modules.

Books:

1. P.C. Sen, Power Electronics, TMH, New Delhi

2. M. H. Rashid, Power Electronics, PHI/Pearson Education

3. C. W. Lander, Power Electronics, Mc Graw Hill

5. Mohan N, Underland T M & Robbins W P – Power Electronics, John Wiley & Sons

6. P. S. Bimbhra – Power Electronics, Khanna Publishers

CO-PO matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EI603A.1	3	2	2	1	1	-	-	-	-	-	2	1
EI603A.2	1	2	3	-	2	-	-	-	-	-	-	-
EI603A.3	2	-	2	-	1	-	-	-	-	-	-	-
EI603A.4	-	1	-	-	3	1	-	-	-	-	-	-
EI603A.5	-	-	-	-	-	-	1	2	-	-	-	-

INDUSTRIAL DRIVES
CODE: EIE603B
CONTACT: 3P
CREDITS: 3
TOTAL CONTACT HOURS: 30

Prerequisite:

Knowledge of Electrical Machines and Power Electronics.

Course Objective:

To understand the importance of different industrial drives.

To understand the working principle of different types of industrial drives.

To classify applications in different industries.

To understand the different control techniques of industrial drives.

Course Outcomes:

At the end of this course, students will able to

EI603B.1: Demonstrate the basic requirements of dc drive and ac drive.

EI603B.2: Illustrate the principles of speed-control of dc motors and ac motors.

EI603B.3: Classify the industrial applications of dc drive and ac drive.

Module I: AC Drives **12L**

Basic Elements of a Variable Frequency Drive (VFD) 1L
External Components in a typical Power and Control Circuit of a drive for a simple pump application 2L
Drive Control modes: Variable Frequency Control, Sensorless Vector Control, Vector Control with sensor, Flux Vector Control, Direct Torque Control 4L
Basic Specifications and Selection Procedure for AC Drives – with specific reference to Variable Torque and Constant Torque applications 3L
Use of AC Drives for energy efficient production as applied to 2L

Pumps, Fans, Compressors
Hoisting, Breaking, Lowering Conveyor Technology

Module II: DC Drives 10L

Modern DC Drives and its applications in 8L
Winders & Un-winders
Wire Drawing Machine,Bar Rolling Mill,Rotary Kiln, Basic Specifications and Selection Procedure for DC Drives 2L

Module III: Servo Motor and Servo Drives **8L**

Block Diagram of a typical Servo Controlled System with 2L
velocity and torque feedback, velocity and position feedback,DC and AC Servomotors 2L
Selection of Servomotor for an application 2L
Fundamentals of Axis Control and its implementation 2L

Books :

1. Fundamentals of Industrial Drives, B.N. Sarkar, PHI
2. Fundamentals of Electric Drives, Gopal K Dubey, Narosa
3. Electrical Drives And Control, U.A. Bakshi, M.V.Bakshi, Technical Publications
4. Industrial Drives, Mukhtar Ahmad, MacMillan
5. Electric Drives, V Subramanyam, McGraw-Hill
6. Electric Drives, Boldea & Nasar, CRC
7. Vector Control of AC Drives, Boldea & Nasar, CRC

CO-PO Matrices of the course EI603B:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EI603B.1	3	1	-	-	2	-	-	-	-	-	-	2
EI603B.2	3	2	2	-	3	-	-	-	-	-	-	2
EI603B.3	3	-	-	1	2	2	-	-	-	-	1	2

ADVANCED SENSORS
CODE: EI 603C
CONTACT: 3P
CREDITS: 3
TOTAL CONTACT HOURS: 30

Prerequisite: Knowledge of Sensor & Transducer; Fabrication techniques.

Course Objective:

1. To understand different techniques of sensors designing parameters.
2. To determine the specification of different types of sensors.
3. To understand and compare the different micro sensor development technique.
4. To design and apply the micro sensors using different technique.

Course Outcome:

EI603C.1: Able to explain different techniques of sensors designing parameters.

EI603C.2: Able to determine the specification of different types of sensors.

EI603C.3: Able to understand and compare the different micro sensor development technique.

EI603C.4: Able to design the micro sensors using different technique.

EI603C.5: Able to apply the knowledge of micro-sensors in different field.

Module I : Sensor Signal conditioning & Reliability: [10L]

Design techniques of signal conditioning for different sensors

Sensor reliability, reliability models and testing, ageing tests, failure mechanisms and their evaluation, stability studies

Module II :Micro Sensor & MEMS: Introduction & Application [10L]

Historical Development of Microelectronics, Evolution of Micro sensors, Evolution of MEMS, Emergence of Micro machines, Sensor Systems, Sensors types and classification, Mechanical Sensors, Acoustic Sensors, Magnetic Sensors, Thermal Sensors, Optical sensors Chemical Sensors, Radiation Sensors and Biosensors. Micro sensors, Sensors based on surface-acoustic wave devices. Review Of Fabrication Techniques (Lithography, PVD,CVD ,RIE), Applications

Module III: Smart Sensors [10L]

Importance and Adoption of Smart Sensors, Architecture of Smart Sensors: Important components,their features, Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol- gel, Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor and Future scope of research in smart sensor

Text Books:

1. Triethy HL - Transducers in Electronic and Meachanical Design, Mercel Dekker 1986

2. D. Patranabis – Sensor and Transducers (2e) Prentice Hall, New Delhi, 2003

3. Silicon Sensors – Middlehoek S and Audel S. A. – Academic Press, London 1989

4. Chemical Sensors – Edmonds T. E. (Ed); Blackie – London, 1988

5. Problems and possibilities of oxidic and organic semiconductor gas sensors, G. Heiland and D. Kohl, Sensors andActuators, Volume 8, Issue 3, November 1985, Pages 227-233.

6. Thick-film sensors: an overview, Maria Prudenziati and Bruno Morten, Sensors and Actuators, Volume 10, Issues 1–2,10 September 1986, Pages 65-82.

7. The use of polymer materials as sensitive elements in physical and chemical sensors, F.J. Gutierrez Monreal, Claudio M. Mari,Sensors and Actuators, Volume 12, Issue 2, August–September 1987, Pages 129-144.

CO-PO matrices of courses EI 603C:

	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EI603C.1	3	2	3	**1**	**-**	**-**	3	**-**	**-**	**-**	1	1
EI603C.2	**1**	**3**	1	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-
EI603C.3	3	-	3	**-**	1	-	-	**-**	**-**	**-**	**-**	-
EI603C.4	2	2	-	**3**	-	-	**-**	**-**	**-**	**-**	**1**	2
EI603C.5	1	2	2	**1**	-	**-**	**-**	**-**	**-**	**-**	**1**	3

OPTOELECTRONICS AND FIBRE OPTIC SENSORS
Code: EI 604A
Contacts: 3L
Credits: 3
Total contact hours: 32

Prerequisite: Knowledge of geometrical optics and semiconductor physics

Course Objective:

1. To make the learners understand the different aspects of optoelectronic sources
2. To make the learners understand the different aspects of optoelectronic detectors
3. To make the learners understand the different aspects of optical fiber
4. To make the learners understand the application and advantages of different fiber optic sensors

Course Outcome:

After the completion of the course, learner will be able to:

EI604A.1: compare LED and semiconductor LASER based on working principle and applications
EI604A.2: compare p-n photodiode, p-i-n photodiode, avalanche photodiode, photo transistor and photo multiplier tube based on responsivity, efficiency, and working principle
EI604A.3: explain working principle of single mode and multimode optical fibers
EI604A.4: select a suitable optical fiber for an engineering application, based on number of modes required, distance to be covered and V-parameter
EI604A.5: justify the selection of fiber optic sensors for measuring temperature, pressure, liquid level, displacement and angle of rotation

Module I: Optoelectronic sources and laser (10L)

Optoelectronics: Characteristics of optical emission, electro-luminescence, optical emission from p-n junction, direct bandgap and indirect band gap materials.

LED: spontaneous emission, power and efficiency calculation, materials of LED, structure of LED and its characteristics, double heterojunction LED, surface emitter LED, edge emitter LED, superluminescent LED.

Laser: Einstein relations, population inversion, 3- and 4-energy level systems, optical pumping, modes of laser, lasing materials-gaseous, liquid, and solid.

Semiconductor based lasers – p-n junction laser, double heterojunction laser, stripe geometry.

Holography.

Module II: Optoelectronic detectors (8L)

Optical detection principle, quantum efficiency, responsivity.

Photo diode: p-n photodiode, p-i-n photodiode, avalanche photo diode, Schottky photodiode, hetero junction diode, phototransistor

LDR, photovoltaic cells, photo emissive cells - types, materials, construction, response.

Opto-couplers – components, characteristics, noise figures, applications

Module III: Optical fiber and fiber optics (8L)

Fiber optics: Optical fiber – materials, construction, step index and graded index fibres, ray propagation. Modes in optical fibres, intermodal dispersion. Single mode and multimode fiber, attenuation and dispersion in single mode and multimode optical fibers

Active fiber,Optical fiber coupling- splices and connectors

Module IV: Fiber optic sensors (6L)

Fibre-optic sensors: advantages, intrinsic and extrinsic sensors

Classification- intensity modulated sensors, phase modulated sensors, spectrally modulated sensors.

Fibre optic sensors for Industrial applications: temperature, displacement, pressure and liquid-level sensors.

Fiber optic interferometer- Mach –Zahnder interferometer, Sagnac interferometer

Books:

P. Bhattacharjee, *Semiconductor Optoelectronic Devices*, PHI

John Wilson and John Hawkes, *Optoelectronics- An Introduction*, PHI

John M. Senior, *Optical Fibre Communications*, PHI

R.P. Khare, *Fiber Optics and Optoelectronics*, Oxford University Press

CO-PO matrix of course EI604A:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EI604A. 1	3	-	3	-	-	-	-	-	-	-	2	-
EI604A.2	3	-	3	-	-	-	-	-	-	-	2	-
EI604A.3	3	-	-	-	-	-	2	-	-	-	-	2
EI604A.4	3	-	2	-	3	-	2	-	-	-	-	-

EI604A.5	3	-	3	**-**	3	**-**	**-**	**-**	**-**	**-**	2	2

SOFT COMPUTING
Code: EI 604B
Contacts: 3L
Credits: 3
Total contact hours: 30

Prerequisite: Knowledge of set theory, nervous system, and biological evolution

Course Objective:

1. To make the learners understand the advantages of soft computing techniques

2. To make the learners understand the different aspects of fuzzy logic and fuzzy reasoning

3. To make the learners understand the different aspects of artificial neural networks

4. To make the learners understand the different aspects of genetic algorithm

Course Outcome:

After the completion of the course, learner will be able to:

EI604B.1: use fuzzy logic for decision making in presence of uncertainty

EI604B.2: design a fuzzy logic control system for a continuous-time plant with single i/p-single o/p

EI604B.3: compare the different types of artificial neural networks, based on supervised and unsupervised learning techniques

EI604B.4: justify the application of genetic algorithm based optimization technique in a situation with large number of possible solutions

Module I: Soft Computing and Fuzzy logic (8L)

Soft-computing-definition, advantage over conventional computing, areas of application, Fuzzy Sets, membership function and membership value, linguistic variable, Fuzzy operators, T- Norms and S- Norms, Fuzzy relations, implications, cylindrical extensions, projection, Fuzzification and defuzzification

Module II: Fuzzy reasoning and fuzzy logic control (10L)

Fuzzy extension principle, compositional rule of inference, approximate reasoning (fuzzy reasoning)
Different Fuzzy models-Mamdani's model, Sugeno's model (T-S-K model)
Fuzzy logic control system, fuzzy PID controller

Module III: Genetic algorithm (4L)

Genetic Algorithm (GA)- basic concept, components-chromosome and gene, GA operators, methods of selection, elitism, Fuzzy-GA system

Module IV: Artificial neural networks (8L)

Artificial neural network (ANN)- basic concept, areas of application, McCulloch and Pitts model, perceptron, realization of logic gates, training of ANN, Supervised and unsupervised learning- techniques and comparison, Neuro-fuzzy system

Books:

D.Dirankov, H. Hellendoorn, and M.Reinfrank, *An Introduction to Fuzzy logic control,* Narosa

S.Rajasekaran and G.A.V. Pai, *Neural Networks, Fuzzy logic and Genetic Algorithm: Synthesys and Applications*, Pearson Education

J.S.R.Jang, C.T. Sun and, E.Mizutani, *Neuro-fuzzy and soft Computing*, Pearson Education

T.J.Ross, *Fuzzy Logic with Engineering Applications*, Wiley (India)

B.Yegnanarayana, *Artificial Neural Networks*, PHI

CO-PO matrix of course EI604B:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EI604B. 1	3	-	2	-	**-**	**-**	-	**-**	**-**	**-**	-	2
EI604B.2	3	**-**	3	**-**	3	**-**	**-**	**-**	**-**	**-**	-	2

EI604B.3	3	-	1	2	-	**-**	-	**-**	**-**	**-**	**-**	2
EI604B.4	3	-	1	2	-	-	-	**-**	**-**	**-**	**-**	2

DATA STRUCTURES & ALGORITHMS

CODE: CS(EI) 615A
CONTACT : 3
CREDIT : 3
NO. OF LECTURES: 36 HOURS

Prerequisite:

Familiarity with the fundamentals of C or other programming language.
A solid background in mathematics, including probability, set theory.

Course Objective:

1. To learn the basics of abstract data types.

2. To learn the principles of linear and nonlinear data structures.

To build an application using different data structures.

Course Outcome:

CS(EI) 615A.1: Understand the concept of abstract data types and algorithms.

CS(EI) 615A.2: Understand linear data structures such as arrays, linked lists, stacks and queues.

CS(EI) 615A.3: Understand non-linear data structures such as tree, graph.

CS(EI) 615A.4: Apply different data structures in building applications.

Module I: Linear Data Structure [10L]

Introduction (2L):

Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.

Algorithms and programs, basic idea of pseudo-code **(1L)**

Algorithm efficiency and analysis, time and space analysis of algorithms – order notations **(1L)**

Array (2L):

Different representations – row major, column major **(1L)**

Sparse matrix - its implementation and usage, Array representation of polynomials **(1L)**

Linked List (6L):

Singly linked list – operations, Doubly linked list – operations **(4L)**

Circular linked list – operations, Linked list representation of polynomial and applications **(2L)**

Module II: Linear Data Structure [6L]

Stack and Queue (4L):

Stack and its implementations (using array and linked list) **(1L)**

Applications (infix to Postfix, Postfix Evaluation) **(1L)**

Queue, circular queue, de-queue **(1L)**

Implementation of queue- linear and circular (using array and linked list) **(1L)**

Recursion (2L):

Principles of recursion - use of stack, tail recursion. **(1L)**

Applications - The Tower of Hanoi, Eight Queens Puzzle **(1L)**

Module III: Nonlinear Data structures [12L]

Trees (8L):

Basic terminologies, forest, tree representation (using array and linked list) **(1L)**

Binary trees - binary tree traversal (pre-, in-, post- order) **(1L)**

Threaded binary tree **(1L)**

Binary search tree- operations (creation, insertion, deletion, searching) **(1L)**

Concept of Max-Heap and Min-Heap (creation, deletion) **(1L)**

Height balanced binary tree – AVL tree (insertion with examples only) **(1L)**

Height balanced binary tree – AVL tree (deletion with examples only) **(1L)**

m –Way Search Tree, B^+ Tree – operations (insertion, deletion with examples only) **(1L)**

Graphs (4L):

Graph theory review **(1L)**

Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) **(2L)**

Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) **(1L)**

Module IV: Searching, Sorting [8L]

Sorting Algorithms (4L):

Bubble sort, Insertion sort, Selection sort – with notion of complexity **(1L)**
Quick sort, Merge sort – with complexity **(2L)**
Radix sort – with complexity **(1L)**
Searching (2L):
Sequential search – with complexity **(1L)**
Binary search, Interpolation Search– with complexity **(1L)**
Hashing (2L):
Introduction to Hashing and Hashing functions **(1L)**
Collision resolution techniques **(1L)**
Recommended books:
"Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung
"Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed
"Data Structures in C" by Aaron M. Tenenbaum
"Data Structures" by S. Lipschutz
"Data Structures Using C" by Reema Thareja
"Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev

CO-PO matrix of course CS(EI)615A:

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI)615A.11	3	3	2	2	3	2	2	3	3	3	2	3
CS(EI)615A.2	3	2	2	2	2	2	3	2	2	3	3	2
CS(EI)615A.3	3	3	3	2	3	3	3	2	2	3	3	2
CS(EI)615A.4	3	3	3	3	3	3	3	3	3	3	3	3

DATABASE MANAGEMENT SYSTEM
CODE: CS(EI)615B
CONTACT: 3L
CREDITS: 3

Total Contact Hours:34

Prerequisite:

An understanding of basic computer software
Object Oriented programming skills.

Course Objective:

1. To develop basic Knowledge in Software Engineering and its applications.

2. To understand software Engineering layered architecture and the process frame work.

3. To analize software process models such as the waterfall, spiral, evolutionary models and agile method for software development.

4. To design software requirements and specifications of documents.

5. To understand project planning, scheduling, cost estimation, risk management.

6. To describe data models, object models, context models and behavioral models.

7. To learn coding style and testing issues.

8. To know about the quality checking mechanism for software process and product.

Course Outcome:

CS(EI) 615B.1	To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CS(EI) 615B.2	To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CS(EI) 615B.3	To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
CS(EI) 615B.4	To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.
CS(EI) 615B.5	To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

ModuleI (6L)

SoftwareEngineering–Characteristics,Components,Application,Definitions,SoftwareProcessmodels-WaterfallModel,Prototypemodel,RAD,EvolutionaryModels,Incremental,Spiral.,SoftwareProjectPlanning-FeasibilityAnalysis,TechnicalFeasibility,Cost-BenefitAnalysis,Basics of estimation : COCOMO (Basic, intermediate, Complete) model

ModuleII (6L)

SystemAnalysis:PrincipleofStructureAnalysis,RequirementAnalysis,DFD,EntityRelationship Diagram,DataDictionary,DataModeling,SoftwareRequirementsSpecification

SoftwareDesignAspects:Objectives,Principles,Concepts,HLD and LLD, Top-DownandBottom-Updesign;

Decision tree,decisiontableandstructuredEnglish,Structurechart,TransformanalysisFunctional Vs.Object-Orientedapproach.

ModuleIII (3L)

Introduction to Agile Methodology ,Agile Testing , Quality in agile software development

ModuleIV (4L)

UnifiedModelingLanguage:
Classdiagram,interactiondiagram:collaborationdiagram,sequencediagram,statechartdiagram,activity, diagram,implementationdiagram, Use Case diagram

ModuleV (10L)

Coding&Documentation–StructuredProgramming,ModularProgramming,ModuleRelationship-Coupling,Cohesion,OOProgramming,InformationHiding,Reuse,SystemDocumentation.

Testing–LevelsofTesting,IntegrationTesting,SystemTesting**.**

TestCases-WhiteBoxandBlackBoxtestingSoftwareQuality,QualityAssurance,SoftwareMaintenance, SoftwareConfigurationManagement,SoftwareArchitecture.

ModuleVI (5L)

Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

Text Book

1. SoftwareEngineering:Apractitioner'sapproach–Pressman(TMH)

ReferenceBooks:

1.SoftwareEngineering-PankajJalote(Wiley-India)

2.SoftwareEngineering-RajibMall(PHI)

3. SoftwareEngineering–AgarwalandAgarwal(PHI)

4. “Database Management Systems”, ArunK.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill

CO-PO matrix of course CS(EI)615B:

CO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI) 615B.1	1	1	2	2	1	-	-	-	-	-	-	-
CS(EI) 615B.2	2	2	1	-	-	-	-	-	-	-	-	-
CS(EI) 615B.3	-	-	-	-	-	2	-	1	-	1	-	-
CS(EI) 615B.4	-	-	-	-	-	-	-	-	-	2	-	-
CS(EI) 615B.5	-	-	-	-	-	-	-	-	3	-	1	2

SOFTWARE ENGINEERING
CODE: CS (EI) 615C
CONTACT: 3L
CREDIT: 3
TOTAL CONTACT HOURS: 36

Prerequisite:

An understanding of basic computer software
Object Oriented programming skills.

Course Objective:

To understand the working environment in industry and aware of cultural diversity, who conduct themselves ethically and professionally.

Graduates use effective communication skills and technical skills to assure production of quality software, on time and within budget.

Graduates build upon and adapt knowledge of science, mathematics, and engineering to take on more expansive tasks that require an increased level of self-reliance, technical expertise, and leadership.

Course Outcome:

CS(EI)615.1	To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CS (EI)615.2	To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project
CS (EI)615.3	To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
CS (EI)615.4	To acquire the ability to function effectively in teams.
CS (EI)615.5	To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.
CS (EI)615.6	To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

Module I

Software Engineering –Characteristics, Components, Application, Definitions, Software Process models - Waterfall Model, Prototype model, RAD, Evolutionary Models, Incremental, Spiral. Agile Method

Software Project Planning- Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO (Basic, intermediate, Complete) model, (**6L)**

Module II

System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, Data Dictionary, Data Modeling, Software Requirements Specification **(3L)**

Module III

Software Design Aspects: Objectives, Principles, Concepts, Top-Down and Bottom-Up design; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional Vs. Object-Oriented approach. **[3L]**

Module IV

Unified Modeling Language: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity, diagram, implementation diagram, Use Case diagram **(4L)**

Module V

Coding & Documentation – Structured Programming, Modular Programming, Module Relationship-Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation. **[4L]**
Testing – Levels of Testing, Integration Testing, System Testing**.[4L]**

Test Cases- White Box and Black Box testing Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management, Software Architecture. **[6L]**

Module VI

Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement Project Monitoring. **[6L]**

Reference Books:

1. Software Engineering : A practitioner's approach– Pressman(TMH)
2. Software Engineering- Pankaj Jalote (Wiley-India)
3. Software Engineering- Rajib Mall (PHI)
4. Software Engineering –Agarwal and Agarwal (PHI)

CO-PO matrix of course CS(EI)615C:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI)615C.1	1	1	2	2	1	-	-	-	-	-	-	-
CS(EI)615C.2	2	2	1			-	-	-	-	-	-	-
CS(EI)615C.3	-	-	-	-	-	2		1	-	1	-	-
CS(EI)615C.4	-	-	-	-	-	-	-	-	-	2	-	-
CS(EI)615C.5	-	-	-	-	-	-	-	-	3	-	1	2
CS(EI)615C.6	-	-	-	-	-	-	-	-	2	1	2	2

PROCESS CONTROL LAB
CODE: EI691
CONTACT: 3P
CREDITS: 2

COURSE OUTCOME:

After completion of the laboratory course students will be able to:

EI691.1 Recognize & explain basic process control loop elements via hands on experiment.
EI691.2 Control different process variable (flow, pressure, level & temperature) using different controller mode.
EI691.3 Use various PLC functions and develop PLC programs to control a real time system.
EI691.4 Control & monitor different process variable through DCS.

Experiments :

1. Study of Flow, Level, Pressure, Temperature processes and construction of the P&I diagrams in accordance with ISA guidelines / standards

2. Study of a Temperature Control Loop having Furnace, suitable final control element, Temperature transmitter, conventional PID controller/Control System, and data logger/recorder

3.Study of a Pressure Control Loop having Pressure source, Pressure Transmitter, Motorized/Pneumatic control valve, and conventional PID controller/Control System

4. Study of a Flow Control Loop having suitable Flow meter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System

5.Study of a Level Control Loop having Level Transmitter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System
6.Study of a typical Air Duct Flow Monitoring and Control
7. PLC Programming
8. Study of a PC based Automation Software / Simulation Software

9. Configuring the DCS for Temp./Flow/Pressure processes.

10. Extra Mural Experiment

CO-PO matrix of course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EI691.1	2	2	1	-	-	-	-	-	-	-	-	-
EI691.2	2	2	1	1	2	-	-	-	2	-	-	-
EI691.3	2	3	3	3	3	1	-	-	1	-	-	-
EI691.4	1	2	2	-	-	-	-	-	1	-	-	-

POWER ELECTRONICS LABORATORY
Code : EI 693A
Contacts : 3P
Credits : 2

Course Outcome:

At the end of the course, a student will be able to:

EI 693A .1.Identify relevant information to supplement to the Power Electronics (EE603)course.

EI 693A .2. Set up testing strategies and select proper instruments to evaluate performance characteristics of Power devices and power electronics circuits and analyze their operation under different loading conditions.

EI 693A .3. Realize the limitations of computer simulations for verification of circuit behavior, apply these techniques to different power electronic circuits and evaluate possible causes of discrepancy in practical experimental observations in comparison to theory.

EI 693A .4. Prepare professional quality textual and graphical presentations of laboratory data and computational results, incorporating accepted data analysis and synthesis methods, mathematical software,and word-processing tools.

EI 693A .5. Primarily via team-base laboratory activities, students will demonstrate the ability to interact effectively on a social and interpersonal level with fellow students, and will demonstrate the ability to divide up and share task responsibilities to complete assignments.

Experiments:

1. Study of Characteristics of an SCR and a TRIAC.

2. Study of Diode-Resistance, Diode-Resistance-Capacitance, Resistance-Capacitance and UJT Triggering Circuits for SCR.

3. Study of the operation of a single phase fully controlled bridge converter supplying R-L load and freewheeling diode, including generation of triggering pulses for the devices for both continuous and discontinuous modes of conduction.

4. Study of a self commutation circuit for commutating an SCR operating on a DC supply.

5. Simulation of DC to DC step down chopper.

6. Simulation of PWM bridge inverter using MOSFET/IGBT with R/R-L load.

7. Simulation of Single phase AC regulator.

8. Study of a control circuit for a stepper motor and its operation./ Study of a single quadrant chopper controlled PM dc motor.

CO-PO matrix of course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EI 693A .1	2	1	1	1	-	-	-	-	-	-	2	1
EI 693A .2	1	2	1	1	-	1	1	-	-	-	-	1
EI 693A .3	1	2	1	1	2	-	-	-	-	-	-	1
EI 693A .4	1	-	-	-	2	1	1	-	-	-	1	-
EI 693A .5	-	-	-	-	-	1	1	-	-	-	1	-

INDUSTRIAL DRIVES LABORATORY
CODE: EI693B
CONTACTS: 3P
CREDIT: 2

Course Outcomes:

At the end of this course, students will able to

EIE693B.1: Test DC and AC motor drive.

EIE693B.2: Perform tests on transformers.

Experiments:

Study of the characteristics of a DC motor
Study of methods of speed control of DC motor
Measurement of speed of DC series motor as a function of load torque.
Polarity test on a single phase transformer & study of different connections of three phase transformer.
Study of performance of three phase squirrel- cage Induction motor – determination of iron-loss, friction & windage loss.
Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer & Star-Delta].
Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltage control & frequency control].
Speed control of 3 phase slip ring Induction motor by rotor resistance control. Load test on single phase Induction motor to obtain the per
Load test on wound rotor Induction motor to obtain the performance characteristics.

formance characteristics.

CO-PO matrix of course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EIE693B.1	3	3	2	-	2	-	-	-	-	-	2	2
EIE693B.2	3	3	2	-	1	-	-	-	-	-	3	2

ADVANCED SENSORS LABORATORY
CODE: EI 693C
CONTACT: 3P
CREDITS: 2

Course Outcome:

EI693C.1: Able to experiment with the different techniques of sensors fabrication.
EI683C.2: Able to demonstrate the characteristics of different types of smart sensors.
EI693C.3: Able to analyze and compare the different micro sensor development technique.

EI693C.4: Able to estimate the different sensors parameters such that this knowledge can be used for sensors development.

EI683C.5: Able to design the smart sensors and IC based sensors.

List of Experiments:

1. Study of fabrication procedure for sensor.
2. To study and find characteristics of any chemical sensor.
3. To study of different materials used for micro sensors.
4. Design of smart sensor and its signal conditioning.
5. Study of gas sensors and its industrial applications.
6. Design of application for any IC sensors.
7. Implementation of fibre optic sensor application.
8. Implementation of gas sensor application.

CO-PO matrix of course

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
EI693C.1	3	3	2	-	-	-	-	-	-	-	2	2
EI683C.2	3	3	2	-	-	-	-	-	-	-	2	2
EI693C.3	3	2	1	-	-	-	-	-	-	-	1	2
EI693C.4	2	3	1	-	-	-	-	-	-	-	2	2
EI693C.5	3	2	2	-	-	-	-	-	-	-	1	1

DATA STRUCTURES & ALGORITHMS LAB
CODE: CS(EI) 685A
CONTACT : 3P
CREDIT POINT: 2
Course Outcome:
CS(EI) 685A.1: Ability to identify the appropriate data structure for given problem.

CS(EI) 685A.2: Graduate able to design and analyze the time and space complexity of algorithm or program.

CS(EI) 685A.3: Ability to effectively use compilers includes library functions, debuggers and trouble shooting.

Module 1

Write a C program that uses functions to perform the following:

Create a singly linked list of integers.

Delete a given integer from the above linked list.

Display the contents of the above list after deletion.

Write a C program that uses functions to perform the following:

Create a doubly linked list of integers.

Delete a given integer from the above doubly linked list.

Display the contents of the above list after deletion.

Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.

Write a C program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array.

Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.

Module 2

Write a C program that uses functions to perform the following:

Create a binary search tree of characters.

Traverse the above Binary search tree recursively in Postorder.

Write a C program that uses functions to perform the following:

Create a binary search tree of integers.

Traverse the above Binary search tree non recursively in inorder.

Module 3

Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:

Insertion sort

Merge sort

Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:

Quick sort

Selection sort

Write C programs for implementing the following searching methods:

Linear Search
Binary Search

Write a C program to implement all the functions of a dictionary (ADT) using hashing.

Module 4

Write C programs for implementing the following graph traversal algorithms:

Depth first search

Breadth first search

CO-PO Mapping

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI) 685A.1	**3**	**2**	**2**	-	-	-	-	**2**	-	-	-	**1**
CS(EI) 685A.2	**3**	-	**3**	-	-	**2**	-	-	-	-	-	-
CS(EI) 685A.3	**3**	**3**	-	-	-	-	-	-	-	-	-	**1**

DATABASE MANAGEMENT SYSTEM LAB
CODE:CS(EI)685B
CONTACT: 3P
CREDITS: 2

Course Outcome(s)

On completion of the course students will be able to

CS(EI)685B.1 Understand the basic concepts regarding database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.

CS(EI)685B.2 Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.

CS(EI)685B.3 Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.

CS(EI)685B.4 Analyze database system concepts and apply normalization to the database.

CS(EI)685B.5 Apply and create different transaction processing and concurrency control applications.

Structured Query Language
Creating Database
Creating a Database
Creating a Table Specifying Relational Data Types
Specifying Constraints Creating Indexes
Table and Record Handling
INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements
Retrieving Data from a Database
The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause Using Aggregate Functions
Combining Tables Using JOINS
Sub-queries
Database Management
Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE
PL/SQL
Database design using E-R model and Normalization
Design and implementation of some on line system [Library Management System]

CO-PO Mapping

CO	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1
CS(EI)685C.1	3	2	3	2	3	-	-	-	-	-	-	1
CS(EI)685C.2	2	2	3	-	-	-	-	-	-	-	-	1
CS(EI)685C.3	2	3	2	2	3	-	-	-	-	-	-	-
CS(EI)685C.4	3	2	-	-	-	-	-	-	-	-	-	-

CS(EI)685C.5	2	1	-	-	-	-	-	-	-	-	-	1

SOFTWARE ENGINEERING LAB
PAPER CODE: CS(EI)685C
CONTACT :3P
CREDIT POINT: 2

Course Outcomes:

CS(EI)685C.1 To handle software development models through rational method.
CS(EI)685C.2 To prepare SRS document, design document, test cases and software configuration management and risk management related document.
CS(EI)685C.3 To Develop function oriented and object oriented software design using tools like rational rose.
CS(EI)685C.4 To perform unit testing and integration testing
CS(EI)685C.5 To apply various white box and black box testing techniques

Assignments to be given from the following
1. Preparation of requirement document for standard application problems in standard format. (e.g. Library Management System, Railway Reservation system, Hospital management System, University Admission system) .DFD of standard application problems.

2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables.

3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)

4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.

5. Design Test Script/Test Plan(both Black box and White Box approach)

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CS(EI)685C.1	3	3	3	1	3	-	-	-	-	-	-	1
CS(EI)685C.2	3	2	3	-	-	-	-	-	-	-	-	1
CS(EI)685C.3	3	2	2	3	2	-	-	-	-	-	-	-
CS(EI)685C.4	3	2	-	-	-	-	-	-	-	-	-	-
CS(EI)685C.5	3	2	-	-	-	-	-	-	-	-	-	2

4th Year,7th Semester

A.THEORY:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	HS	HU702	Values & Ethics in Profession	2	0	0	2	2
2	PC	EI 701	Telemetry and Remote Control	3	0	0	3	3
3	PC	EI 702	Process Control-II	3	0	0	3	3
4	PE	EI703A/ EI703B/ EI703C	Digital Image Processing/ Non-Conventional Energy Sources/ Analytical Instrumentation	3	0	0	3	3
5	OE	CS(EI)714A / CS(EI)714B /CS(EI)714C	Computer Networking/ Computer graphics and Multimedia /Object Oriented Programming	3	0	0	3	3
Total Theory							14	14

B. PRACTICAL & SESSIONAL:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	PC	EI 791	Telemetry and Remote Control Lab	0	0	3	3	2
2	OE	CS(EI)784A / CS(EI)784B / CS(EI)784C	Computer Networking Lab/ Computer graphics and Multimedia Lab / Object Oriented Programming Lab	0	0	3	3	2
3	PW	EI 793	Project-1	0	0	6	6	2
Sessional								
4	PW	EI 781	Industrial Training Evaluation	4 wks during 6th -7th Sem-break				2
5	MC	MC781	Foreign Language	2	0	0	2	0

Total practical and sessional	14	8
Total 7th Semester	28	22

VALUES AND ETHICS IN PROFESSION

PAPER CODE: HU702

TOTAL CONTACT HOURS: 24

CREDIT: 2

Pre requisites: Basic knowledge of management, basics of communication, Knowledge about environment science

Course Objective: To create awareness on professional ethics and Human Values

Course Outcome:
On Completion of this course student will be able to :

HU702.1: Understand the core values that shape the ethical behaviour of an engineer and Exposed awareness on professional ethics and human values.

HU702.2: Understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories

HU702.3: Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field

HU702.4: Aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer.

HU702.5: Acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives

Module: 1. Introduction: Definition of Ethics; Approaches to Ethics:

Psychological, Philosophical, Social.

Module: 2. **Psycho-social theories of moral development**: View of Kohlberg;

Morality and Ideology, Culture and Morality, Morality in everyday

Context.

Module: 3. **Ethical Concerns**: Work Ethics and Work Values, Business Ethics,

Human values in organizations: Values Crisis in contemporary society

Nature of values: Value Spectrum of a good life.

Module: 4. ***Ethics of Profession:***

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals.

Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Module: 5. **Self Development**: Character strengths and virtues, Emotional

Intelligence, Social intelligence, Positive cognitive states and processes

(Self-efficacy, Empathy, Gratitude, Compassion, and Forgiveness).

Module: 6.Effects ***of Technological Growth:***

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics

Appropriate Technology, Movement of Schumacher; Problems of man, machine, interaction.

Text / Reference Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994

(2nd Ed)

2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.

3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

CO-PO matrix of the course:

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12
HU702.1	_	_	_	_	_	1	1	1	1	2	_	_
HU702.2	_	_	_	_	_	1	1	3	1	2	_	_
HU702.3	_	_	_	_	_	3	2	3	_	1	_	_
HU702.4	_	_	_	_	_	3	2	1	_	_	_	_
HU702.5	_	_	_	_	_	3	2	2	_	1	3	_

Telemetry & Remote Control
Code: EI701
Contact: 3P
Credits: 3
Total contact hours: 31
Prerequisite:
To understand this course, the learner must have ideas of Laplace transformation & Fourier transformation, digital and analog electronics, digital and analog communication, Fiber Optics, Modulation and Multiplexing techniques

Course Objective:

To understand the concepts of telemetry system
To understand the concepts remote sensing,
To enable selection and design of remote sensing and telemetry systems

Course Outcome:

EI 701.1 : Identify the concepts and utilities of telemetry systems EI 701.2 : Describe various coding procedures , system functional blocks, and communication system
EI 701.2 : Describe utilities of modulation and multiplexing processes in telemetry systems and their technicalities
EI 701.3 : Design of various telemetry systems and identification of applications
EI 701.4 : Identify the need of remote control and various methods in existence
EI 701.5: Design guidelines for solving different industry related complex problems

Module I

Basic Concept: Telemetry:-its purpose and application potential, basic schemes-pneumatic, current, voltage, frequency; Wired and wireless types. Concepts of Information transfer, Noise and its distribution; Probability function. Bit error rate 5

Module II

Different Multiplexing & De multiplexing techniques:FDM and TDM ,CDM , WDM
Multiple accessing techniques: TDMA,FDMA , CDMA ,WDMA
TDM Systems: their circuits, scanning techniques; TDM-PAM, PAM-PM Systems, Synchronization, TDM-PCM System 5

Modem Protocols, Modems & Modem protocols, Synchronous protocols.
Wave Propagation: Aspects of wave propagation; Space and Surface waves 5

Module III 9

Satellite Communication: Basic concepts of Satellite Communications, Communication Networks and Services, Comparison of Network Transmission technologies, Orbital and Spacecraft problems, Growth of Satellite communications, TT and C services, subsystems, The earth station, Multiple access, Single Access, Pre-assigned FDMA, Demand Assigned FDMA, TDMA, Pre-assigned TDMA, Demand-assigned TDMA, Satellite-Switched TDMA, Code Division Multiple Access, GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System, Direct Broadcast Satellites (DBS)- Direct To Home Broadcast (DTH), Digital Audio Broadcast (DAB)

Module IV 6

Remote Control: Communication based processing control system, pipelines, operational security systems components, pipeline control, power system control

Reference Books:

1. D. Patranabis, Telemetry principles, TMH, New Delhi

2. E. L. Gruenberg, Handbook of Telemetry and Remote control, Mc Graw Hill

3. Modern Digital and Analog Communication Systems - B. P. Lathi, Oxford University Press

4. Swobada G – Telecontrol Method and Application of Telemetering and Remote Control, Von Nostrand, 1971

5. Lillesand, M.T. and Ralph, W., Remote Sensing and Image Interpreation, John Wiley (2004) 6th ed

CO-PO Matrices of the course EI 701.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
EI 701.1	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
EI 701.2	**1**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**
EI 701.3	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
EI 701.4	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
EI 701.5	**1**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**

Process Control- II

Code: EI 702
Contacts: 3L
Credits: 3
Total contact hours: 32

Prerequisite: Knowledge of continuous time control system, process control, fuzzy logic (preferred)

Course Objective:

1. To make the learners understand discretization and reconstruction of signals
2. To make the learners understand z-transform and inverse z-transform
3. To make the learners understand the different aspects of discrete-time control system including stability analysis, modeling and time-response analysis
4. To make the learners understand the techniques to design digital controller
5. To make learners understand the advantage of DCS in process control and the functions of different parts of DCS
6. To introduce the learner to fuzzy logic control

Course Outcome:

After the completion of the course, learner will be able to:

EI702.1: carry out the discretization and reconstruction of a given signal by using ideal sampler and zero order hold, respectively
EI702.2: carry out z-transform and inverse z-transform for given functions
EI702.3: carry out mathematical modeling, stability analysis and time response analysis of a linear time-invariant discrete-time control system

EI702.4: design digital PID controller and deadbeat controller for linear time-invariant single i/p-single o/p system
EI702.5: explain the functionality of DCS in a process plant, including control, communication, protocols and network topology
EI702.6: compare the fuzzy logic control system with a conventional control system

Module I: Signal discretization, signal reconstruction, z-transform (10L)

Digital control system with continuous process and digital controller,

advantages & limitations of digital control system

Signal discretization - Sampling of continuous signal, sampling as impulse modulation, sampled spectra & aliasing, sampling theorem

Signal reconstruction – zero order hold and first order hold

Mapping between s-plane and z-plane.

z-transform- advantage of z-transform, z-transform of discrete-time signals, z-transform theorems, modified z-transform, inverse z-transform, limitations of z-transform

Representation of digital control system – Linear Difference Equations, Pulse Transfer Function.

Analysis of a discrete-time single input-single output system by Z-transform techniques

Stability studies for discrete-time control systems – Jury's stability criteria

w - plane transforms for discrete-time systems

Module II: Digital controllers (4L)

Designing a digital controller, physical realizability

Digital control algorithms :-

(a) Digital PID controller
Dead beat control
Dahlin's algorithm

Module III: DCS (12L)

DCS – basic components and their functions.
HMI – operator & engineering interface, functions and requirements.
Communication – ISO/OSI reference model ; data highway and Fieldbus ; HART

Network access protocols – TDMA, CSMA/CD, token passing, Master – Slave
Transmission media – twisted pair, co-axial, optical fiber ;
Network topology – mesh, ring, star, bus ;
Redundancy – processor, bus and input-output level

Module IV: Fuzzy logic control (4L)

Fuzzy logic control –fuzzy set, membership function, linguistic variable, fuzzy operators, fuzzy reasoning, defuzzification, Mamdani's model, Sugeno's model

Module V: Case studies (2L)

Case studies- rolling mill control (system with time delay), pH control (nonlinear system)

Books:

1. B.C.Kuo, *Digital Control System*, Oxford
2. George Stephanopoulos, *Chemical Process Control*, PHI
3. M. Gopal, *Digital Control System*, New Age
4. K. Ogata, *Discrete Time Control Systems*, Pearson Education Inc
5. D.Dirankov, H.Hellendoorn, M.Reinfrank, *Introduction. to Fuzzy Control*, Narosa
6. B. G. Liptak(ed.), *Instrument Engineers' Handbook vol-2*, CRC Press

CO-PO matrix of course EI702:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EI702. 1	3	-	3	-	1	**-**	-	**-**	**-**	**-**	-	-
EI702.2	3	**-**	3	**-**		**-**	**-**	**-**	**-**	**-**	-	-
EI702.3	3	-	3	-	3	**-**	-	**-**	**-**	**-**	**-**	-
EI702.4	3	-	3	-	3	-	-	**-**	**-**	**-**	**-**	-
EI702.5	3	-	3	-	3	-	-	**-**	2	**-**	**-**	2
EI702.6	3	-	1	-	3	-	-	**-**	**-**	**-**	**-**	2

DIGITAL IMAGE PROCESSING
CODE: EI 703A
CONTACTS: 3L

CREDITS: 3
LECTURES: 36

Prerequisite: Digital Signal Processing, Signals And Systems

Course Objective:

1. To learn basic concepts of digital filter and transform techniques for image processing and feature extraction.

2. To know the overview of common heuristic algorithms for Image Processing.

3. To learn about digital image processing sampling and quantization techniques.

Course Outcome:

EI703A.1: Understand image formation and the role human visual system plays in perception of gray and color image data.

EI703A.2: Get broad exposure to and understanding of various applications of image processing in industry, medicine, and defense.

EI703A.3: Learn the signal processing algorithms and techniques in image enhancement and image restoration.

EI703A.4: Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real world problems.

EI703A.5: Be able to conduct independent study and analysis of image processing problems and techniques.

Module 1:

Digital Image Processing Systems: Introduction to human eye, Image formation techniques in the human eye, Brightness adaptation and discrimination techniques, Image sensing and acquisition, storage, Processing, Communication techniques. Image sampling and quantization techniques. Spatial and Tonal resolutions, pixels. [4]

Module 2:

Image Transforms (implementation): Introduction to Discrete Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Twiddle factor, Walsh transform, Hadamard transform, Discrete sine and cosine transform, Slant transform, Optimum transform: Karhunen - Loeve (Hotelling) transform. [7]

Module 3:

Image Enhancement in the Spatial and Frequency Domain: Gray level transformations, Histogram processing, Arithmetic and logical operations, Spatial filtering: Introduction, Smoothing (low pass) and sharpening (high pass) filters. Frequency domain filters: Homomorphic filtering. Basic MATLAB codes to demonstrate the image enhancement and filtering techniques.
[5]

Module 4:

Image Data Compression: Fundamentals, Redundancies: Coding, Inter pixel Psycho-visual, fidelity criteria, Image compression techniques, Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone Still Image compression standards, Video compression standards. [7]

Module 5:

Morphological Image Processing: Introduction, algebraic and logical operations, Dilation, Erosion, Opening, closing, Hit or miss transformation, thickening, thinning, skeletonization. Morphological algorithms on binary Images. Morphological algorithm operations on gray-scale Images.
[6]

Module 6:

Image Segmentation, Representation and Description: Detection of discontinuities, Edge linking and Boundary detection, Thresholding Region based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors. Basic MATLAB codes to demonstrate the different edge detection techniques. [7]

Text Books:

1. Digital Image Processing, R. C Gonzalez and R. Woods, Indian reprint: Pearson publication, 2001

2. Digital Image Processing, Anil K. Jain, Prentice-Hall, India

3. Digital Image Processing, Sanjay Sharma, S. K. Kataria & Sons

Reference Books:

1. Digital Image Processing, W. K. Pratt, 2nd Edition, John Wiley & Sons

2. Digital Image Processing and Analysis, B. Chanda & D. Dutta Majumder, Prentice-Hall, India

3. Image Processing - Theory, Algorithms & Architecture, M. A. Sid-Ahmed, McGraw-Hill

CO-PO matrix of course EI703A**:**

COs for Course	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
EI703A.1	1	2	3	2	1	0	3	1	2	2	1	1	2	2
EI703A.2	2	2	1	1	1	0	1	0	2	3	3	2	1	3
EI703A.3	2	2	1	1	0	1	2	1	1	2	3	3	2	3
EI703A.4	2	2	1	3	0	1	3	1	2	2	3	3	2	2

NON-CONVENTIONAL ENERGY SOURCES
CODE: EI703B
CONTACT: 3P
CREDITS: 3
TOTAL CONTACT HOURS: 32

Prerequisite: Knowledge of basic chemistry & physics; Knowledge of basic thermodynamics.

Course Objective:

1. To know different nonconventional energy resources.
2. To explain the different techniques of energy extraction from non conventional energy resources.
3. To understand and compare the different energy conversion technique.
4. To chose and design the energy conversion plant after survey the suitability fruitfulness of the plant.

Course Outcome: Student will be able to

EI703B.1: Gain knowledge of different nonrenewable sources.

EI703B.2: Realize solar energy applications using photo voltaic cells.

EI703B.3: Analyses the performance and testing of different energy resources.

EI703B.4 Select the design parameters of the nonconventional energy plants.

Module I:Introduction to Energy Sources: [2L]

Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development;
strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment.

Module II: Solar Energy & Applications photovoltaic cell: [10L]

Solar radiation: beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length.
Flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance;
Photovoltaic - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems**.** Types and performance characteristics. Characteristics equivalent circuit photo voltaic effect photo voltaic for battery charging applications.

Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, Solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. Solar cell power plant and limitations Solar collectors.

Module II: Biomass Energy Systems: [4L]

Availability of Biomass and it's conversion theory, production processes, Gasification, Anaerobic Digestion, Pyrolysis, Biogas, performance analysis and testing.

Module III:Wind energy: [8L]

Wind distribution, principles of wind energy conversion basic components of wind energy conversion

advantages and disadvantages, principles of operation of wind turbines, types of wind turbines and characteristics, Generators for wind Turbines, Control strategies. Performance and limitations of energy conversion systems.

Module IV: Geothermal Ocean, wave & Tidal energy: [8L]

Resources of geothermal energy, thermodynamics of geothermal energy conversion- electrical conversion, non electrical conversion, environmental considerations.

Principle of working of various types of fuel cells and their working, performance and limitations.

Ocean Thermal Energy conversion: Availability, theory and working principle, performance and limitations.

Wave and Tidal wave: Principle of working, performance and limitations, waste recycling plants.

Text Books:

1.G.D.Rai"Non Conventional Energy sources", Khanna publishers, New Delhi, 1999.

2.G.N.Tiwari and M.K.Ghosal, "Renewable energy resources, Basic principles and applications", Narosa Publishing house, New Delhi.

3.S.N.Badra, D.Kastha and S.Banerjee"Wind electricalSustems", Oxford University press, New Delhi.

4.M.V.R.KoteswaraRao"Energy resourcesConventional&Non conventional" BS publications Hyderabad, 2004.

5.Gilbert M.Masters "Renewable and Efficient electric power systems" Wileyinterscience Publications, 2004

CO-PO matrices of courses EI 703B:

	PO1	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
EI703B.1	3	-	3	**2**	**-**	**2**	1	**-**	**-**	**-**	1	1
EI703B.2	**3**	**2**	1	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	-
EI703B.3	3	1	1	**-**	1	2	-	**1**	**-**	**-**	**-**	-
EI703B.4	1	2	2	**3**	2	1	-	**-**	**1**	**1**	**-**	2

.

.**ANALYTICAL INSTRUMENTATION**

CODE: EI703C
CONTACT: 3P

CREDITS: 3
TOTAL CONTACT HOURS: 30

Prerequisite: Knowledge of measurement methods of various process parameters

Course Outcome:

After completion of the course, the students will be able to

1. EI703C.1: Determine the physical properties of samples like pH, viscosity, humidity and moisture

2. EI703C.2: Quantitatively measure the composition of gas and liquid samples.

3. EI703C.3: Apply analytical techniques to accurately determine the elements present in the given sample using spectroscopic methods.

4. EI703C.4: Apply and use chromatography in real time industrial environments.

Module I: [6L]

Introduction to Analytical Instrumentation: Classification, types of Instrumental methods
Measurement of Humidity: dry & wet psychrometer, hair hygrometer, Electrolysis type hygrometer
Moisture: electrical conductivity type, capacitive method type, IR method
Viscosity: Saybolt's viscometer, rotameter type viscometer, Searle's rotating cylinder type
Density: pressure head type, buoyancy effect type, radioactive type, photoelectric type, displacer type
Gas Analysis: a) Thermal conductivity method
b) Heat of Reaction method.
Oxygen Analysis: a) Magneto Dynamic instrument (Pauling cell)
b) Thermomagnetic type or Hot wire type instrument.
c) Zirconia oxygen analyzer.

Module II: [8L]

Liquid analysis: a) Electrodes-Ion selective, Molecular selective types- their variations.
b) pH analysis: pH electrodes, circuit for pH measurement and applications.
c) Conductivity cells – standards, circuits.
d) Polarography- apparatus, circuits and techniques-pulse polarography, applications
e) Colorimetry

Module III: [10L]

Spectroscopic Methods: Introduction, Laws relating to absorption of radiation, Molecular Absorption Spectroscopy in UV & VIS ranges: sources, wavelength selectors, sample container, detectors Spectrophotometers (Single beam & Dual beam arrangement)
Atomic Absorption & Emission spectroscopy : Atomizers, sources, single & dual beam arrangement.
Atomic X Ray spectrometry : Absorption & diffraction phenomena, sources, detectors, techniques. IR Spectroscopy : sources, monochromators, detectors. IR Spectrometer, FT-IR spectrometers.
Introduction to NMR

Module IV: [6L]

Chromatography :Introduction, basic definitions, some relationships. Gas chromatography : basic parts, columns ,detectors, techniques. LC : types, HPLC : basic parts, sample injection system, column, detectors, Applications..

Books:

Principles of Industrial Instrumentation- D.C. Patranabis, Publisher: Tata McGraw Hill
Analytical Instrumentation- B.G. Liptak
Principles of Instrumental Analysis- Skoog, Holler, Nieman, Publisher: Thomson Brooks/Cole
Introduction to Instrumental Analysis- Robert D. Braun, Publisher: Pharma Book Syndicate
Handbook of Analytical Instruments- R.S. Khandpur, Publisher: Tata McGraw Hill

CO-PO matrices of course EI703C:

COs for Course	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
EI703C.1	2	2	1	1	3	3	3	1	2	1	3	3	2	3
EI703C.2	2	3	1	1	3	3	2	1	2	1	1	3	2	3
EI703C.3	3	2	1	1	3	3	1	3	2	1	3	3	3	3
EI703C.4	2	2	1	1	3	3	1	1	2	1	2	3	3	3

COMPUTER NETWORKING
CODE :CS(EI)714A
CONTACT :3L
CREDIT : 3
TOTAL NO. OF LECTURES: 36

Prerequisite:
Familiarity and knowledge of Operating Systems and Computer Architecture
Also require little bit programming languages concepts like C, Java.

Course Objective:

To educate basic knowledge of networking technologies and network management concepts
To interpret the layering concepts in computer networks.

To analyze the functions of each layer and gain knowledge in different applications that use computer networks.
To emphasize the hand-on experience of network topology in a laboratory environment
To be familiar with contemporary issues in networking technologies.

Course Outcome:

CS(EI)714A .1: Understand OSI and TCP/IP models.
CS(EI)714A .2: Analyze MAC layer protocols and LAN technologies.
CS(EI)714A .3: Design applications using internet protocols.
CS(EI)714A .4: Implement routing and congestion control algorithms.
CS(EI)714A .5: Develop application layer protocols and understand socket programming

Module I: Introduction [6L]

Introduction (3L):

Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to wired and wireless network.

Physical Layer: [3L]

Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network;

Module II: Data Link Layer [10L]

Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop-and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go-Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sub-layer, The Channel Allocation. **[5L]**

Multiple Access Protocols **:** ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx , Bluetooth, RFID, Bridges, Virtual LANs, Switching**.[5L]**

Module III: Network Layer [10L]

IP Addressing, IPv_4 and IPv_6. Difference IPv_4 and $IPv_{6,\ Conversion}$ of IPv_4 and IPv_6 , Subnetting, Supernetting, Design Issues, Store-and-Forward Packet Switching, Virtual-Circuit and Datagram Networks, ARP, IP, ICMP, IPV6, BOOTP and DHCP–Delivery protocols Other Protocols such as mobile IP in wireless Network.**. [5L]**

Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Anycast Routing, : RIP, OSPF, BGP; Routing for Mobile Hosts**. [5L]**

Transport layer: [6L]

Process to Process delivery; UDP; TCP, SCTP, TCP RENO, TCP/IP in Wireless environment, Congestion control in TCP :Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. **[5L]**

Advanced topic such as Remote Procedure Call, Delay Tolerant Networks.**[1L]**

Module IV: Application Layer [4L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls

Socket Programming [2L]

Introduction to Socket Programming, UDP socket and TCP Socket

Text books:

B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP

Recommended books:

Kurose and Rose – " Computer Networking -A top down approach featuring the internet" – Pearson Education
Leon, Garica, Widjaja – "Communication Networks" – TMH
Walrand – "Communication Networks" – TMH.
Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

CO-PO Matrices of the course:

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI)714A.1	-	2	-	2	-	-	-	-	2	-	-	-
CS(EI)714A.2	-	2	-	-	-	-	-	-	2	-	-	-
CS(EI)714A.3	2	2	-	-	2	-	-	-	2	-	-	-
CS(EI)714A.4	2	2	-	-	2	2	-	-	2	-	-	-
CS(EI)714A.5	3	3	-	-	3	-	-	-	2	-	-	-

COMPUTER GRAPHICS AND MULTIMEDIA
CODE: CS(EI)714B
CONTACT:3L
CREDITS:3
TOTAL CONTACT HOURS:35

Prerequisite:

Computer Programming, Mathematics

Course Objective:

1.To develop an understanding and awareness how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
2.To become familiar with various software programs used in the creation and implementation of multi-media
3.To gain knowledge about graphics hardware devices and software used.
4.To understand the two-dimensional, three-dimensional graphics and their transformations.
5.To appreciate illumination and color models
6.To become familiar with understand clipping techniques

Course Outcome:

After completion of this course student will be able to

CS(EI)714B.1 Design and apply two dimensional graphics and transformations.
CS(EI)714B.2 Design and apply three dimensional graphics and transformations.
CS(EI)714B.3 Apply Illumination, color models and clipping techniques to graphics.
CS(EI)714B.4 Understood Different types of Multimedia File Format.

Module I:TWO-DIMENSIONAL GRAPHICS [7L]

Two dimensional geometric transformations, Matrix representations and homogeneous coordinates, composite transformations, Two dimensional viewing , viewing pipeline, viewing coordinate reference frame, window-to-viewport coordinate transformation, Two dimensional viewing functions, clipping operations, point, line, and polygon clipping algorithms.

Module II: ILLUMINATION AND COLOR MODELS [7L]

Height sources, basic illumination models, halftone patterns and dithering techniques, Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model, Colour selection. Output primitives, points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms, Pixel addressing and object geometry.

Module III:THREE-DIMENSIONAL GRAPHICS [7L]

Three dimensional concepts, Three dimensional object representations, Polygon surfaces, Polygon tables, Plane equations, Polygon meshes, Curved Lines and surfaces, Spline representations, Bezier curves and surfaces, B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations, Translation, Rotation, Scaling; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping.

Module IV: MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING [7L]

Multimedia basics, Multimedia applications, Multimedia system architecture, Evolving technologies for multimedia, Defining objects for multimedia systems, Multimedia data interface standards, Multimedia databases. Compression and decompression, Data and file format standards, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage and retrieval technologies.

Module V: HYPERMEDIA [7L]

Multimedia authoring and user interface, Hypermedia messaging, Mobile messaging, Hypermedia message component, Creating hypermedia message, Integrated multimedia message standards, Integrated document management, Distributed multimedia systems.

TEXT BOOKS:

Hearn Baker Carithers, - “Computer Graphics with Open GL”, Pearson New International Edition

REFERENCES:

Donald Hearn and Pauline Baker M, ―Computer Graphics”, Prentice Hall, New Delhi, 2007 [UNIT I – III]

Andleigh, P. K and Kiran Thakrar, ―Multimedia Systems and Design‖, PHI, 2003.[UNIT IV,V]

Judith Jeffcoate, ―Multimedia in practice: Technology and Applications, PHI, 1998.

Foley, Vandam, Feiner and Hughes, ―Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.

Jeffrey McConnel, ―Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, 2006.

Hill F S Jr., “Computer Graphics”, Maxwell Macmillan, 1990.

Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, ―Fundamentals of Computer Graphics, CRC Press, 2010.

William M. Newman and Robert F.Sproul, ― Principles of Interactive Computer Graphics, Mc Graw Hill 1978.

CO-PO Matrix of the Course:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI)714B.1	**2**	**3**	-	**2**	**1**	**2**	-	**1**	-	-	-	-
CS(EI)714B.2	**2**	**2**	**1**	-	**3**	-	**2**	-	**1**	-	-	-
CS(EI)714B.3	**2**	**2**	**3**	**3**	-	**1**	-	**1**	-	-	-	-
CS(EI)714B.4	**3**	**1**	**2**	**2**	**2**	-	**1**	-	-	-	-	-

OBJECT ORIENTED PROGRAMMING
CODE: CS(EI)714C
CONTACT: 3L
CREDITS: 3
TOTAL LECTURES: 36

Prerequisites:
Computer Fundamentals
Basic understanding of Computer Programming and related Programming Paradigms
Problem Solving Techniques with proper logic Implementation.
Basic Computer memory architecture with data accession.

Course Objective:

It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance)

Course Outcome:

CS(EI)714C.1: Design the process of interaction between Objects, classes & methods w.r.t. Object Oriented Programming using java.
CS(EI)714C.2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.
CS(EI)714C.3: Analyze various activities of different string handling functions with various I/O operations.
CS(EI)714C.4: Discuss basic Code Reusability concept w.r.t. Inheritance, Package and Interface.
CS(EI)714C.5: Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Module 1: [5L]

Introduction:

Object Oriented Analysis & Design-Concepts of object oriented programming language, Object, Class.**[1L];** Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class. **[1L] ;**Object Oriented Programming concepts - Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, Method. **[1L];** Properties of OOP- message passing, inheritance, encapsulation, polymorphism, Data abstraction. **[1L];** Difference between different OOPs Languages. **[1L].**

Module 2: [9L]

Java Basics:

Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables. **[1L] ;**Access specifiers, Operators, Control statements & loops. **[1L];** Array. **[1L] ;**Creation of class, object, method. **[1L];** Constructor- Definition, Usage of Constructor, Different types of Constructor. **[1L];** finalize method and garbage collection, Method & Constructor overloading. **[1L];** this keyword, use of objects as parameter & methods returning objects. **[1L];** Call by value & call by reference. **[1L];** Static variables & methods. Nested & inner classes. **[1L].**

Module 3:[4L]

Basic String handling & I/O :

Basic string handling concepts- Concept of mutable and immutable string, Methods of String class- charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(). **[1L];** toCharArray(), toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class- append(), capacity(), charAt(), delete(), deleteCharAt(). **[1L];**

ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString(). **[1L] ;**Command line arguments, basics of I/O operations – keyboard input using BufferedReader& Scanner classes. **[1L].**

Module 4: [8L]

Inheritance and Java Packages :

Inheritance - Definition, Advantages, Different types of inheritance and their implementation. **[1L] ;**Super and final keywords, super() method. **[1L];** Method overriding, Dynamic method dispatch. **[1L];** Abstract classes & methods. **[1L];** Interface - Definition, Use of Interface. **[1L];**

Multiple inheritance by using Interface. **[1L] ;**Java Packages -Definition, Creation of packages. **[1L];** Importing packages, member access for packages. **[1L]**

Module 5: [10L]

Exception handling, Multithreading and Applet Programming :

Exception handling - Basics, different types of exception classes. Difference between Checked & Unchecked Exception. **[1L];** Try & catch related case studies.**[1L];** Throw, throws & finally. **[1L];** Creation of user defined exception. **[1L];** Multithreading - Basics, main thread, thread life cycle.**[1L];** Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), isAlive().**[1L] ;**Thread priorities, thread synchronization.**[1L];**Interthread communication, deadlocks for threads**[1L];** Applet Programming - Basics, applet life cycle, difference between application & applet programming**[1L];** Parameter passing in applets. **[1L]**

Recommended Books:

Textbooks:

Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH

E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

References:

R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.

Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India.

CO-PO Matrix of the Course:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI)714C.1	3	3	2	-	-	-	-	-	-	-	-	-

CS(EI)714C.2	**3**	**2**	-	-	-	-	-	-	-	-	-	-
CS(EI)714C.3	**3**	**3**	**3**	-	-	-	**2**	-	**2**	-	-	-
CS(EI)714C.4	-	-	**2**	-	-	-	-	-	-	-	-	-
CS(EI)714C.5	-	-	-	-	**2**	-	-	-	**2**	**2**	**2**	-

TELEMETRY AND REMOTE CONTROL LAB
CODE: EI 791
CONTACT: 3P
CREDITS: 2
Course Outcome:

After completion of the laboratory course students will be able to:

EI 791.1: Recognize and explain basic computational properties of remote sensing data acquisition, storage, and processing.
EI 791.2: Apply mathematical relationships describing fundamental physical, geometric, and computational principles relevant to remote sensing.
EI 791.3: Recognize and explain at a basic level fundamental physical principle of remote sensing.
EI 791.4: Explain EM radiation interactions vary across a limited number of substances, geometries, and temperatures; and geometric properties of photographs and images.
EI 791.5: Demonstrate proficiency and conceptual understanding in using software or manual techniques to carry out remote sensing image processing and analysis through a series of laboratory exercises and reports.

Experiments:

1. Study of voltage telemetry system using a process variable transducer.
2. Study of 4-20 mA current telemetry system: 2 wire and 3 wire systems.
3. Study of a frequency telemetry system using a VCO and a PSD.
4. Study of a FDM and Demultiplexing system using wire transmission for 2 to 4 channels.
5. Study of a PCM system.
6. Study of a Bio – Telemetry System.
7. Study of a (wireless) remote control system.
8. Study of Computerized control wireless telemetry system.

CO-PO Matrix of the Course:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
EI 791.1	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

EI 791.2	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
EI 791.3	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
EI 791.4	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
EI 791.5	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**

COMPUTER NETWORKING LAB
CODE: CS(EI)784A
CONTACT :3P
CREDIT POINT: 2

Course Outcome(s)
CS(EI)784A .1: Demonstrate the socket program using TCP & UDP.
CS(EI)784A .2: Develop simple applications using TCP & UDP.
CS(EI)784A .3: Develop the code for Data link layer protocol simulation.
CS(EI)784A .4: Examine the performances of Routing protocol.
CS(EI)784A 5: Experiment with congestion control algorithm using network simulator

Experiments:

Familiarization of UNIX or Linux environment, UNIX or Linux general Commands specially Network Commands. Familiarization of Internetworking - Network Cables - Color coding - Crimping. Internetworking Operating Systems - Configurations. **[6L]**
Implementation of flow control mechanisms [3L]
Socket Programming using TCP and UDP **[15L]**
Implementing routing protocols such as RIP, OSPF. **[2L]**
Familiarization of advanced simulators like Packet Tracer, NS2/NS3, OMNET++, TinyOS**[4L]**
Server Configuration: only web server (If time permit..instructor can do more than that) **[6L]**

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI)784A.1	3	3	3	2	3	2	1	-	3	2	2	3

CS(EI)784A.2	3	3	3	2	3	3	2	3	3	2	2	3
CS(EI)784A.3	3	3	3	2	2	1	2	1	3	2	2	3
CS(EI)784A.4	3	3	3	1	2	2	1	3	3	2	2	3
CS(EI)784A.5	3	3	3	2	2	2	1	2	3	2	2	3

COMPUTER GRAPHICS AND MULTIMEDIA LAB
CODE : CS(EI)784B
CONTACT HOURS :3P
CREDITS:2

Course Outcome
After completion of this course student will be able to
CS(EI)784B**.1:** Create 3D graphical scenes using open graphics library suits

CS(EI)784B**.2:** Implement image manipulation and enhancement

CS(EI)784B**.3:** Create 2D animations using tools

Course Content:
IMPLEMENT THE EXERCISES USING C /C++/ OPENGL / JAVA

Implementation of Algorithms for drawing 2D Primitives – Line (DDA, Bresenham) – all slopes, Circle (Midpoint)
2D Geometric transformations – Translation, Rotation Scaling , Reflection Shear, Window-Viewport Composite 2D Transformations
Line Clipping
3D Transformations - Translation, Rotation, Scaling.
3D Projections – Parallel, Perspective.
Creating 3D Scenes.
Image Editing and Manipulation - Basic Operations on image using any image editing software, Creating gif animated images, Image optimization.
2D Animation – To create Interactive animation using any authoring tool.
VLC and Video Streaming
HTML 5 and media publishing with Projects based learning.Web document creation using Dreamweaver.
Creating Animation using Flash.

CO-PO Mapping

CO	PO	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

	1											
CS(EI)784B**.1**	3	3	3	1	-	1	1	-	-	-	2	2
CS(EI)784B**.2**	3	3	3	1	-	2	2	-	-	-	2	2
CS(EI)784B**.3**	3	3	3	1	1	1	2	-	-	-	2	2

Object Oriented Programming Lab
CODE: CS(EI)784C
CONTACT: 3P
CREDITS: 2
Course Outcome(s)
CS(EI)784C .1 Implement the process of object orientation in java with the help of Class-object-Constructor relationship in Object Oriented Programming
CS(EI)784C.2 Implement basic knowledge of code reusability with the help of Java in Object Oriented Programming.
CS(EI)784C.3 Analyze the significance of various keywords w.r.t Encapsulation and polymorphism technique in OOPs.Implements exception handling in Java.
CS(EI)784C.4 Discuss basic Data abstraction concept w.r.t. Inheritance, Package and Interface
CS(EI)784C.5 Implement Exception handling, Multithreading and Applet (Web program in java) programming concept in Java
Experiments:
Assignments on Basic Object oriented programming in java using class-object & method, constructor (Default constructor, parameterized constructor, Copy constructor), method/constructor overloading.
Assignments on Inheritance (Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance) method overriding.
Assignments on Dynamic method Dispatch, encapsulation, this keyword, super keyword &super () method, static keyword, final keyword.
Assignments on developing Data abstraction- Abstract class & abstract methods, interfaces- multiple inheritance, extending interfaces.
Assignments on creating and accessing packages, exception handling (Different case studies of try-catch-finally block, chained exception, used defined exception with throw and throws keyword.)
Assignments on multithreaded programming-Thread creation, different method implementation of Thread life cycle (yield(),suspend(),resume(),sleep(n),join(),isAlive(), wait(), notify()), Thread priority, Thread Synchronization.
Assignments on applet programming.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS(EI)784C.1	**3**	-	**2**	-	-	-	-	-	-	-	-	-
CS(EI)784C.2	**3**	**2**	**2**	-	-	-	-	-	-	-	-	-
CS(EI)784C.3	-	**3**	**3**	**3**	-	-	**2**	-	-	-	-	-
CS(EI)784C.4	**3**	**3**	**2**	-	-	-	-	-	-	-	-	-
CS(EI)784C.5	-	-	**3**	-	**2**	-	-	-	**2**	**2**	-	-

FOREIGN LANGUAGE
Code: MC781
Contacts: 2L
Credits: 0
Total contact hours: 20

Pre-requisites: Basic high school level reading, writing and communication skills in English.

Course outcomes: By the end of the course the students will be able to
MC781.1 Read basic French and interpret the meaning
MC781.2 Construct simple sentences in French
MC781.3 Interact with others and hold simple conversations in French

The proposed syllabus is as follows:

Unit 1 100 marks

Vocabulaire

L' alphabet français (The Alphabets)
Les nombres (cardinaux et ordinaux) (Numbers)
Les mois de l'année (The Months of the Year)
Les saisons (The Seasons)
Les jours de la semaine (The Days of the Week)
Les couleurs (The Colours)
La famille (The Family)
Les nationalités (The Nationalities)

Grammaire
Les Verbes—*être, avoir* et *aller*
Nouns—Gender and Number

Les articles (définis, indéfinis, contracté et partitif)
Les adjectifs—possessifs et demonstraifs

Français Intéractif (Listening and Speaking)
Les salutations
Les forms de politesse
Présentez-vous (About Yourself)

Unit 2

Vocabulaire
L'heure (the time)
La maison (the house)
Le corps (the body)
Les vêtements (clothes)
Les professions (professions)
Les loisirs (pastimes)
Le sport (Sports)

Grammaire
Le Verbes—*voir, savoir, venir, aller, sortir, connaître, partir.*
Les négations
Le futur
Les interrogatifs

Français Intéractif (Listening and Speaking)
Décrivez les images
La dictée
Liséz le journal

Unit 3

Vocabulaire
La nourriture (Food)
Les repas (Meals)
Les légumes (Vegetables)
Les fruits (Fruits)
Les fleurs (Flowers)
Les animaux (Animals)
Les oiseaux (Birds)

Grammaire
Les adverbes
Les adjectifs
Les prépositions

Français Intéractif (Listening and Speaking)
Ecoutez la radio/la télévision

Dialogues—À la médecin, au café, a la gare

Unit 4

Vocabulaire
Le jardin (The Garden)
Le temps (the weather)
Les voyages (Travel)
La ville (the City)
Les vacances (Holidays)

Grammaire
Pronoms interrrogatifs
Mood—subjonctif et l'impératif

Français Intéractif (Listening and Speaking)
Se présenter (expressing ideas/opinions on general topics)
Ecoutez le programme sur la radio/la télévision

Recommended Texts:
*Le Nouveau Sans Frontières-1 (*Paris: CLE International, 1999)
Dondo, *Modern French Course* (1930, Oxford:Oxford UP, 1999)
Dictionnaire Larousse

Mapping of Course:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
MC781.1	2	-	-	3	**-**	3	2	2	3	3	**-**	**3**
MC781.2	2	3	3	3	**-**	3	3	3	2	3	**-**	3
MC781.3	1	3	3	3	**-**	2	2	2	2	3	**-**	2

Autonomy Curriculum and Syllabus of B.Tech Programme
Implemented from the Academic Year 2016
EIE Department
4th Year: 8th **Semester**

THEORY:

Sl. no.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	HS	HU804	Industrial &Financial Management	2	0	0	2	2
2	PE	EI801A/ EI801B/	Plant Automation/ Embedded System Design/	3	0	0	3	3
3	PE	EC(EI) 802A/ EC(EI)802B/	Mobile Communication/ VLSI & Microelectronics/	3	0	0	3	3
Total Theory							8	8

PRACTICAL & SESSIONAL:

Sl.	Field	Code	Subjects	Contact hours/week				Credit points
				L	T	P	Total	
1	PC	EI 891	Instrumentation & Control Lab	0	0	3	3	2
2	PW	EI 892	Project-2	0	0	12	12	6
3	PW	EI893	General Viva-voce					4
Total sessional							15	12
Total 8th semester							23	20

Industrial & Financial Management
Paper Code: HU804
Total Contact Hours: 42
Credit: 2

Pre requisite:

Mathematics, English

Course Objective:

Introduce students to financial management and its importance and its applications in business, their relationship with the business environment and the role and functions of chief financial officer.
Introduce students to financial planning, and objectives, and its benefits, and the types of areas and stages of financial planning, and the factors that help the success of financial planning.
Introduce students to the methods used in financial planning to assess the short-term financial needs.
Introduce students to time value of money and its relationship to the objectives of financial management, rationale for using the time value of money, and simple and compound interest and how to calculate it, and also to understand the present value of the future payments.
Introduce students to major financial statements of businesses as well as the definition of the purposes and tools of financial analysis and its importance in the financial control process. Introduce students to the basics of investing in securities through exposure to the following points: knowledge of financial markets, and their components, and functions of the financial market, and the parties worked in the financial markets, the stock traded in the money markets and capital markets, then find out the efficiency standards of the financial market, as well as valuations of Shares and bonds.
Giving students how to apply full financial cycle and makes the necessary adjustments on service and commercial installations.
Giving student's of Application processors to finance small projects.

Course Outcome :

After completion of this course students will be able to

HU804.1: Explain and describe various technology-based business models and the dynamics of value creation, value proposition, and value capture in industrial enterprises.

HU804.2: Select, interpret and use different costing techniques as a basis for decisions in various business situations.

HU804.3: Understand the basic principles of financial accounting and reporting.

HU804.4: Produce and interpret an industrial company’s Annual Statement, at a basic level.

HU804.5: Describe the operations of an industrial enterprise from various perspectives, and analyze its basic strengths and weaknesses based on concepts from the field of Industrial Management.

HU804.6: Explain how the industrial company markets and price it's products considering GST.

MODULE I[12L]:
Introduction to Accounting, Important Definitions, Basic concepts and conventions, Types of Accounts with Golden Rule of Accounting, Journal, Ledger and Trial Balance, Preparation of Trading Account, Profit & Loss A/C and Balance Sheet for business organizations.

MODULE II[13L]:
Financial Management, Introduction to Financial Management, Introduction, Definition and concept, scope, objective, functions of Finance Manager. Ratio Analysis: Definition, Objectives, Advantages &Disadvantages.
Classification of Ratios: Liquidity ratios, Capital Structure ratios, Activity ratios & Profitability Ratios, Capital Budgeting: Nature of Investment Decision, Importance of Capital Budgeting, capital budgeting process, Investment criteria, payback period, Rate of return, cash flow, discounting cash flow NPV method and IRR method, Benefit cost ratio, ARR.

MODULE III[8L]:
Cost Accounting: Introduction to cost accounting-Cost Centre, Cost unit, Elements of costs, Statement of cost or cost sheet, Marginal cost & C-V-P analysis with BEC. Budget and Budgetary Control: Concepts of Budget, Budgeting and budgetary control, advantages, disadvantages, uses, Master Budget, Zero Based Budget ,Cash budget, Flexible budget.

MODULE IV[5L]:
Working capital management**,** Introduction-working capital concept-financing working capital-importance of working capital-management of working capital-working capital cycle-management of different components of working capital-working capital forecast.

MODULE V[4L]:
Introduction to GST-Basic concept and application.

Text Books:
Financial Management, Khan & Jain, S. Chand
Management Accounting, Khan & Jain, S. Chand
Modern Accountancy, Haniff& Mukherjee, TMH

Reference Books:
1. An Introduction to Accountancy, S.N.Maheswari, Vikas publication
2. Cost Accounting: Theory and Practices, B. Banerjee, PHI
3. Financial Management, IM Pandey, Vikas

CO-PO Matrix of the course:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HU804.1	-	1	1	2	-	2	-	-	-	-	-	-
HU804.2	-	-	-	-	3	1	2	-	-	-	1	-
HU804.3	3	-	-	-	-	2	-	-	-	-	3	-
HU804.4	-	2	-	-	1	-	1	-	-	-	-	-
HU804.5	-	3	-	2	-	-	-	-	-	-	-	-
HU804.6	-	2	2	3	-	-	-	-	-	-	2	-

PLANT AUTOMATION
CODE: EI 801A
CONTACT: 3L
CREDITS: 3
TOTAL CONTACT HOURS: 32

Prerequisite: Knowledge of Process Control

Course Objective:

The objective of this course is to provide the student with basic skills useful in identifying the concepts of automated machines and equipment and describe the terms and phrases associated with industrial automation.

Course Outcome:

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

EI801A.1: understand the operational functions of PLC, DCS and SCADA.

EI801A.2: analyze Industrial Networking, Networking protocols and topologies.

EI801A.3: demonstrate the competence in maintaining and troubleshooting technology, detecting more serious problems, generating workable solutions to correct deviations and recognizing when to get additional help.

EI801A.4: analyze the automation technologies in different types of plants.

Module I: [4]

Introduction to Plant Automation, Architecture,Recapitulation Basic Components and Functions of DCS, PLC, HMI (OS and ES); ISO/OSI Reference Model; TCP/IP Basics, Industrial Ethernet, Fieldbus, Network Access Protocols, Network Topology and Arbitration Methods; Computer Integrated Processing; OPC and OLE Connectivity

Module II: [10]

Plant Automation System network Elements of Plant Automation System (PAS) : Smart Sensors, Sensor networks, Intelligent actuators, SCADA systems, I/O Modules (wired and wireless), RTUs, AS-Interface. Safety Interlocks, Sequence Controls PAS network and typical system architecture using the above elements PAS developed into MES (manufacturing execution systems) integrated with high level software

Module III: [6]

Automation Solutions: PLC based systems, HMI and SCADA based systems PC based automation systems, Safety in industries.

Module IV: **IIOT [4]**

Introduction, What is IoT, What is IIoT, Differences between IoT and IIoT, Evolution of IIoT, Architecture of IIoT, IIoT Characteristics, IIoT Platform, IIoT Protocols, Application Areas of IIoT,

Challenges: Adaptability, Scalability, Security; Benefits of IIoT

Module V: **Case Study (any two) [8]**

Paper Mill
Power Plant
Batch Processes
Steel Plant
Food processing industry

Books:

Process Automation Handbook : A Guide to Theory and Practice. J LOVE, Springer 2007
Overview of Industrial Process Automation, KLS Sharma, Elsevier, 2011
Automation Made Easy, P. G. Martin & H. Gregory, ISA, 2009
Industrial Automation, Circuit Design and components, D W Pessen
Serial Networked Field Instrumentation, JR Jordan, Wiley Series - Measurement Science and Technology
Springer Handbook of Automation

CO-PO matrices of the course EI801A:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
EI 801A.1	3	3	1	0	3	0	0	0	0	0	0	0	3	2
EI 801A.2	2	2	0	0	0	1	0	0	0	0	0	0	1	1
EI 801A.3	2	1	1	1	0	2	0	0	0	0	0	0	3	1
EI 801A.4	2	1	0	0	1	0	1	0	0	0	0	0	1	2

EMBEDDED SYSTEM DESIGN
CODE: EI801B
CONTACT: 3L
CREDITS: 3
TOTAL CONTACT HOURS: 30

Prerequisite: Knowledge of basic microprocessor and microcontroller.

Course Objective:

1. An ability to design a system, component, or process to meet desired needs within realistic constraints.

2. Ability to understand microcontroller, microcomputer, embedded system.

3. Understand different components of a micro-controller and their interactions.

4. To become familiar with the programming environment used to develop embedded systems.

5. Understand key concepts of embedded systems like IO, timers, interrupts, interaction with peripheral devices

6. Learn debugging techniques for an embedded system

Course Outcome:

After completion of the course, the students will be able to

EI801B.1: Understand the architecture and classifications of embedded system and the related programming.
EI801B.2: Understand the concepts of embedded systems like IO, timers, interrupts, interaction with peripheral devices
EI801B.3: Choose case-specific debugging technique for an embedded system.
EI801B.4: Design various real time systems using embedded systems.

Module I: **[3L]**
Introduction to Embedded System: Embedded system Vs General computing systems, Purpose of Embedded systems, classifications of embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC

Module II: **[7L]**
Serial and parallel communication: devices and protocols, wireless communication: devices and protocols, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth.

Module III: **[5L]**
Program Modeling Concepts ; Fundamental issues in Hardware software co-design, Unified Modeling Language(UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.

Module IV: **[5L]**

Real Time Operating Systems: Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS.

Module V: [10L]
PIC microcontroller: introduction, architecture, comparison of PIC with other CISC and RISC based systems and microprocessors, assembly language programming, addressing modes, instruction set, Interfacing with various sensors and actuators using PIC microcontroller. Programming concepts and embedded programming.

Text Books:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)

2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)

3. Embedded Systems : Rajkamal (TMH)

4. Embedded Systems : L. B. Das (Pearson)

5. Embedded System design : S. Heath (Elsevier)

6. Embedded microcontroller and processor design: G. Osborn (Pearson)

7. Programming PIC microcontrollers with PIC basic by chuck helebuyck

8. PIC microcontrollers-programming in basic by Milan verle

CO-PO matrices of the course EI801B:

COs for Course	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS O 1**	**PSO 2**
EI801B.1	3	-	2	1	2	-	-	-	-	-	-	-	1	1
EI801B.2	2	1	3	1	-	-	-	-	-	-	-	-	2	-
EI801B.3	2	2	3	1	-	-	-	-	-	-	-	-	1	2
EI801B.4	3	2	2	-	-	-	-	-	-	-	-	-	1	2

VIRTUAL INSTRUMENTATION
CODE: EI801C
CONTACT: 3P
CREDITS: 3
TOTAL CONTACT HOURS: 31
Prerequisite:
Basic Electricity, Basic electronics, programming languages, Communication engineering

Course Objective:

The objective of this course is:

to introduce the concept of virtual instrumentation

to develop basic VI programs using loops, case structures etc. including its applications in image, signal processing and motion control

Course Outcome:

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

EI801C.1: To demonstrate the working of LabVIEW.

EI801C.2: To explain the various types of structures used in LabVIEW.

EI801C.3: To analyze and design different type of programs based on data acquisition.

EI801C.4: To demonstrate the use of LabVIEW for signal processing, image processing etc.

Module I: **[8]**

Review of Virtual Instrumentation: Historical perspective, Block diagram and Architecture of Virtual Instruments Data, Review of measurement systems- analog systems, digital systems

Flow Techniques: Graphical programming in data flow, Comparison with conventional programming.

Module II: **[8]**

VI Programming Techniques: VIs and sub-VIs, Loops and Charts, Arrays, Clusters and graphs, Case and sequence structures, Formula nodes, Local and global variables, Strings and file I/O.

Module III:

Data Acquisition Basics: ADC, DAC, DIO, Counters and timers**.** **[8]**

Data acquisition boards – Serial ports: RS-232, USB ; Parallel ports: IEEE-1284, GPIB standard IEEE-488.2 , System buses, Interface buses: PCMCIA, VXI, SCXl, PXI, etc.

Module IV: **[8]**

Virtual instrumentation in LabVIEW: Introduction (Front Panel, Block Diagram)

Data Types, Operators, Instructions, Graphics, Virtual Instrument projects

Books:

1. Johnson, G., LabVIEW Graphical Programming, McGraw–Hill (2006).

2. Wells, L.K. and Travis, J., LabVIEW for Everyone, Prentice Hall Inc. (1996).

3. Gupta, S. and Gupta, J.P., PC Interfacing for Data Acquisition and Process Control,

Instrument Society of America (1988)

CO-PO matrices:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2
EI801C.1	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

EI801C.2	**1**	**-**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
EI801C.3	**-**	**3**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
EI801C.4	**1**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

MOBILE COMMUNICATION
CODE: EI 802A
CONTACTS: 3L
CREDITS: 3
TOTAL NO. OF LECTURES: 34

Prerequisite: Analog and Digital Communication System

Course Objective:

1. To make students familiar with basics of mobile communication systems.
2. To choose system (TDMA/FDMA/CDMA) according to the cost of installation, complexity, speed of propagation, channel properties etc.
3. To compare between mobile communication and static communication.
4. To identify the advantages, limitations and design techniques of 2G and 3G wireless mobile communications.
5. This subject can be considered as a prerequisite for the course in Wireless LANs.

Course Outcome:

EI802A.1: By the end of the course, the student will be able to analyze and design wireless and mobile cellular systems.
EI802A.2: By the end of the course, the student will have the ability to work in advanced research wireless and mobile cellular programs.
EI802A.3: By the end of the course, the student will be able to realize all the applications of wireless protocols
EI802A.4: By the end of the course, the student will be able to design the mobile networks.

Module 1

Introduction: Vision of mobile communication. Historical perspective in the development of mobile communication - 1G to 4G and beyond (5G). Wireless standards. [3]

Module 2

Cellular system principle and planning: Cellular concepts - cell structure, frequency reuse, cell splitting and channel assignments, cellular network architecture. Location updating and Call setup. Hand off techniques and power control. Selection of uplink and downlink frequencies. [8]

Module 3

Global System of Mobile communication (GSM): System overview, GSM architecture. Mobility management. Network signaling. [6]

Module 4

GSM system architecture and function partitioning. Introduction to Mobile System (MS). Base Station System (BSS). Home Location Register (HLR), Visiting Location Register (VLR), Equipment Identity Register (EIR). [6]

Module 5

GSM radio aspects: Wireless medium Access Control – FDMA, TDMA, CDMA, WCDMA. GSM radio standards. Frequency band and channel allocation. [5]

Module 6

Mobile data communication. Wireless LANS (WLANS). IEEE 802.11 Standards, Mobile IP [4]

Module 7

Introduction to GPS systems. [2]

Text Books:

1. Mobile Cellular Telecommunications – Analog & Digital Systems, William C. Y. Lee, McGraw Hill, 1995
2. Mobile Communications Design Fundamentals, William C. Y. Lee, A Wiley-lnterscience Publication
3. Mobile Communications, J. Schiller, Pearson Education

Reference Books:

1. Wireless Communications, T. S. Rappaport, Prentice Hall International, 2002.
2. Wireless Network Evolution, V. K. Garg - Pearson Ed.

CO-PO matrices

COs	**PO1**	**PO 2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
EI802A.1	1	2	1	2	1	3	3	1	2	2	1	1	3	2
EI802A.2	2	2	1	1	3	0	1	0	2	3	3	2	1	3
EI802A.3	2	2	1	2	0	1	2	1	3	2	3	3	2	1

EI802A.4	2	2	1	3	0	1	3	2	2	2	3	3	2	3

VLSI & MICROELECTRONICS
CODE: EC(EI)802B
CONTACTS: 3L
CREDITS: 3
TOTAL NO. OF LECTURES: 34

Prerequisite: Concept of courses Solid State Devices ; Analog Electronic Circuit; Digital Electronic and Circuit

Course Objective:

Objective of the course is:
to motivate students to design VLSI circuits in the area of digital , analog
to encourage for the design of IC with low power and high speed .

Course Outcome:

COs	CO Statement
EC(EI)802B.1	Able to describe scale of integration – SSI ,MSI,LSI,VLSI, Moor's Law , scaling , short channel effect ,VLSI design flow, FPGA architecture and construct gate level circuit with PAL & PLA concept.
EC(EI)802B.2	Able to analyze CMOS inverter voltage transfer characteristics with the parameters – V_{IL} , V_{IH} , V_{OL} , V_{OH} , V_{th} and based on the knowledge of digital circuit design methodology like – CMOS , Pass transistor , TG , DCVSL , dynamic logic , NORA , able to construct schematic of combinational , sequential circuit , SRAM , DRAM cell using MOSFET
EC(EI)802B.3	Based on the fundamental concept of MOSFET characteristics and model , able to calculate value of resistance of current source ,MOS diode , current of current mirror circuit , voltage of references (voltage divider , threshold voltage and band gap), emulate resistance of switch capacitor circuit , gain of switch capacitor integrator and 1st order switch capacitor filter .
EC(EI)802B.4	With the help of MOS transistor model, able to calculate the value of parameters to design CMOS differential amplifier and two stage OP-AMP .

EC(EI)802B.5 Able to describe fabrication steps of IC and construct stick diagram & layout of CMOS inverter and basic gates based on lambda and micron design rules.

EC(EI)802B.6 Able to calculate gate delay, dynamic power, short circuit power and leakage power and total power consumption across CMOS inverter circuit based on the derived expression of delay and power.

Course Content:

Module –I: Introduction to VLSI Design: (8L)

VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.

Module-II : MOS structure: (10L)

E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat band voltage, Potential balance & Charge balance, Inversion, MOS capacitances. Three Terminal MOS Structure: Body effect. Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation). Scaling in MOSFET, General scaling, Constant Voltage & Field scaling.] CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.

Module-III: Micro-electronic Processes for VLSI Fabrication: (10L)

Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator Layout Design Rule: Stick diagram with examples, Layout rules.

Module –IV: Hardware Description Language:

VHDL or Verilog Combinational & Sequential Logic circuit Design. (6L)

Text Books:

1. Digital Integrated Circuit , J.M.Rabaey, Chandrakasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuits Analysis and Design , S.M.Kang & Y.Leblebici,TMH.
3. CMOS Analog Circuit Design , Allen & Holberg , Oxford
4. Design of Analog CMOS Integrated Circuits , Behzad Razavi , TMH .

Reference Books:

Microelectronic Circuits , Sedra & Smith , Oxford
Introduction to VLSI Circuits and System , Uyemura , Wiley
VLSI Design , Debaprasad Das , Oxford
VLSI Design and EDA Tools , Angsuman Sarkar , Swapnadip De , C.K. Sarkar , Scitech
VLSI Design Techniques for Analog and Digital Circuits , Geiger , Allen , Strader , TMH

Mapping of COs with POs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

EC(EI)802B.1	**2**	**2**	**3**	**1**	**1**	**-**	**-**	**1**	**2**	**1**	**1**	**1**
EC(EI)802B.2	**3**	**3**	**3**	**3**	**1**	**-**	**-**	**1**	**2**	**1**	**1**	**3**
EC(EI)802B.3	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**1**	**2**	**1**	**1**	**3**
EC(EI)802B.4	**3**	**3**	**3**	**1**	**1**	**-**	**-**	**1**	**2**	**1**	**1**	**3**
EC(EI)802B.5	**3**	**3**	**3**	**1**	**1**	**-**	**-**	**1**	**2**	**1**	**1**	**3**
EC(EI)802B.6	**3**	**3**	**3**	**2**	**1**	**-**	**-**	**1**	**2**	**1**	**1**	**2**

MECHATRONICS
CODE:EC(EI)802C
CONTACTS : 3L+0T
CREDITS : 3
TOTAL CONTACT HOURS: 30

Prerequisite: Knowledge of basic electrical, sensors & transducers, microprocessors and microcontrollers, control system etc's are required .

Course Objective:

1.Have a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies

2. Be able to design, analyze, and test "intelligent" products and processes that incorporate appropriate computing tools, sensors, and actuators.

3. Be able to demonstrate professional interaction and communicate effectively with team members.

4. Be able to work efficiently in multidisciplinary teams.

5. Be prepared for a variety of engineering careers, graduate studies, and continuing education .
6. Practice professional and ethical responsibility, and, be aware of the impact of their designs on human kind and the environment.

Course Outcome:
EC(EI)802C.1:Mechatronics graduate will be able to Employ the knowledge of mathematics, science, and engineering.

EC(EI)802C.2: able to Design mechatronics component, system or process to meet desired needs.

EC(EI)802C.3: Define and solve engineering problems.

EC(EI)802C.4: Use the techniques, skills, and modern mechatronics engineering tools necessary for engineering practice.

EC(EI)802C.5: Identify and evaluate ethical ramifications and professional responsibilities in a variety of situations.

EC(EI)802C.6: Discuss the impact of engineering on society, safety, and environment in relation to contemporary issues.

Module I:Introduction to Mechatronics: [4L]

Introduction to Mechatronics: Definition, Mechatronics in design and manufacturing, Comparison between Traditional and Mechatronic approach; Concurrent engineering.

Module II: Electromechanical Drives : [6L]

Electrical Drives: Stepper motors, servo drives. Mechanical Drives: Different mechanisms, Ball screws, Linear motion bearings, Transfer systems.

Module III: Robot End effecters & Actuators [6L]

Types, mechanical grippers, other types of grippers, Tools as end effecters. Characteristics of actuating systems, Actuating System – Hydraulic devices, pneumatic devices, electric motors, other special actuators.

Module IV: Introduction of robot [6L]

Definition of robot, classification of robots according to coordinate system and control method, Main components of robots – manipulator, sensors, controller etc, Robot characteristics – payload, reach, repeatability, accuracy, resolution.

Module V: Sensors and Artificial Intelligence [8L]

Characteristics of Sensors, Position sensors, velocity sensors, acceleration sensors, force and pressure sensors, force and torque sensors, micro switches, touch and slip sensors, non-contact proximity sensors, Robot Vision System, Robot programming Languages – VAL, AML/2, ARM BASIC.

Text Books

1. N.P. Mahalik, Mechatronics, Tata McGraw Hill Publication

2. W. Bolton, Mechatronics, Pearson Education

3. A. Smaili and F. Arnold, Mechatronics, Oxford University Press, Indian Edition

4. M.D. Singh and J.G. Joshi, Mechatronics, Prentice Hall of India Pvt. Ltd.

5. K.K. Appuu Kuttan, Mechatronics, Oxford University Press, New Delhi

6. HMT Ltd., Mechatronics, Tata McGraw Hill Publication

7. F.H. Raven, Automatic Control Engineering, McGraw Hill International.

CO-PO matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC(EI)802C.1	3	2	2	1	1	-	-	-		-	2	1
EC(EI)802C.2	1	2	3	-	2	-	-	-	-	-	-	-
EC(EI)802C.3	2	-	2	-	1							
EC(EI)802C.4	-	1	-	-	3	1	-	-	-	-	-	-
EC(EI)802C.5	-	-	-	-	-	-	1	2	-	-	-	-
EC(EI)802C.6	-	-	-	-	-	-	1	3	2	-	-	-

INSTRUMENTATION & CONTROL DESIGN LABORATORY
CODE: EI 891
CONTACT: 3P
CREDITS: 2

Course Outcome:

After completion of the laboratory course students will be able to:

EI 891.1: understand and analyze Instrumentation systems and their applications.
EI 891.2: demonstrate the procedure to design an instrument and system that meets desired specifications and requirements.
EI 891.3: apply the knowledge of signal conditioning to practical engineering problems.
EI 891.4: design a real control loop using the knowledge of Instrumentation and control.

Experiments:

1. Design and demonstrate general signal conditioning circuit to convert sensor output to 4-20 mA.
2. Design and fabrication of an instrument like
   a. thermal conductivity analyser
   b. piezo-electric accelerometer

3. Process Control Loop Design
   a. Flow Control
   b. Level Control

4. Design of a. amplifier
   b. counters (high frequency)

5. Signal to data converter design including coding for different sampling rates.
6. Controller (digital) design (designing of processor i.e., program) for different process transfer function Including dead time (Smith Predictor)

7. Sensor design and Simulation: specified sensor only

CO-PO matrices:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EI 891.1	3	2	2	1	1	2	-	-		-	2	1
EI 891.2	1	2	3	2	2	-	-	-	-	-	1	-
EI 891.3	2	3	2	2	1	1					1	1
EI 891.4	3	1	3	1	3	1	-	-	-	-	1	2