SYLLABUS

FOR

FOUR-YEAR B. TECH PROGRAMME

IN

ELECTRONICS & INSTRUMENTATION ENGINEERING

NAAC – A Grade

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING

COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous and Constituent College of BPUT, Odisha)

Techno Campus, MahalaxmiVihar, Ghatikia,

Bhubaneswar-751029, Odisha,

INDIA www.cet.edu.in

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1st SEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Basic Science Course	UBSCH101	CHEMISTRY	3	1	0	4	30	70	0	100
2	Basic Science Course	UBSMH102	MATHEMATICS - I	3	1	0	4	30	70	0	100
3	Engineering Science Course	UESCS103	PROGRAMMING FOR PROBLEM SOLVING	3	0	0	3	30	70	0	100
4	Basic Science Course	ULCCH101	CHEMISTRY LAB	0	0	3	1.5	0	0	100	100
5	Engineering Science Course	ULCCS102	PROGRAMMING FOR PROBLEM SOLVING LAB	0	0	4	2	0	0	100	100
6	Engineering Science Course	ULCME103	ENGINEERING GRAPHICS AND DESIGN LAB	1	0	4	3	0	0	100	100
7	Humanities &Social Sciences	UHSMH105	ENGLISH	2	0	0	2	30	70	0	100
8	HS	ULCMH104	ENGLISH LAB	0	0	2	1	0	0	100	100
							20.5				**800**
7	**Mandatory Course**		**Induction Programme**								

2nd SEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Basic Science Course	UBSPH201	PHYSICS	3	1	0	4	30	70	0	100
2	Basic Science Course	UBSMH202	MATHEMATICS-II	3	1	0	4	30	70	0	100
3	Engineering Science Course	UESEE203	BASIC ELECTRICAL ENGG.	3	1	0	4	30	70	0	100
4	Basic Science Course	ULCPH201	PHYSICS LAB	0	0	3	1.5	0	0	100	100
5	Engineering Science Course	ULCEE202	BASIC ELECTRICAL ENGG. LAB	0	0	2	1	0	0	100	100
6	Engineering Science Course	ULCME205	WORK SHOP/BASIC MANUFACTURING PROCESS LAB	1	0	4	3	0	0	100	100
7	Engineering Science Course	UESIE202	BASIC ELECTRONICS ENGINEERING	2	0	0	2	30	70	0	100
8	LAB Course	ULCIE202	BASIC ELECTRONICS ENGINEERING LAB	0	0	2	1	0	0	100	100
			Total				**20.5**				**800**

3rd SEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Core Course	UPCIE301	Network Theory	3	0	0	3	30	70	0	100
2	Core Course	UPCIE302	Analog Electronics Circuit	3	0	0	3	30	70	0	100
3	Core Course	UPCIE303	Electrical & Electronics Measurement	3	1	0	4	30	70	0	100
4	Engg. Science Course	UESIE301	Signal & System	3	0	0	3	30	70	0	100
5	Basic Science Course	UBSMH301	Mathematics-III	3	1	0	4	30	70	0	100
6	Humanities Science Course	UHSMH306	Organizational Behavior	3	0	0	3	30	70	0	100
7	Lab Course	ULCIE301	Analog ElectronicCircuit Laboratory	0	0	3	1.5	0	0	100	100
8	Lab Course	ULCIE302	Electrical & Electronics Measurement Lab	0	0	3	1.5	0	0	100	100
			Total				**23**				**800**

4thSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Core Course	UPCIE401	Digital System Design	3	0	0	3	30	70	0	100
2	Core Course	UPCIE402	Electromagnetic field theory	3	1	0	4	30	70	0	100
3	Core Course	UPCIE403	Instrumentation Devices & Systems-I	3	0	0	3	30	70	0	100
4	Engg. Science Course	UESIE401	Fundamental of Communication Theory	3	0	0	3	30	70	0	100
5	Humanities Science Course	UHSMH407	Engineering Economics	3	0	0	3	30	70	0	100
6	Lab Course	ULCIE401	Digital System Design Lab	0	0	3	1.5	0	0	100	100
7	Lab Course	ULCIE402	IDS-I Lab	0	0	3	1.5	0	0	100	100
8	Lab Course	ULCIE403	Communication Engg. Lab	0	0	3	1.5	0	0	100	100
9	Mandatory Course	UMCCE401	Environmental Science	2	0	0	0	30	70	0	100

			Total				**20.5**				**900**

5thSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Core Course	UPCIE501	Microprocessor &Microcontroller	3	0	0	3	30	70	0	100
2	Core Course	UPCIE502	Control System Engineering	3	0	0	3	30	70	0	100
3	Core Course	UPCIE503	Instrumentation Device Systems-II	3	0	0	3	30	70	0	100
4	Core Course	UPCIE504	Process Control-I	3	0	0	3	30	70	0	100
5	Programme Elective-I	UPEIE501	Optoelectronic Devices and Instrumentation	3	0	0	3	30	70	0	100
		UPEIE502	Fibre optics Instrumentation								
6	Open Elective-I			3	0	0	3	30	70	0	100
7	Lab Course	ULCIE501	Microprocessor & Microcontroller Lab	0	0	3	1.5	0	0	100	100
8	Lab Course	ULCIE502	Control System Engineering Lab	0	0	3	1.5	0	0	100	100
9	Lab Course	ULCIE503	Process Control I Lab	0	0	3	1.5	0	0	100	100
			Total				**22.5**				**900**

6thSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Core Course	UPCIE601	Process Control-II	3	0	0	3	30	70	0	100
2	Core Course	UPCIE602	Digital Signal Processing	3	0	0	3	30	70	0	100
3	Programme Elective-II			3	0	0	3	30	70	0	100
4	Programme Elective-III			3	0	0	3	30	70	0	100
5	Open Elective-II			3	0	0	3	30	70	0	100
6	Lab Course	ULCIE601	Instrumentation design lab	0	0	3	1.5	0	0	100	100

7	Lab Course	ULCIE602	Digital Signal Processing Lab	0	0	3	1.5	0	0	100	100
8	Lab Course	ULCIE603	Design and simulation lab	0	0	4	2	0	0	100	100
9	Mandatory Course			2	0	0	0	30	70	0	100
			Total				**20**				**900**

Programme Elective-II & III

Sl. no	Code	Subjects	L	T	P	Contact hrs. /wk.	Credits
1	UPEIE601	Analytical Instrumentation	3	0	0	3	3
2	UPEIE602	Biomedical Instrumentation	3	0	0	3	3
3	UPEIE603	Power Electronics and drive	3	0	0	3	3
4	UPEIE604	Advanced Electronics Circuit	3	0	0	3	3

7th SEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Programme Elective-IV			3	0	0	3	30	70	0	100
2	Programme Elective-V			3	0	0	3	30	70	0	100
3	Open Elective-III			3	0	0	3	30	70	0	100
4	Open Elective-IV			3	0	0	3	30	70	0	100
5	Humanities Science Course	UHSMH701	Entrepreneurship Development	3	0	0	3	30	70	0	100
6	Project Course	UPRIE701	Project Stage-1	0	0	6	3	0	0	100	100
7	Seminar	USEIE701	Seminar	0	0	2	1	0	0	100	100
			Total				**19**				**700**

Programme Elective-IV & V

Sl no	Code	Subjects	L	T	P	Contact hrs. /wk.	Credits
1	UPEIE701	Adaptive Signal Processing	3	0	0	3	3
2	UPEIE702	Advanced Control System	3	0	0	3	3

3	UPEIE703	Embedded System	3	0	0	3	3
4	UPEIE704	MEMS	3	0	0	3	3
5	UPEIE705	VLSI	3	0	0	3	3

8thSEMESTER

Sl. No.	Subject Type	Subject Code	Subject Name	Teaching Hours/Week			Credit	Maximum Marks			
				L	T	P		IA	EA	PA	Total
1	Programme Elective-VI			3	0	0	3	30	70	0	100
2	Open Elective-V			3	0	0	3	30	70	0	100
3	Open Elective-VI			3	0	0	3	30	70	0	100
4	Project Course	UPRIE801	Project Stage-2	0	0	14	7	0	0	100	100
5	Core Course	UPCIE801	Comprehensive Viva Voce	0	0	2	1	0	0	100	100
			Total				**17**				**500**

Programme Elective-VI

Sl. no	Code	Subjects	L	T	P	Contact hrs. /wk.	Credits
1	UPEIE801	Artificial Intelligence	3	0	0	3	3
2	UPEIE802	Satellite Communication system	3	0	0	3	3
3	UPEIE803	Digital Image processing	3	0	0	3	3
4	UPEIE804	Machine Learning					
5	UPEIE805	Wireless Sensor Network	3	0	0	3	3

Suggested Open Elective for other branches:

1. Digital Image and VideoProcessing
2. SatelliteCommunication
3. Digital Communication
4. MEMS
5. AnalogVLSI
6. Wireless SensorNetworks

OPEN ELECTIVE OFFERED BY OTHER BRANCHES TO "INSTRUMENTATION & ELECTRONICS ENGINEERING"

OPEN ELECTIVE - I (5TH SEM)

Sl. No	Branch	Subject Code	Subject
1	CIVIL ENGINEERING	UOECE501	Fluid Mechanics
2	ELECTRICAL ENGINEERING	UOEEE501	Industrial Electrical Systems
3	MECHANICAL ENGG.	UOEME501	Thermodynamics and Heat Transfer
		UOEME502	Applied Thermal Engineering
4	COMPUTER SCIENCE ENGG	UOECS504	Real-Time Systems
		UOECS505	Advance Algorithms
		UOECS506	Parallel & Distributed Systems
5	INFORMATION TECHNOLOGY	UOEIT501	Data Structure
6	BIOTECHNOLOGY	UOEBT501	Physiology for Engineers
7	FASHION TECHNOLOGY	UOEFT501	Fundamental Techniques of Apparel Design
8	TEXTILE ENGG.	UOETE501	Textile Structural composite

OPEN ELECTIVE - II (6TH SEM)

Sl. No	Branch	Subject Code	Subject
1	CIVIL ENGINEERING	UOECE601	Mechanics of Solids
2	ELECTRICAL ENGINEERING	UOEEE601	Renewable Energy Systems
3	MECHANICAL ENGG.	UOEME601	Basic Manufacturing Process
4	COMPUTER SCIENCE ENGG	UOECS609	Cambinatorics& Graph Theory
		UOECS610	Human Computer Interaction.
5	INFORMATION TECHNOLOGY	UOEIT601	Object Oriented Programming using C++
6	BIOTECHNOLOGY	UOEBT601	Introduction to Biopharmaceutical Technology
7	FASHION TECHNOLOGY	UOEFT601	Visual Art and Illustration Techniques
8	TEXTILE ENGG.	UOETE601	Clothing Science and Technology

OPEN ELECTIVE - III (7TH SEM)

Sl. No	Branch	Subject Code	Subject
1	CIVIL ENGINEERING	UOECE701	Composite Materials
2	ELECTRICAL ENGINEERING	UOEEE701	Control System Design
3	MECHANICAL ENGG.	UOEME701	Mechanics of Solids
4	COMPUTER SCIENCE ENGG	UOECS709	Big Data Analytics
		UOECS710	Information Retrieval

5	INFORMATION TECHNOLOGY	UOEIT701	Java Programming
6	BIOTECHNOLOGY	UOEBT701	Computational Biology
7	FASHION TECHNOLOGY	UOEFT701	Fashion Photography
8	TEXTILE ENGG.	UOETE701	Specialty Yarn and Fabric
OPEN ELECTIVE - IV (7TH SEM)			
Sl. No	**Branch**	**Subject Code**	**Subject**
1	CIVIL ENGINEERING	UOECE702	Solid Waste & Hazardous Waste Management
2	ELECTRICAL ENGINEERING	UOEEE702	Electric & Hybrid Vehicles
3	MECHANICAL ENGG.	UOEME702	Project and Production Management
4	COMPUTER SCIENCE ENGG	UOECS711	Machine Learning
		UOECS712	Neural Network & Deep Learning.
5	INFORMATION TECHNOLOGY	UOEIT702	Data Base Engineering
6	BIOTECHNOLOGY	UOEBT702	Industrial Biotechnology
7	FASHION TECHNOLOGY	UOEFT702	Fashion Business and Forecasting
8	TEXTILE ENGG.	UOETE702	Color Measurement
OPEN ELECTIVE - V (8TH SEM)			
Sl. No	**Branch**	**Subject Code**	**Subject**
1	CIVIL ENGINEERING	UOECE801	Building Materials & Building Constructions
2	ELECTRICAL ENGINEERING	UOEEE801	Electrical Engineering Materials
3	MECHANICAL ENGG.	UOEME801	Fluid Mechanics & Hydraulic Machines
		UOEME802	Mechanism of Machines
4	COMPUTER SCIENCE ENGG	UOECS804	Internet of Things
		UOECS805	Fog Computing
5	INFORMATION TECHNOLOGY	UOEIT801	Computer Organization
6	BIOTECHNOLOGY	UOEBT801	Bioseparation Technology
7	FASHION TECHNOLOGY	UOEFT801	Visual Merchandising
8	TEXTILE ENGG.	UOETE801	Application of Nanotechnology in Textile
OPEN ELECTIVE - VI (8TH SEM)			

Sl. No	Branch	Subject Code	Subject
1	CIVIL ENGINEERING	UOECE802	Engineering Geology
		UOECE803	Environmental Impact Assessment
2	ELECTRICAL ENGINEERING	UOEEE802	Power Station Engineering and Economy
		UOEEE803	Electrical Energy Conservation and Auditing
3	MECHANICAL ENGG.	UOEME803	Quality Engineering and Management
4	COMPUTER SCIENCE ENGG	UOECS806	Multi-Agent Intelligent Systems
		UOECS807	Virtual Reality
5	INFORMATION TECHNOLOGY	UOEIT802	Data Mining
6	BIOTECHNOLOGY	UOEBT802	Tissue Engineering
7	FASHION TECHNOLOGY	UOEFT802	Smart and Functional Apparel
8	TEXTILE ENGG.	UOETE802	Costing of Textile Materials

Chemistry(3-1-0) Code –UBSCH101

Course Outcomes

At the end of this course, students will be able to:

1. Understand the basics of molecularinteractions.
2. Idea about organometallic and their catalyticapplications.
3. Understand basics of fuels and corrosionchemistry.

Module 1: (10 Hours)

QuantumChemistryandSpectroscopy:Basicconceptsandpostulatesofquantummechanics.Introduction to Schrodinger Wave Equation, Particle in a box: Energy levels, quantum numbers and selectionrule.

Spectroscopy: Lambert Beer's Law, Principles and applications of UV-Visible Molecular Absorption Spectroscopy; Chromophores, applications to colorimetry. Effect of conjugation on chromophores, Absorption by aromatic systems, introductory idea on Rotational and Vibrational Spectroscopy Principles and application to diatomic molecules.

The phase rule: Statement of Gibb's phase rule and explanation of the terms involved, Phase diagram of onecomponentsystem-waterandsulfursystem,Condensedphaserule,Phasediagramoftwocomponent system - Eutectic Bi-Cdsystem

Module 2: (10 Hours)

Organometallics: Introduction to organometallics, EAN rule; classification, nomenclature and characteristics of organometallic compounds. Applications of organometallic compounds and catalyst in alkene isomerization hydrogenation and hydroformylation (detail mechanisms are to be excluded).

Module 3: (10 Hours)

Fuels: Classification of fuels, calorific value. (Determination by Dulong's formula), G. C. V. and N. C. V. Liquid fuels: Classification of petroleum, refining of petroleum, Cracking, Knocking and anti-knocking, cetane and octane numbers. Unleaded petrol, synthetic petrol, power alcohol. Gaseous Fuel: Producer gas, Water gas, LPG, CNG, Kerosene gas, Combustion calculation.

Module 4: (10 Hours)

Corrosion: Electrochemical theory of corrosion, galvanic series, Types of corrosion; Differential metal corrosion, Differential aeration corrosion (Pitting and water line corrosion), Stress corrosion (caustic embrittlementinboilers),Factorsaffecting,Metalcoatings-GalvanizingandTiming,Corrosioninhibitors, cathodicprotection.

Text Books:

1. Text Book in Applied Chemistry by A. N. Acharya and B. Samantaray, PearsonIndia.
2. Introductory to Quantum Chemistry by A. K. Chandra, 4th Edition, McGraw HillEducation.
3. Fundamentals of Molecular & Spectroscopy by Banwell, Tata McGraw HillEducation.
4. Physical Chemistry by Gordon M. Barrow,McGraw-Hill
5. Engineering Chemistry, 12th Edition, Author: Wiley India Editorial Team PublishersWiley.
6. Engineering Chemistry: Fundamentals and Applications. Shikha Agarwal. Cambridge University Press.
7. Engineering Chemistry, Jain and Jain, Dhanpat RaiPublication.

Reference Books:

1. Inorganic Chemistry by Donald A. Tarr, Gary Miessler, Pearson India, ThirdEdition.
2. Quantum Chemistry by Ira N. Levine, Pearson 7thEdition.

3. Molecular Spectroscopy, Ira N. Levine, John Wiley andSons
4. Modern Spectroscopy - A Molecular Approach, by Donald McQuarrie and John Simon,published by University ScienceBooks.
5. Inorganic Chemistry by W. Overton, Rounk and Armstrong, Oxford University Press, 6thedition.

Mathematics-I(3-1-0) Code-UBSMH102

Course Outcomes

On successful completion of this course, the students will be able to:

1. Applytheprinciplesofdifferentialcalculustosolveavarietyofpracticalproblemsinengineering and appliedsciences.
2. Possess fundamental understanding of Fourier series and be able to give Fourier expansions of a function,
3. Apply the principles of vector calculus to solve a variety of basic problems in engineering and appliedscience,
4. Solve a variety of first order and higher order differential equations selecting from a variety of techniques covered in thesyllabus.

Module 1: (10 Hours)

Calculus:Asymptote,Curvature,Convergenceofsequenceandseries,testsforconvergence,powerseries, Taylor's series, Fourierseries.

Partialdifferentiation,Taylor'stheoremforfunctionoftwovariables,MaximaandMinimaforfunctionof twovariables.

Module 2: (10 Hours)

Vector differential calculus: vector and scalar functions and fields, Derivatives, Curves, tangents and arc length, gradient, divergence, curl.

Vector integral calculus: Line Integrals, Green Theorem, Surface integrals, Gauss theorem and Stokes Theorem.

Module 3: (10 Hours)

Differential Equation: Differential Equation: First order differential equations, Separable Equation, Exact differentialequation,lineardifferentialequation,Bernoulli'sequationandapplicationtoElectricalcircuits.

Lineardifferentialequationofsecondandhigherorder,Homogeneousequationwithconstantco-efficient, Euler-Cauchy equations, Solution by undetermined co-efficient, Solutions by variation of parameters, Modelling of electriccircuits.

Module 4: (10 Hours)

Series solution of differential equations, Power series method, Legendre equation and Legendre polynomials.

Laplace transformation and its use in getting solution to differential equations, Convolution, Integral Equations.

Text Books:

1. Differential Calculus by Santi Narayan and Mittal, Chapters 14, 15Publication.

2. Advanced Engineering Mathematics by E. Kreyszig, Tenth Edition,Wiley.
3. Higher Engineering Mathematics by B. V. Raman, McGraw HillsEducation.

Reference Books:

1. Engineering Mathematics by Pal and S. Bhunia, OxfordPublication.
2. Ordinary and Partial Differential equations by J. Sinha Roy and S. Padhy, KalyaniPublishers.
3. Advance Engineering Mathematics by P. V. O'Neil,Cengage.

Programming for ProblemSolving (3-0-0) Code –UESCS103

Module 1: (10 Hours)

Introduction to Programming, Introduction to components of a computer sys- tem (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

IdeaofAlgorithm:stepstosolvelogicalandnumericalproblems.RepresentationofAlgorithm:Flowchart/ Pseudo code with examples, From algorithms to programs; source code, variables (with data types) variables and memory lo- cations, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions andprecedence

Module 2: (07 Hours)

Conditional Branching and Loops, Arrays (1-D, 2-D), Character arrays and Strings, Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion, as a different way of solving problems.

Module 3: (07 Hours)

Structure & Unions, defining structures and Array of Structures, Pointers, Idea of pointers, Defining pointers, Pointers to functions, Double pointers.

Module 4: (06 Hours)

Dynamicmemoryallocation,useofmalloc(),calloc(),realloc(),free().Storageclasses:local,global,static & register variables. File handling: reading & writing to afile.

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGrawHill.
2. E. Balaguruswamy, Programming in ASI C, Tata McGrawHill.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

ChemistryLab(0-0-3) Code –ULCCH101

List of Experiments

(At least 10 experiments should be done)

Experiment List:

1. Determination of amount of sodium hydroxide and sodium carbonate in amixture.
2. Determination of total hardness of water by EDTAmethod.

3. Estimation of calcium in calcium inlimestone.

4. Determination of percentage of available chlorine in a sample of bleachingpowder.

5. Preparation ofPhenolphthalein.

6. Acid-Base Titration byPotentiometry.

7. Preparation of buffer solution and determination of pH of a buffersolution.

8. Standardization of KMnO4 using sodium oxalate. Determination of ferrous iron in Mohr's salt by potassiumpermanganate.

9. Determination of partition coefficients of iodine between benzene andwater.

10. Determination of rate constant of acid catalyzed hydrolysisreaction.

11. Determination of concentration of a colored substance byspectrophotometer.

12. Determination of dissolved oxygen in a sample ofwater.

13. Determination of Viscosity of a lubricating oil by Red Woodviscometer.

14. Determination of Flash point of a given oil by Pensky-Marten's flash pointapproach.

15. Determination of Critical Micelle concentration (CMC) of an ionic surfactant (Both cationic and anionic).

Programming for Problem Solving Lab (0-0-4) Code – ULCCS102

List of Experiments

(At least 10 experiments should be done)

Experiment List:

1. Familiarization with programmingenvironment.

2. Simple computational problems using arithmeticexpressions.

3. Problems involving if-then-elsestructures.

4. Iterative problems e.g., sum ofseries.

5. 1-D Arraymanipulation.

6. Matrix problems, Stringoperations.

7. Simplefunctions.

8. Programming for solving Numerical methods problems(1).

9. Programming for solving Numerical methods problems(2).

10. Recursivefunctions.

11. Pointers andstructures.

12. Fileoperations.

Engineering Graphics and Design (1-0-4) Code – ULCME103

Module 1: (05 Hours)

Introduction: Introduction to Engineering Drawing, Drawing Instruments and their uses, Dimensioning, Scale, types of lines, Lettering. (1 sheet)

Orthographic Projection: Introduction to Projection, Projection types or methods (First angle and Third angle)

PlaneofProjection,Referenceline,orthographicProjectionofPoints(pointslocatedinallfourquadrants), Projection of Straight lines (first and third quad- rant only), traces of lines. (1sheet)

Orthographic Projection of Plane Surfaces in various positions (Triangle, Square, Rectangle, Rhombus, Pentagon, hexagon and Circle), Traces of a Plane. (1 sheet)

Introduction to Solids and Types of Solids, Orthographic Projection of Solids in different Positions. (1 sheet)

Module 2: (05 Hours)

Sections and Development of Lateral Surface of Solids: Sectional view (half section and full section), development of surfaces of right regular prisms, pyramids, cylinders and cones. (1 sheet)

Isometric Projection: Introduction, Isometric Scale, Isomeric projection of cube, right regular prism, cylinders and cones. (1 sheet)

Applications: Orthographic and sectional view of Machine components (Screw Thread, nut and bolt). (1 Sheet)

Auto CAD: Introduction to Auto CAD. Fundamental concepts.

Text Books:

1. Machine Drawing by N. D. Bhatt, V. M. Panchal, Charotar PublishingHouse.
2. Machine Drawing by N. D. Junarkar, PearsonEducation.
3. Machine Drawing with AutoCAD by GoutamPohit and Goutam Ghosh, PearsonEducation.
4. Machine Drawing includes AutoCAD by Ajeet Singh, Tata McGrawHill.

Physics(3-1-0) Code-UBSPH201

Course Outcomes:

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

1. Enhance the fundamental knowledge in Physics and its application relevant to various streams of Engineering andTechnology.
2. Understand interaction of light with matter through interference, diffraction and be able to distinguish ordinary light with a laser light and to realize propagation of lightpolarization.
3. Understand various crystal systems and their structures elaborately through opticalfibers.
4. Understand basic knowledge of quantummechanics.

Module 1: (16 Hours)

Classical Dynamics: Newton's laws of motion, generalized coordinates, constraints, Principle of virtual

work,D'Alembert'sPrinciple,Lagrangian,Actionprinciple,Lagrangeequationofmotion(noderivation) and its application to Simple Harmonic oscillator and simplependulum.

General properties of Matter: Stress, Strain, Hooks' law, Young's modulus.
Oscillation & Waves: Simple Harmonic Oscillation, damped harmonic oscillation, forced oscillator, resonance, coupled oscillation, concept of wave and wave equation.

Optics: Concept of interference, two source interference pattern, Biprism, Michelson Interferometer & measurementofwavelength.Diffraction:Huygensprinciple,Fresnel&Fraunhoferdiffraction,Zoneplate, Plane diffraction grating (formulaonly).

Module 2: (12 Hours)

Solid State Physics: Crystalline and amorphous solid, unit cell, Miller Indices, Reciprocal lattice, Bragg's law, Brillouin's zone, concept of fermions, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution function (only statement and formula), Concept of Fermions and Bosons. Classification of materials: metals, semiconductor and insulator in terms of band theory.

LASER and Fibre Optics: Principle and application, stimulated emission, population inversion, Lasing material (solid and gas), He-Ne laser, Rubi- LASER, Application of LASER (Engineering Application), Principle of optical fibre and its application to communication.

Module 3: (12 Hours)

Electromagnetism: Student will be familiarized with some basics used in vector calculus prior to development of Maxwell's electromagnetic wave equations. No proof of theorems and laws included in this unit expected-statement and interpretation should sufficient.

a) Vector calculus: gradient of scalar field, divergence, curl of vector field (Only Physical significance) Gauss divergence theorem, Stoke's theorem, Green's theorem (Only Statements) and applications.

b) Gauss's law of electrostatics in free space and in a medium and application (Only statements) electric displacement (D) magnetic Induction (B), Amperes circuital law (Only statements), displacement current,Faraday'slawofelectromagneticinduction(Onlystatements),BiotSavartsLaw(Onlystatements), Maxwell's four electromagnetic equations, Wave equation for E and B fields in vacuum, Electromagnetic energy, Poynting vector (noderivation).

Quantum Physics: Elementary concepts of quantum physics formulation to deal with physical systems.

a) Need for Quantum Physics-Historical overviews, Particle aspects of radiation- Black body radiation, photoelectric effect, Compton scattering, pair production. (No derivations), Wave aspect of particles-matterwave,deBroglieHypothesis,HeisenbergUncertaintyprinciples-Statement,Interpretation and application to H-atom, Harmonic oscillator to calculate ground stateenergy.

b) Basic features of Quantum mechanics- Transition from deterministic to probabilistic, States of system-Wavefunction,probabilitydensity,superpositionprinciple,observablesandoperators,expectation values. Schrodinger equation- Time dependent and time independent, wavepackets.

Text Books:

1. L. Maharana, P. K. Panda, S. N. Dash, B. Ojha, Lectures in Engineering Physics,Pearson.

Reference Books:

1. An Introduction to Mechanics -D. Klippner& R. Kolenkow,TMH
2. Concepts of Modern Physics - ArthurBeiser.

3. Electricity & Magnetism -E. M.Purecell

4. Engineering Physics by D. K. Bhattacharya and Poonam Tandon, Oxford UniversityPress

5. Engineering Physics by D. R. Joshi, Mc GrawHill

6. Introduction to Electrodynamics- David J. Griffiths, PHIPublication

7. Optics- A. K.Ghatak

8. Physics-I for engineering degree students- B. B. Swain and P. K.Jena.

9. Quantum Mechanics -Powel &Craseman.

10. Quantum Physics -Gasiorowicz

Mathematics-II(3-1-0) Code -UBSMH202

Course Outcome:

On successful completion of this course, the students will be able to:

1. Use the basic concepts of vector and matrix algebra, including linear dependence / independence, basisanddimensionofasubspace,rankandnullityforanalysisofmatricesandsystemsoflinearequations,

2. Apply linear algebra techniques to solve various engineeringproblems,

3. Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational re-sources,

4. Compare different numerical methods with respect to accuracy and efficiency of thesolution.

Module 1: (10 Hours)

Matrices, vectors: addition and scalar multiplication, matrix multiplication: Linear systems of equations, linear independence, rank of a matrix, determinants, Cramer's rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Vector space, linear dependence of vectors, basis, dimension.

Module 2: (10 Hours)

Linear transformations (maps), range and kernel of a linear map, rank and nullity, Inverse of a linear transformation, rank-nullity theorem, composition of linear maps, matrix associated with a linear map.

Eigenvalues, eigenvectors, symmetric, skew-symmetric and orthogonal matrices, Eigen basis, Diagonalization, Inner product spaces, Gram-Schmidt orthogonalization.

Module 3: (10 Hours)

Solution of polynomial and transcendental equations - Bisection method, Newton- Raphson methods and Regula-Falsi method.

Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical approximation of functions.

Module 4: (10 Hours)

Numerical differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Gauss

Legendre and Gauss quadrature rule.

Gauss Siedel iteration method for solving a system of linear equations Euler and modified Euler's methods, Runge-Kutta methods.

Text Books:

1. Advanced Engineering Mathematics by E. Kreyszig, John Willey & Sons Inc. 10thEdition
2. Linear algebra and its applications by Gilbert Strang, Cengagelearning.

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, McGraw Hill Edu-cation.
2. Engineering Mathematics by Pal and S. Bhunia, OxfordPublication.
3. Advance Engineering Mathematics by P. V.O'Neil.
4. Introductory methods of numerical analysis by S. S. Sastry,PHI.

Basic ElectricalEngineering(3-1-0) Code –UESEE203

This is a foundation course aimed to expose the students the basic and under- lying principles ofElectrical circuits, Electro-mechanical energy conversion andMeasurements.

Course Outcomes

At the end of this course, students will be able to:

1. Understand and analyse basic electric and magneticcircuits.
2. Analysis of Transient condition in DCcircuit.
3. Understand the basic of various types of electrical machines andmeasurements.
4. Explain the under-laying principle of generation, transmission and distribution of the electrical power.

Module 1: (10 Hours)

Fundamentals of Electric Circuits: Fundamentals of electrical circuit, Ohm's law, Kirchhoff's laws, series and parallel connections, Electric Power and sign conventions, circuit elements and their characteristics. Practical voltage and current sources. Source Conversion.

ResistiveNetworkAnalysis:nodevoltageandmeshcurrentmethods,supernodeandsupermeshmethods, delta-starandstar-deltaconversions,superpositionprinciple,Thevenin'sandNorton'stheorems.maximum powertransfer.

Module 2: (10 Hours)

Single phase AC circuits: Single phase emf generation, Representation of sinusoidal waveforms, average, effective, peak and rms values, j operators, phasor concept, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel) Instantaneous Power in AC Circuits, Real power, reactive power, apparent power, Power Factor, Power triangle, Complex Power.

Three-phase AC circuits: Three phase emf generation, Delta-star and star- delta conversions, voltage and currentrelationsinstaranddeltaconnections.solutionofthethreephasecircuitswithbalancedvoltageand balanced load conditions, phasor diagram, measurement of power in three phasecircuits.

Transient Analysis: Writing differential equations for circuits, DC steady state solutions of first order circuits.

Module 3: (10 Hours)

ElectricalMeasuringinstruments:Introduction,PMMCAmmetersandVoltmeterswithextensionofrange, Moving-Iron Ammeters and Voltmeters, Dynamometer type Wattmeter, Energymeter.

Magneticcircuits:MMF,flux,reluctance,inductance.ReviewofAmpereLaw,BiotSavartLaw.Magnetic field, Electricity and Magnetism, B-H characteristics and hysteresis loss, series and parallel magnetic circuits.

Transformers:Construction,operatingprinciple,emfequationandturnsratio.Typesoftransformer,phasor diagrams for no loadoperation.

Module 4: (10 Hours)

DCMachines:PrincipleofOperationofgeneratorandmotor,EMFequation,TorqueEquation,methodsof excitation. Speed equation of d.c. motor, speed control of d.c. shuntmotor.

Induction motor: construction of AC inductor machines, Revolving magnetic flux, torque and slip, synchronous speed.

Power Systems: Brief idea about various generating plants (Thermal, Hydel, and Nuclear), Transmission and Distribution of Electric Energy.

Text Books:

1. Electrical & Electronic Technology, E. Huges, Pearson, 9thEdition.
2. Electrical Engineering Fundamentals, Vincent Del Toro, 2nd Edition,PHI.

Reference Books:

1. C. L. Wadhwa," Electrical Engineering", New Age International Publishers, 2ndEdition.
2. Basic Electrical Engineering, A. Fitzgerald, D. E. Higginbotham and A. Grabel, TMH, 5thEd.

English(2-0-0) Code -UHSMH205

Course Outcome

At the end of this course, students will be able to:

1. Equipped with the theory and practice ofcommunication.
2. Equipped with both theoretical vocabulary and basic tools which will help them develop as better communicators.

Select literary texts and establish how these texts contribute to the afore- mentionedobjectives

Module 1: (08 Hours)

Introduction to Communication:

Importance of Communication in English, the process of communication and factors that influence the process of communication: Sender, receiver, channel, code, topic, message, context, feedback, 'noise'. Principles of Communication. Barriers to Communication & Communication Apprehension, Verbal (Spoken and Written) and non-verbal communication, Body language and its importance in communication.

Module 2: (07 Hours)

Phonetics and Functional Grammar:

Sounds of English: Vowels (Monophthongs and Diphthongs), Consonants, Syllable division, stress (word, contrastive stress) & intonation, MTI and problem sounds, Review of Parts of Speech, Subject and Predicate, Tense, Voice Change, Idioms and Phrasal Verbs.

(Note:Thisunitshouldbetaughtinasimple,non-technical,applicationorientedmanner,avoidingtechnical terms as fast aspossible.)

Module 3: (05 Hours)

Reading Literature:

Prose:

- Stephen Leacock: My Financialcareer.
- Mahatma Gandhi: from My Experiments withTruth.
- O'Henry: The Last Leaf.

Poetry:

- Nissim Ezekiel:Professor.
- Jack Prelutsky: Be glad your nose is on yourface.
- Maya Angelou: Still I rise(Abridged).

Basic Electronics Engineering Code- UESIE202

Module 1: (12 Hours)

Semiconductor Diodes:

Semiconductor materials- intrinsic and extrinsic types, Ideal Diode, Terminal characteristics of diodes (p-n junction under open circuit condition, p-n junction under forward bias and reverse bias condition)p-n junction in breakdown region, Diode small signal model, Zener diode and applications , Rectifier Circuits (Half wave, Full wave centre tap and bridge rectifiers)

Bipolar Junction Transistors (BJTs):

Physical structure and operation modes**,** Active region operation of transistor**,** D.C. analysis of transistor circuits**,** Transistor as an amplifier**,**

Module 2: (12 Hours)

BJT Biasing and Modeling:

Biasing the BJT: fixed bias, emitter feedback bias and voltage divider bias**,** Basic BJT amplifier configuration: common emitter, common base andcommon collector amplifiers

Field Effect Transistor:

JFET-types, Operations and their Characteristics ,MOSFETs- types, Operations and their Characteristics

Feedback Amplifiers and Oscillators:

Types of feedback, Advantages of Negative feedback, Barkhausen criterion, RC oscillators (phase shift, Wien bridge), LC oscillators (Hartley)

Extra (To be taught in Department level)

Transistor as a switch: cut-off and saturation modes, High frequency model of BJT amplifier.

Operation Amplifier (Op-amps):

Ideal Op-amp, Differential amplifier: differential and common mode operation, common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non -inverting amplifier, weightedsummer, integrator,

differentiator

Reference Books:

1. A. S. Sedra and K. C. Smith, *Microelectronic Circuits: Theory and Applications*, 7th edition. Oxford, 2017.
2. B. Razavi, *Fundamentals of Microelectronics*, 2nd edition. Wiley-India, 2014.
3. R. L. Boylestad and L. Nashelsky, *Electronic Devices and Circuit Theory*, 11th edition. Pearson, 2013.
4. T. C. Carusone, D. Johns, and K. Martin, *Analog Integrated Circuit Design*, 2nd edition. Wiley-India, 2013.
5. P. R. Gray, P. J. Hurst, S. H. Lewis, and R. G. Meyer, *Analysis and Design of Analog Integrated Circuits*, 5th edition. Wiley-India, 2009.
6. D. A. Neamen, *Electronic Circuits: Analysis and Design*, 3rd edition. Tata McGraw-Hill, 2008.

Basic Electronics Laboratory Experiment List

List of Experiments

(At least 5 Experiments Should be done)

Sl No.	Name of the Experiment	Week
1	Familiarization with electronic components&equipments (Active & Passive, Multi-meters, CROs and function generators)	1
2	Study of the characteristics of P-N junction diode and finding dynamic resistance.	2
3	Construction of half-wave rectifier and full wave rectifier circuits & study of their output waveforms by CRO and calculation of efficiency and ripple factor.	3
4	Study of the output characteristics of a Common Emitter Transistor	4
5	Design, setup and plot the frequency response of Common Source JFET/MOSFET amplifier and obtain the bandwidth.	5
6	Study of the characteristics of Zenerdiode.	6
7	Construction of clipper circuits & study of their output waveforms of positive clipper, negative clipper and two level clipper by CRO.	7
8	Construction of clamper circuits & study of their output waveforms of positive clamping, negative clamping by CRO.	8

PhysicsLab(0-0-3) Code –ULCPH201

List of Experiments

(At least 10 experiments should be done)

Experiment List:

1. Determination of Young's modulus by Searle's method / Bending ofbeams.
2. Determination of Rigidity modulus by staticmethod.
3. Determination of surface tension by capillary risemethod.
4. Determination of acceleration due to gravity by Bar / Kater'spendulum.
5. Verification of laws of vibration of string usingsonometer.
6. Determination of wavelength of light by Newton's ringapparatus.
7. Determination of grating element of a diffractiongrating.

8. Determination of wavelength of laser source by diffraction ratingmethod.

9. Determination of wavelength using MichelsonInterferometer.

10. Plotting of characteristic curve of a PN junctiondiode.

11. Plotting of characteristic curves ofBJT.

12. Determination of unknown resistance using MeterBridge.

13. Determine of reduction factor of the given tangentgalvanometer.

14. Determination of horizontal component of earth's magnetic field by using tangentgalvanometer.

15. Determination of Hall coefficient using Hallapparatus.

Basic Electrical EngineeringLab(0-0-2) Code-ULCEE202

List of Experiments

(At least 10 experiments should be done)

Course Outcomes

At the end of the course the students are able to:

1. Learn about the working of different measuring instruments for measuring power, power factor, energyetc.

2. Verify different NetworkTheorems

3. Draw the Open Circuit Characteristics of dc generator andTransformer

4. Visualize the constructional details of differentmachines

Experiment List:

1. Basic safety precautions. Introduction and use of measuring instruments - voltmeter, ammeter, wattmeter, Rheostat, multi-meter,oscilloscope.

2. Connection and measurement of power consumption of an Incandescent, fluorescent, LED and CFL lamp and determination of power factor.

3. Power and power factor measurements in three phase system by two wattmetermethod.

4. Verification of super position, Thevenin and Norton'stheorem.

5. Plotting of B-H curve of different magnetic material and calculation of hysteresisloss.

6. Testing of a single-phase energy meter at different powerfactor.

7. Calculation of power and power factor in series R-L-C circuit excited by single-phase AC supply and draw the phasor diagram.

8. Determination of open circuit characteristics (OCC) of DC shuntgenerator.

9. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change involtage.

10. Observationoftheno-loadcurrentwaveformofatransformeronanoscilloscopeandmeasurement of primary and secondary voltages and currents, and power at differentload.

11. Demonstration of cut-out sections of machines: dc machine (commutator- brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ringarrangement).

Workshop/Basic ManufacturingPractices(1-0-4) Code –UESME205

Module 1: (05 Hours)

Engineering materials: Classification of Engineering materials. Mechanical properties of Steel,Aluminum andPlastics.

Safety precautions in workshop.

Fitting: Knowledge of hand tools: V-block, Marking Gauge, Files, Hack Saw, Drills, Taps, Types of fitting.

Module 2: (05 Hours)

Welding: Study of electric arc welding tools &equipments, Models: Butt Joint, Lap Joint, T joint & L- joint.

Machining: Introduction to different machine tools: Lathe machine, Shaper machine and milling machine. Brief introduction to other basic manufacturing processes like foundry, sheet metal operation and forming processes.

Text Books:

1. Elements of Workshop Technology, Vol. I and II by Hajrachoudhary, KhannaPublishers.
2. Workshop Technology by W. A. J. Chapman, VivaBooks.
3. Workshop Manual by Kannaiah/ Narayana,Scitech.

EnglishLab(0-0-2) Code -ULCMH204

List of Experiments

(All the experiments should be done)

Course Outcome:

At the end of the course the students are able to:

1. Acquaintedwiththeirstrengthandweaknessinexpressingthemselves,theirinterestsandacademic habits.
2. ImproveskillsofLSRW(Listening,Speaking,ReadingandWriting)throughmutualconversation and activities related to theseskills.
3. Promote the creative and imaginative practices before theteacher-trainer.

Lab sessions will give a platform for the students to indulge in activities based on the first two modules of theorytaughtintheclassroom.Allthelabclasseswillbedividedinsuchamannerthatallthefouraspects of language (LSRW) arecovered.

Experiment List:

1. Speaking: Ice-breaking and Introducing each other, Writing: Happiest and saddest moment of

my life.

2. Listening: Listening practice (ear training): News clips, Movie clips, Presentation, Lecture or speech by a speaker, Speaking:Debate.

3. Reading: Reading comprehension, Writing: Creative writing (Short story: Hints to be given by teacher).

4. Reading:TopicsofGeneralawareness,CommonerrorsinEnglishusage,Writing:Constructionof different types ofsentences.

5. Speaking: Practice of vowel and consonant sounds, Writing: Practice of syllabledivision.

6. Speaking: My experience in the college/ or any other topic as per the convenience of the student, Writing: Phonemic transcription practice.

7. Listening: Practice of phonetics through ISIL system and also with the help of a dictionary, Speaking: Role-play ingroups.

8. Speaking: Practice sessions on Stress and Intonation, Writing: Practice sessions on Grammar (Tense and voicechange).

9. Speaking: Extempore, Writing: Framing sentences using phrasal verbs andidioms.

10. Watching a short English Movie, Writing: Critical analysis of themovie.

End-termAssignment:Studentsarerequiredtomakeaprojectofatleast5pagesonatopiconthefollowing broad streams: Technology, General awareness, Gender, Environment, Cinema, Books and the like. The assignment should involve data collection, analysis andreporting.

NETWORKTHEORY UPCIE301

Prerequisites: Fundamental laws of electrical circuits

Course outcomes:

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

1. Apply the concept of tie set and cut set matrix for solving differentcircuits.
2. Solve electrical circuits using different two port networks such as z, y, ABCD and h parameters.
3. Analyze the stability of a network based on Pole-Zeroplots.
4. Select appropriate and relevant techniques for solving the Electrical networks in different conditions.
5. Analyze different network filters and their frequencyresponse.
6. Synthesize networks using Cauer and Fosterforms.

Module I (8 Hrs)

Network Theorems & Coupled Circuits: Substitution theorem; Reciprocity theorem; Maximum power transfer theorem; Tellegen's theorem; Millman's theorem; Compensation theorem; Coupled Circuits; Dot Convention for representing coupled circuits; Coefficient of coupling.

Module II (12 Hrs)

Laplace Transform & Its Application: Introduction to Laplace Transform, Laplace transform of some basic functions, Laplace transform of periodic functions, Inverse Laplace transform, Circuit Analysis (Steady State andTransient).

Two Port Network Functions & Responses: z, y, ABCD and h-parameters; Reciprocity and Symmetry; Interrelation of two-port parameters, Interconnection of two-port networks; Network Functions; Significance of Poles and Zeros, Restriction on location of Poles and Zeros, Time domain behaviour from Pole-Zero plots.

Module III (12 Hrs)

Brief idea about filters (Low pass, High pass, Band pass and Band elimination) and their frequency response. Realization of Active filters (both high and low pass Butterworth filter) –first and second order filters.

Synthesis of Passive Networks: Hurwitz polynomial and its properties, Cauer and Foster Canonic forms of reactive networks.

Network Topology: Graph of a network; Concept of tree; Incidence matrix; Tie-set matrix;Cut-set matrix; Formulation and solution of network equilibrium equations on loop and node basis.

Textbook(s):

1. Network Analysis, M E Van Valkenburg, PHI, thirdedition.

2. Fundamentals of Electric Circuits, Charles K Alexander & Mathew N.O. Sadiku,Tata McGraw Hill, fifthedition.

Reference Book(s):

1. Network Analysis and Synthesis – Franklin F. Kuo – Wiley StudentEdition.
2. Network Theory, P K Satpathy, P Kabisatpathy, S P Ghosh and A K Chakraborty, Tata McGraw Hill, NewDelhi.

ANALOGELECTRONICSCIRCUIT UPCIE302

Prerequisite: Network Theory.

Course outcome:

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

1. Analyse simple electronic circuits based on transistors with special focus ondesigning amplifiers with discretecomponents.
2. Develop the skill to build, and troubleshoot Analogcircuits.
3. Design higher order transistor amplifiers andoscillators.
4. Determine transfer function for frequency dependent amplifier circuits, draw bode plots (magnitude and phase) and calculate frequencybandwidth.
5. Design different signal conditioning circuits like differentiator, integrator and instrumentation amplifier usingOp-Amp.

MODULE I (12 Hrs)

Biasing of BJTs: Load lines (AC and DC); Operating Points; DC Bias with Voltage Feedback; Bias Stabilization; Examples.

MOS Field-Effect Transistor: Principle and Operation of FETs and MOSFETs; PChannel and N-Channel MOSFET; Complimentary MOS; V-I Characteristics of EMOSFETand D-MOSFET; MOSFET as an Amplifier and as aSwitch.

Biasing of FETs and MOSFETs: Fixed Bias Configuration and Self Bias Configuration, Voltage Divider Bias and Design.

Abbreviations Used:L = Lectures, P = Practical or Laboratory, T = Tutorial

IA = Internal Assessment , PA =Practical Assessment, EA = End-Semester Assessment

MODULE II (12 Hrs)

Small Signal Analysis of BJTs: Small-Signal Equivalent-Circuit Models; Small Signal Analysis of CE, CC, CB amplifiers. **Brief Introduction to-**Emitter Follower, Cascade amplifier, Darlington Connection and Current Mirror Circuits.

Small Signal Analysis of FETs: Small-Signal Equivalent-Circuit Model, Small Signal Analysis of CS, CD, CG Amplifiers. Effects of RSIG and RL on CS Amplifier; Source Follower and Cascaded System. **High Frequency Response of FETs and BJTs:** High Frequency equivalent models and frequency Response of BJTs and FETs; Frequency Response of CS Amplifier, Frequency Response of CE Amplifier.

Operational Amplifier: Ideal Op-Amp, Differential Amplifier, Op-Amp Parameters, Non-inverting Configurations, Open-loop and Closed-loop Gains, Differentiator and Integrator, Instrumentation amplifier.

MODULE III (10 Hrs)

Feedback amplifier and Oscillators: Concepts of negative and positive feedback; Four Basic Feedback Topologies, Practical Feedback Circuits, Principle of Sinusoidal Oscillator, Wein-Bridge, Phase Shift and Crystal Oscillator Circuits.

Power Amplifier: Brief Introduction to different classes of amplifier (A, B, AB, C).

Regulated DC Power Supply: Transistor series voltage regulator, series feedback voltage regulator, Transistor shunt voltage regulator, shunt feedback voltage regulator.

Textbook(s):

1. Electronic Devices and Circuits theory, R.L. Boylestad and L. Nashelsky, Pearson Education, New Delhi, 9th/10th Edition,2013. (Selected portions of Chapter 4, 5, 6, 7, 8, 9, 10, 11, 12, and14)
2. Microelectronics Circuits, Adel Sedra and Kenneth C Smith, Oxford University Press, New Delhi, 5th Edition, International Student Edition,2009. (Selected portion of Chapter 2,4, 5, 6, 8, 13, and14)
3. Milliman's Electronics Devices and Circuits, J. Milliman, C. Halkias, S. Jit., Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2ndEdition,2008.
4. Analog Circuit Design: Discrete & Integrated, 1st Edition by SergioFranco

Reference Book:

Abbreviations Used:L = Lectures, P = Practical or Laboratory, T = Tutorial

IA = Internal Assessment , PA =Practical Assessment, EA = End-Semester Assessment

1. Integrated Electronics: Analog and Digital Circuits and Systems, J. Milliman, C. Halkias, Tata McGraw Hill Publishing Company Ltd., New Delhi,2ndEdition.2004.
2. Electronic device and circuits, David A. Bell, Oxford University Press,5thedition,2008.
3. Electronic Principles, Albert Malvino, David Bates, Mcgraw-Hill, EighthEdition
4. Microelectronic Circuits: Analysis and Design, Muhammad H Rashid, Cengage Learning, Second Edition

ELECTRICAL ANDELECTRONICSMEASUREMENT UPCIE303

Prerequisite: Network Theory.

Course outcome:

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

1. Select type of meter and extend the range of measurement in deflecting type instruments (Ammeter & Voltmeter) and Potentiometer. Select the required components for desired measurement. Design measurement circuit for improving resolution of Potentiometer. Choose and Design Electronics Voltmeter for measurement of Average Value, RMS Value and Peak Value. Calibrate these instruments formeasurement.
2. Analyse dynamics of response of electro-mechanical deflecting instruments. Identify and choose the parameters for desired performance in dynamic response. Design electrical damping for achieving desireddamping.
3. Analyse the concept of electrical power and energy measurement. Calculate error, estimate correction factor and calibrate theinstrument.
4. Select type of instrument required for measurement of Power Factor and Frequency of Electric Power Supply. Identify suitable components required in the measuringcircuits.
5. Evaluate measurement range and select type of instrument required for the measurement of Resistance (Low, Medium and High), Inductance (Low & High) and Capacitance (low & High). Identify and choose components in theinstruments.

Abbreviations Used:L = Lectures, P = Practical or Laboratory, T = Tutorial

IA = Internal Assessment , PA =Practical Assessment, EA = End-Semester Assessment

6. Apply the usefulness of Oscilloscope for measurement of Voltage, Current, Power, Phase Angle, Time Period, Frequency and Plotting X-YVoltages.

Module I (12 Hrs)

Ammeter and Voltmeter: PMMC, MI and Electro Dynamometer type and Rectifier types Ammeter and Voltmeter; Wattmeter: Construction, Theory and Principle of operation of Electro-Dynamometer and Induction type single phase wattmeter, compensation; Energy Meter: Construction, Basic Theory and Principle of operation; Sources of Error, Types ofError.

Module II (12 Hrs)

Resistance: Measurement of Low Resistance by Kelvin's Double Bridge, Measurement of Medium Resistance, Measurement of High Resistance, Measurement of Resistance of Insulating Materials, Portable Resistance Testing set (Meg-ohmmeter), Measurement of Resistance of Earth Connections. AC Bridges for measurement of Inductance (Self and Mutual) and Capacitance, Errors in bridges.

Module III (12 Hrs)

Galvanometer: Construction, Theory and Principle of operation of D'Arsonval, Vibration, Influence of Resistance on Damping, Logarithmic decrement, Calibration of Galvanometers, Galvanometer Constants. Potentiometer: Construction, Theory and Principle of operation of DC Potentiometers Electronic Instruments for Measuring Basic Parameters: Amplified DC Meters, AC Voltmeters using Rectifiers, True RMS Voltmeter, Considerations for choosing an Analog Voltmeter, Digital Voltmeters (Block Diagrams only), Q meters and Frequency Meters; Power FactorMeters.

Digital Signal Oscilloscope-Principles and Working of DSO.

Text books:

1. Electrical Measurements and Measuring Instruments – Golding &Widdis, ReemPublication.

Abbreviations Used:L = Lectures, P = Practical or Laboratory, T = Tutorial

IA = Internal Assessment , PA =Practical Assessment, EA = End-Semester Assessment

2. Modern Electronic Instrumentation and Measurement Techniques – Helfrick& Cooper– PearsonEducation.
3. Digital and Analogue Instrumentation-Testing and Measurement, NihalKularatna, IET Press,2003

Reference Books:

1. Electronic Instrumentation – H C Kalsi – 2nd Edition, Tata McGrawHill.
2. Electronic Measurement and Instrumentation – Oliver & Cage – Tata McGrawHill.
3. A Course in Electrical and Electronic Measurements and Instrumentation – A KSawhney – Dhanpat Rai &Co

SIGNALSANDSYSTEMS UESIE301

Prerequisite: Basic knowledge of Engineering Mathematics required, which includes - Differential equations and Integrals, Laplace transform, Ordinary differential equations, Complex numbers, Series and expansions, Fourier analysis.

Course outcomes:

At the end of this course students will be able to

1. Analyze different types ofsignals
2. Represent continuous and discrete systems in time and frequency domain using different transforms
3. Investigate whether the system isstable
4. Sampling and reconstruction of asignal

Module I (12Hrs)

An introduction to signals and systems: Signals and systems as seen in everyday life, and in various branches of engineering, Continuous-Time and Discrete-Time Signals, Transformations of the Independent Variable, Exponential and Sinusoidal Signals, The Unit Impulse andUnit

Step Functions, Continuous-Time and Discrete-Time Systems, Basic System Properties.

Linear Time-Invariant Systems: Continuous-Time LTI Systems: The Convolution Integral, Properties of Linear Time-Invariant Systems, Causal LTI Systems Described by Differential and Difference Equations, Singularity Functions.

Fourier analysis of Continuous Time signal and system: A Historical Perspective, The Response of LTI Systems to Complex Exponentials, Fourier Series Representation of Continuous-Time Periodic Signals, Convergence of the Fourier Series, Properties of Continuous-Time Fourier Series, Fourier Series and LTI Systems, Filtering, Examples of Continuous-Time Filters Described by DifferentialEquations.

Module II(10Hrs)

The Continuous-Time Fourier Transform: Representation of Aperiodic Signals: The Continuous-Time Fourier Transform, The Fourier Transform for Periodic Signals, Properties of the Continuous- Time Fourier Transform, The Convolution Property, The Multiplication Property, Fourier Properties and Basic Fourier Transform Pairs, Systems Characterized by Linear Constant-Coefficient Differential Equations.

Time- and Frequency Characterization of Signals and Systems: The Magnitude-Phase Representation of the Fourier Transform, The Magnitude-Phase Representation of the Frequency Response of LTI Systems, Time-Domain Properties of Ideal Frequency-Selective Filters, Time- Domain and Frequency-Domain Aspects of Nonideal Filters, First-Order and Second-Order Continuous-Time Systems.

Module III (10 Hrs)

The Laplace Transform: The Laplace Transform for continuous time signals and systems: the notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence,

system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. Generalization of Parseval's Theorem.

Sampling: Representation of a Continuous-Time Signal by Its Samples: The Sampling Theorem, Reconstruction of a Signal from Its Samples Using Interpolation, The Effect of Undersampling: Aliasing, Discrete-Time Processing of Continuous-Time Signals.

Text books:

1. A.V.Oppenheim,A.S.WillskyandI.T.Young,"SignalsandSystems",PrenticeHall,1983.
2. A NagoorKani, Signals & Systems" 2ND edition,Mc-Graw Hill.2017
3. Schaum's outlines, Signal and System, H.P.Hsu, 2ndEdition

Reference books:

1. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, PrenticeHall.
2. Douglas K. Lindner, "Introduction to Signals and Systems", Mc-Graw Hill International Edition.
3. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia)Private Limited.
4. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", Tata Mc Graw HillEdition.

Mathematics-III

Prerequisites:

1. Mathematics-I
2. Mathematics-II

Course Outcomes

On successful completion of this course, the students will be able to:

1. Have a fundamental knowledge of the concepts of probabilitytheory.
2. Do correlation and regression and fitting of different types ofcurves.
3. Applysamplingtheoryandtheoryofestimationinvariousengineeringproblemsanddo

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various tests of hypothesis and significance.

4. Use calculators and tables to perform simple statistical analyses for small samples and use popular statistics packages, such as SAS, SPSS, S-Plus, R or MATLAB to perform simple and sophisticated analyses for largesamples.

Module 1: (10 Hours)

Probability: Introduction, Probability of an event, additive rule & multiplication rule, conditional probability, Bayes' rule, random variable, discrete and continuous probability distribution, Joint probability distribution, Mathematical expectations, Variance and Co- variance of random variables, Mean and Co- variance of linear combination of random variables, Chebyshevtheorem.

Module 2: (10 Hours)

Discrete Probability Distribution: Binomial & Multinomial, Hyper- geo- metric, Geometric, Poisson distribution.

Continuous Probability Distribution: Uniform, Normal, Exponential Distribution, Weibull's Distribution, Chi-square Distribution, Sampling Distribution: Sampling Distribution of S2, t Distribution, F Distribution.

Module 3: (10 Hours)

Estimation of parameter: methods of estimation, Estimating the mean of a single sample, Standard error, Prediction interval, Tolerance limits, Estimating the difference between means of two samples, estimating proportion and variance of single sample, Estimating the difference between two proportions and variances of two samples, maximum likelihood estimation.

Module 4: (10 Hours)

Testing of hypothesis: one and two tailed test, test on a single mean when variance is known & variance is unknown. Test on two means, test on single mean and two mean populations. One and two sample test for variance. $\chi 2$ test for goodness of fit and test for independence.

Introduction to linear regression: Simple regression models, method of least squares, Properties of least square estimators, Inferences concerning the regression coefficients, Coefficients of determination and its application.

Statistical quality control (Simple Idea only)

Text Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers & Keying Ye," Probability & Statistics for Engineers & Scientists", Eighth Edition, 2007, Pearson Education Inc., NewDelhi.
2. Jay L. Devore," Probability and Statistics for Engineering and Sciences", Seventh Edition, Thomson/CENGAGE Learning India Pvt.Ltd.

Reference Books:

1. William Mendenhall, Robert J. Beaver & Barbara M. Beaver," Introduction to Probability and Statistics", 13th Edition, 2009, CENGAGE Learning India Pvt. Ltd., NewDelhi.
2. T. Veerarajan," Probability, Statistics and Random Processes", Tata McGrawHill
3. Ronald Deep," Probability and Statistics", AcademicPress

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Organizational Behavior

Prerequisites:

1. English.

Module 1: (10 Hours)

The study of Organizational Behaviour: Definition, Meaning, Why study OB; Learning - Principles of learning and learning theories; Personality- Meaning, Determinants, Types, Personality and OB; Perception- Perceptual Process, perceptual errors, Importance of perception in organizations; Motivation-Nature and Importance, Theories of motivation (Herzberg, Maslow, McGregor).

Module 2: (10 Hours)

Group level: Groups in Organizations -Nature, Types, Reasons behind forming groups, Determinants, factors contributing to Group Cohesiveness, Group Decision Making- Process, advantages and disadvantages; Team- Effective Team Building; Types of Leadership- Effective Leadership, Styles of leadership, Leadership Theories-Trait Theory and Contingency Theory, Leadership and Followership; Conflict- Healthy Vs Unhealthy conflict, Conflict Resolution Techniques.

Module 3: (10 Hours)

Structural level: Organizational Culture: culture and organizational effective- ness; Organizational Change: Types of change, Reasons to change, Resistance to change and to manage resistance. Introduction to organizational development.

Text Books:

1. Stephens P. Robbins, Organizational Behaviour,PHI.
2. K. Aswatthappa, Organizational Behaviour,HPH.

Reference Books:

1. Kavita Singh, Organizational Behaviour,Pearson.
2. D. K. Bhattacharya, Organizational Behaviour,OUP.
3. Pradeep Khandelwal, Organizational Behaviour,TMH.
4. Keith Davis, Organizational Behaviour, McGrawHill.
5. Nelson Quick, ORGB, CengageLearning.

ELECTRICAL AND ELECTRONICS MEASUREMENT LAB ULCIE302

Course Outcome:

1. Recognise and eliminate sources of error in measurement of lowresistance.
2. Select ac bridge to measure unknown inductance andcapacitance
3. Analyse static and dynamics of electro-mechanical deflecting typeinstruments
4. Choosing a standard for calibration and calibrate aninstrument.
5. Recognise sources of error and employing testing procedures of single phase energymeter.

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6. Analyse effect of frequency, type of material and volume of material on B-HCurve.
7. Select Q meter for measurement ofimpedance.
8. Choose Wattmeter and calculate correction factor for measurement of power and power factor.
9. Applyoscilloscopetechniquesformeasurementoffrequency,phaseangleandtimedelay.
10. Design electronic voltmeters for measurement of average and rmsvalues.
11. Analyse choice of selecting A/D converter for a desiredapplication
12. AnalysechoiceofselectingD/Aconverterforadesiredapplication

Experiment List: (At least 10 experiments should be done)

1. Measurement of Low Resistance by Kelvin's Double BridgeMethod.
2. Measurement of Self Inductance and Capacitance usingBridges.
3. Study of Galvanometer and Determination of Sensitivity and GalvanometerConstants.
4. Calibration of D.C. Voltmeters and Ammeters usingPotentiometers.
5. Testing of Energy meters (Single phasetype).
6. Measurement of Iron Loss from B-H Curve by usingCRO.
7. Measurement of R, L, and C usingQ-meter.
8. Measurement of Power and Power Factor in a three phase AC circuit by two wattmeter method.
9. Measurement of Frequency, Phase and Time Delay usingOscilloscope.
10. Calibration of ElectronicVoltmeter.

11 Study of principles & techniques of Analog to Digital Conversion

13. Study of principles & techniques of Digital to AnalogConversion.
14. Mini Project for Hands onExperience

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ANALOG ELECTRONICSCIRCUITLAB ULCIE301

Course outcome:

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

1. Acquire a basic knowledge in solid state electronics including FET, MOSFET, BJT, and operationalamplifier.
2. Designing and evaluation of BJT amplifier in CEconfiguration.
3. Design and test JFET/MOSFETamplifier.
4. Evaluate possible causes of discrepancy in practical experimental observations in comparison totheory.

Experiment List: (At least 10 experiments should be done)

1. Usage of different electronics components (active and passive) and devices and diode characteristics.
2. Input output characteristic of BJT in common emitterconfiguration.
3. Design and simulate BJT voltage divider bias (CE) circuit and compare theresults.
4. Design and test MOSFET bias circuit and compare theresults.
5. Design and test BJT common-emitter circuit and compare D.C and A.Cperformance.
6. Analysis of transfer and drain characteristic ofMOSFET.
7. Determining the frequency response of a common-emitter amplifier: low frequency, high frequency and mid frequency response and compare with simulatedresults.
8. Analysis of differential amplifiers circuits: D.C bias and A.C operation without and with current source.
9. Realize BJT Darlington connection and Current Mirrorcircuits.
10. Analysis of frequency response of a voltage series feedback amplifier with and without feedback.
11. Applications of OPAMP-Inverting and non-inverting, differentiator,integrator

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12. Obtain the band width of FET/ BJT using Square wave testing of anamplifier.

13. Analysis of R.C phase shift oscillator/Wien-Bridge Oscillator using OP-Amp/CrystalOscillator.

14. Study of Class A and Class B Power Amplifier and analysis of conversionefficiency.

15. Software based (SPICE) simulation of a few of the experiments(1-14).

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DIGITALSYSTEMDESIGN UPCIE401

Prerequisites: Basic concepts of number system, Basic knowledge of electronic circuits

Course Outcomes:

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

1. Convert different type of codes and number systems which are used in digital communication and Computer systems and Employ the codes and number systems converting circuits and Compare different types of logicfamilies.
2. Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematicalmethods.
3. Design different types of digital electronic circuits (with and without memory element) for particular operation, within the realm of economic, performance, efficiency, user friendly and environmentalconstraints.
4. Design & analyze synchronous sequential logiccircuits
5. Use HDL & appropriate EDA tools for digital logic design andsimulation

Module I (12 Hrs)

Introduction to Digital Circuits: Representation of numbers in binary, octal, decimal and hexadecimal systems. Conversion between systems, 1's and 2's complement representation of numbers.

Logic Gates and Combinational Circuits: Functions, representations and truth tables of logic gates. Universal logic gates, Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and DeMorgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display,

Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

Module II (12 Hrs)

Multivibrator: BistableMultivibrator, fixed-bias bistablemultivibrator, self-biased transistor binary, Triggering the binary, Unsymmetrical Triggering of the bistablemultivibrator, Symmetrical Triggering, Schmitt Trigger Circuit (Emitter coupled BistableMultivibrator).

MonostableMultivibrator, Gate Width of a Collector-Coupled MonostableMultivibrator, Waveforms of the Collector-Coupled MonostableMultivibrator, Astable Collector-Coupled Multivibrator.

Module III (10 Hrs)

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using Programmable Devices.

Textbook(s):

1. Morris Mano and Michael D. Ciletti, "Digital Design", 4th Ed., Pearson Education,2008.
2. C.H. Roth, "Fundamentals of Logic Design", 5th Ed. Cengage Learning,2004.
3. John F. Wakerly, “Digital Design: Principles & Practices”, 3rd Ed,PHI.
4. A Anand Kumar, “Fundamentals of Digital Circuits”, 2nd Ed.,PHI.

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Reference Book(s):

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition,2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition,2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition,2006.
4. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill,1989

ELECTROMAGNETICFIELDTHEORY UPCIE402

Prerequisite: Vector Algebra, Calculus and Differentiation

Course Outcomes:

At the end of the course, students will able to

1. Obtain the electric and magnetic fields for simple configurations under staticconditions.
2. Analyze time varying electric and magneticfields.
3. Derive Wave equations using Maxwell'sequations.
4. Analyze the propagation of EM waves under differentmedium.

Module I (13 Hrs)

Vectors and Fields: Cartesian Coordinate System, Cylindrical and Spherical coordinate system, Vector Algebra, Scalar and Vector Fields, gradient, divergence, curl operations, The Laplacian, Divergence Theorem, Stoke's Theorem, Useful vector identities and their derivations

Electric and Magnetic fields: Field due to a line/sheet/volume charge, Biot Savart Law, Gauss's Law for Electric Field and Magnetic Field, Fields of electric and magnetic dipoles, Applications of electrostatics and magnetostatics, Faraday's Law, Ampere's Circuital Law.

Module II (13 Hrs)

Maxwell's Equations: Divergence and Differential Form, Line Integral, Surface Integral and

Integral form, Faradays Law, Ampere's Circuital Law, Gauss's Law for Electric Field and Magnetic Field.

Wave Propagation in Free Space: The electromagnetic wave equation and its solution, Uniform Plane Waves, Direction cosines, Concept on TEM mode, Poynting Vector and Power density

Module III (10 Hrs)

Wave Propagation in Material Media: Conductors and Dielectrics, Magnetic Materials, Wave Equation and Solution, Uniform Plane Waves in Dielectrics and Conductors, Polarization, Boundary Conditions, Reflection and Transmission of Uniform Plane Waves at the boundary of two media for normal and oblique incidence, Brewster's angle.

Transmission Line Analysis: Transmission lines, Circuit representation of a parallel plane transmission line, Transmission line Parameters, Input Impedance, Standing Wave Ratio.

Textbook(s):

1. Electromagnetic Waves and Radiating Systems, 2nd Edition, E.C. Jordan and K.G. Balmain, Pearson Education, NewDelhi.
2. Elements of Electromagnetic, Mathew N.O. Sadiku, Oxford University Press, NewDelhi.
3. Engineering Electromagnetic, 2nd Edition, Nathan Ida,Springer

Reference Book(s):

1. Fundamentals of Electromagnetic for Engineering, First Impression – 2009, N. N. Rao, Pearson Education, NewDelhi.
2. Engineering Electromagnetic, 7th Edition, William H. Hyat, Tata McGraw Hill Publishing Company Ltd., NewDelhi.
3. Electromagnetic Field Theory Fundamentals, B.S. Guru and H.R. Hiziroglu, PWS Publishing Company, a division of Thomson LearningInc

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4. Griffith

INSTRUMENTATION DEVICES & SYSTEMS–I UPCIE403

Prerequisites: One must have prior knowledge of physics.

Course Outcomes:

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

1. Identify static and dynamic characteristics of general measurement system, identification and compensation of systemdynamics.
2. Choose a sensor suitable for measurement of temperature, displacement, strain, force, pressure.
3. Design of signal conditioning circuit for enhancement of sensorsignal

Module I (10 Hrs)

Elements of a general measurement system; Static Characteristics: systematic characteristics, statistical characteristics, calibration; Dynamic characteristics of measurement systems: transfer functions of typical sensing elements, step and frequency response of first and second order elements, and dynamic error in measurement systems. Techniques for dynamic compensation, loading effect, signal and noise in measurement system, Propagation of errors.

Module II (15 Hrs)

Sensing elements: Transducers and sensors, Resistive sensing elements: potentiometers, Resistance Temperature Detector (RTD), Thermistors, strain gauges. Capacitive sensing elements: variable separation, area and dielectric; Inductive sensing elements: variable reluctance, LVDT and RVDT displacement sensors; Electromagnetic sensing elements velocity sensors; ultrasonic, radar, nucleonic type sensing elements, thermoelectric sensing elements: thermocouple laws, characteristics, installation problems, cold junction compensation. IC

temperature sensor, Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force and torque measurement.

Module III (8 Hrs)

Signal Conditioning Elements: Deflection bridges: design of resistive and reactive bridges, push- pull configuration for improvement of linearity and sensitivity Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, noninverting and differential amplifiers, instrumentationamplifier, and filters. A.C. carrier systems, phase sensitive demodulators and its applications ininstrumentation.

Textbook(s):

1. Principles of Measurement Systems- J.P. Bentley (3/e), Pearson Education, New Delhi,2007.
2. Introduction to Measurement and Instrumentation- A.K. Ghosh(3/e), PHI Learning, New Delhi,2009.
3. Measurement Systems Application and Design- E.O. Doeblin (4/e), McGraw-Hill, International, NY.
4. Transducers and Instrumentation- D.V.S. Murthy (2/e), PHI Learning, New Delhi,2009.

Reference Book(s):

1. Instrumentation for Engineering Measurements- J.W. Dally, W.F. Riley and K.G. McConnel (2/e), John Wiley, NY,2003.
2. Industrial Instrumentation- T.R. Padmanabhan, Springer, London,2000.

FUNDAMENTALS OFCOMMUNICATIONTHEORY UESIE401

Prerequisite: Knowledge of various Analog Hardware Components, Basics of Calculus, Probability and Statistics.

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Course Outcomes:

At the end of this course students will be able to,

1. Apply the knowledge of basic components in communicationsystem.
2. Analyse and design analog communicationsystems.
3. Evaluate the performance of analog communication in presence ofnoise.
4. Interpret various radio transmitter and receiver with theirparameters.

Module I (12 Hrs)

Introduction to basic elements of communication systems

Signal transmission through linear systems:

condition for distortion less transmission of signals through networks. Different types of distortion and their effect on the quality of output signals, transmission of transient signals, distortion analysis.

Amplitude modulation:

Modulation principle and definitions, sideband and carrier power, generation of AM signal, demodulation of AM signal. Different type of modulator circuits, square law modulator, balanced modulator. Demodulator basic principle of coherent detections, square law detectors, average envelope and peak envelope detectors. Quadrature amplitude modulation (QAM), amplitudemodulation: single sideband (SSB), generation of SSB signals, selective filtering method, phase shift method, demodulation of SSB-SC signals, envelop detection of SSB signals with a carrier (SSB+C), amplitude modulation: vestigial sideband (VSB), envelop detection of VSB+C signals, noise in AM receivers using envelope detection, concept of SNR.

Module II (10Hrs)

Frequency and phase modulation:

Principles and definitions, relationship between frequency and phase modulations. phase and frequency deviations, spectrum of FM signal, bandwidth considerations. Effect of modulation

index on bandwidth, narrow band and sideband FM and PM principles, circuit for realization of FM and PM. Demodulation: Principle of demodulation: different type of demodulator, discriminator, use of PLL etc. **Module III (10Hrs)**

Radio transmitter:

Basic block diagram of radio transmitter (AM and FM), Analysis of a practical circuit diagram used for medium power transmitter.

Radio receiver:

Basic block diagram of TRF, Superheterodyne principle, its advantages, Mixer principle and circuit, AVC, Radio receiver measurement.

System noise calculation:

Signal to noise ratio of SSB, DSB, AM for coherent and envelope and square law detection, threshold effect. Signal to noise calculation for FM and threshold

Text books:

1. Haykin S., "Communications Systems", John Wiley and Sons,2001.
2. *B.P. Lathi, Modern Digital and Analog Communication Systems,Oxford*
3. R P Singh, S D Sapre," Communication Systems", TMH,2nd Edition

Reference Books:

1. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGrawHill,2001.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", PearsonEducation,2002.
3. Schaum's Outlines "Analog and Digital Communication",3rd edition

EngineeringEconomics (UHSMH211)

Prerequisites:

1. Mathematics.
2. BasicEconomics.

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Module 1: (10 Hours)

Engineering Economics: Nature, Scope, Basic problems of an economy, Micro Economics and Macro Economics.

Demand: Meaning of demand, Demand function, Law of Demand and its exceptions, Determinants of demand, Demand Estimation and Forecasting, Elasticity of demand & its measurement (Simple numerical problems to be solved), Supply-Meaning of supply, Law of supply and its exception, Determinants of supply, Elasticity of supply, Determination of market equilibrium (Simple numerical problems to besolved).

Production: Production function, Laws of returns: Law of variable proportion, Law of returns to scale.

Module 2: (10 Hours)

Cost and revenue concepts, Basic understanding of different market structures, Determination of equilibrium price under perfect competition (Simple numerical problems to be solved), Break Even Analysis-linear approach (Simple numerical problems to be solved).

Banking: Commercial bank, Functions of commercial bank, Central bank, Functions of Central Bank.

Inflation: Meaning of inflation, types, causes, measures to control inflation.

National Income: Definition, Concepts of national income, Method of measuring national income.

Module 3: (10 Hours)

Time value of money: Interest - Simple and compound, nominal and effective rate of interest, Cash flow diagrams, Principles of economic equivalence.

Evaluation of engineering projects: Present worth method, Future worth method, Annual worth method, Internal rate of return method, Cost benefit analysis for publicprojects.

Depreciation: Depreciation of capital assert, causes of depreciation, Methods of calculating depreciation (Straight line method, Declining balance method), After tax comparison of project.

Text Books:

1. Riggs, Bedworth and Randhwa," Engineering Economics", McGraw Hill EducationIndia.
2. DevigaVengedasalam," Principles of Economics", Oxford UniversityPress.
3. William G. Sullivan, Elin M. Wicks, C. PatricKoelling," Engineering Economy",Pearson.
4. R. Paneer Selvam," Engineering Economics",PHI.
5. S. P. Gupta," Macro Economics",TMH.
6. S. B. Gupta," Monetary Economics", Sultan Chand andCo.

DIGITAL SYSTEMDESIGNLAB ULCIE401

Prerequisites: Basic concepts of number system, Basic knowledge of electronic circuits

Course Outcomes:

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

1. Design and analyze combinational logiccircuits

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2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder,Encoder
3. Design & analyze synchronous sequential logiccircuits
4. Use HDL & appropriate EDA tools for digital logic design andsimulation

List of Experiments: (At least 10 experiments should be done)

Hardware:

1. Digital Logic Gates: Investigate logic behaviour of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffergates.
2. Combinational Circuits: design, assemble and test: adders and subtractors, code converters, gray code to binary and 7 segment displays.Design, implement and test a given design example with (i) NAND Gates only (ii) NOR Gates only and (iii) using minimum number ofGates.
3. Design with multiplexers andde-multiplexers.
4. Flip-Flop: assemble, test and investigate operation of SR, D & J-Kflip-flops.
5. Counters: Design, assemble and test various ripple and synchronous counters - decimal counter, Binary counter with parallelload.
6. Clock-pulse generator: design, implement andtest.

Software:

1. Design CMOS Inverter using Mentor Graphics/any open sourcesoftware
2. Design AND, OR, NAND, NOR, EX-OR, EX-NOR gate using VHDL/Verilog and Implement onFPGA
3. Design adders and subtractors, code converters using VHDL/Verilog and Implement onFPGA
4. Design 4-BIT Magnitude Comparator using VHDL/Verilog and Implement onFPGA
5. Design 8X1 Multiplexer, 1X4 Demultiplexer using VHDL/Verilog and Implement onFPGA
6. Design ALU using VHDL/Verilog and Implement onFPGA.

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7. Design Decade Counter using VHDL/Verilog and Implement onFPGA.

Reference Book(s):

1. Morris Mano and Michael D. Ciletti, "Digital Design", 4th Ed., Pearson Education,2008.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition,2002.

INSTRUMENTATION DEVICES &SYSTEMSLAB ULCIE402

Course Outcome

1. To measure/ characterize and calibrate different sensors/Transducer
2. To compare a group of similarsensors
3. To design and simulate different control scheme usingPLC
4. To design and simulate different circuits using MATLAB/ Multisim/LabVIEW

List of Experiments (Any 10 experiments to be carried out)

1. Temperature sensing using RTD, Thermistor, Semiconductor type temperature sensor andThermocouple.
2. Study of Load cell for measurement ofweight.
3. Measurement of linear displacement usingLVDT.
4. Flow measuring transducers (Pitot Tube, Rotameter, Orifice plate, Venturi meteretc…)
5. Pressure measurement using Bourdon tube and diaphragm typesensor.
6. Design of Regulated power supply unit.
7. Study of RLL for a PLC based sequential controlscheme.
8. Design of Instrumentationamplifier.

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9. Design of active low pass, high pass & band passfilters.
10. Speed measurement using variable reluctance typetransducer.
11. Design of a microcontroller-based storage & displaydevice.
12. Study of Piezoelectric, pH, Humiditysenors.
13. Experiments based onLabVIEW.

COMMUNICATIONSYSTEMLAB ULCIE403

Prerequisite: Basic knowledge and use of, various analog and digital components and systems.

Course Outcomes:

After completing the course, the student will be able to,

1. Practice the basic theories of communicationsystem
2. Design different types of modulators and demodulators like AM, FM, PWM, PAM,PPM
3. Verify the operation of multiplexing, mixer circuit, PLL characteristicsetc.
4. Use computer simulation tools such as P-SPICE, LabVIEW and MATLAB to carryout design experiments as it is a key analysis tool of engineeringdesign.

List of Experiments: (At least 10 experiments should be done)

1. Basic Measurements using SpectrumAnalyzer
2. Study of Amplitude Modulation and Demodulation
3. DSB-SC modulator andDemodulator
4. SSB Modulation andDemodulation
5. Study of Frequency Modulation andDemodulation
6. Study of PAM, PPM and PWM Modulator andDemodulator
7. TDM Multiplexer andDe-multiplexer
8. FDM Multiplexer andDemultiplexer
9. AM Super HeterodyneReceivers
10. Study the functioning of PCM and Deltamodulator

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Simulation experiments using P-SPICE/ ORCAD /LabVIEW / MATLAB.

11. AM modulation and demodulationsystem.
12. FM modulation and demodulationsystem.
13. AM modulator with AWGN noise inMATLAB.
14. Pre-emphasis and De-emphasis in FM usingP-SPICE

Environmental Science

4thSem

Course Objectives:

- Understanding the importance of ecological balance for sustainabledevelopment.
- Understanding the impacts of developmental activities and mitigationmeasures
- Understanding the environmental policies andregulations

Course Outcomes:

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn help in sustainable development

UNIT – I

An Introduction to – Multidisciplinary nature of Environmental Studies.

The Earth and Biosphere (The Earth Science)

Ecology: Concept and Principle of Ecology, Ecological Succession, Population Ecology, Community Ecology, Relationship, Human Ecology, Origin and Evolution of Life, Plant and Speciation.

Ecosystems: Definition, Properties, Function and Structure of Ecosystem. Ecological Balance: Cause, Food chains, food webs, Flow of Energy, Ecological Pyramids, Types of Ecosystem: Land, Aquatic and Artificial ecosystem. Biogeochemical cycles, Bioaccumulation, Bio magnification, ecosystem value, Degradation of Ecosystem.

Bio-diversity and Conservation

Natural Resources: Classification of Resources, Conservation of Resources, Environmental Degradation, Equitable use of Resources for Sustainable Life styles, Role of Individual in

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Conservation of natural Resources.

Water Resources: Sources, Status of World and Indian's Water Resources, Over Utilization of Water, Conservation, Flood and Control measure,Others.

Mineral Resources. Land Resources, Energy Resources, Food Resources, etc.: Classification, Conservation, Environmental Impacts.

UNIT – II

Environmental Pollution: Types of Pollution and Control Measures, Role of Individual in Pollution Prevention.

Waste Management: MSW, WM Techniques, Agricultural Solid Waste Management and Legislation on Solid Waste management.

Disaster Management: Objectives, Type of Disaster. Elements, Organisational Set- up, NDMA, Preparedness, Mitigation, Prevention, Response.

Environment and Development: Social Issues, environmental Ethics, Sustainable Development, Sustainable Energy and materials, Environmental Challenges,: Climate Change, Green House Effect, Global Warming, Ozone Layer Depletion, Protection of Ozone Layer, Acid Rain, EL Nino, Waste land and itsReclamation

Human Population and the Environment: Pupation Growth and Explosion, Pupation Growth and Environment, Family Welfare Programme, Women and Child welfare, HIV/ AIDS, Environment and Health, Human Rights, Value of Education.

Resettlement and Rehabilitation: Introduction, Social Impact Assessment, Methodology of SIA, Land Acquisition and Impact, Stake holder participation and consultation, Socio-economic Issue,, Mitigation Measure.

Rehabilitation Action Plan, Legal Frame work, Training and capacity Building, Grievance and Redressal Mechanism.

UNIT - III

Environmental Protection: Introduction, International efforts, Government Effort, environmental Organisations, Public Awareness, Environmental Education and Training, Green Building, Clean Development Mechanism, carbon Credits.

Environmental Legislation: Environmental Legal Framework, environmental Protection Act, 1986, the Air Act 1981, Water Act 1974, Wild Life Act, 1972, Forest Conservation Act, 1980.

Environmental Management: Environmental Impact Assessment, TOR for EIA, EIA Methodology

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(Brief), Baseline Data, Environmental Clearance, MoEF Notification Dated September 2006, Stake holder in EIA Process

Environment Management and EMP: Introduction, Issues covered, Environmental Management System- ISO-14000, Institution and Implementation Arrangement, Mitigation measures, Environmental Monitoring, Environmental Auditing.

TEXT BOOKS:

1. EnvironmentalStudies(Concept,Impacts,Mitigationandmanagement)byM.P.PooniaandS. C. Sharama, Khana Book Publishing Co. (P) T Ltd. 2019 Edition
2. Textbook of Environmental Studies for Undergraduate Courses by ErachBharucha for University GrantsCommission.
3. Environmental Studies by R. Rajagopalan, Oxford UniversityPress.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. NewDelhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt.Ltd.
3. Environmental Science by Daniel B. Botkin& Edward A. Keller, Wiley INDIAedition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BSPublications.

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MICROPROCESSORANDMICROCONTROLLER UPCIE501

Prerequisite: Digital Electronic Circuits, Hexadecimal Arithmetic, Basic Programming Skills

Course Outcome:

At the end of this course, students will be able to,

1. Recall and apply a basic concept of digital fundamentals to Microprocessor basedsystem.
2. Identify a detailed software and hardware structure of the Microprocessor and Microcontrollers.
3. Analyze the data transfer information through serial & parallelports.
4. Analyze and implement different applications using different peripherals with Microprocessor andMicrocontroller.

Module I (12 Hrs) Microprocessor

The Processors: 8085 - block diagram as well as its pin description, addressing modes of 8085,instruction sets and its data formats, timing diagram of 8085, Assembly language programing , memory and I/O interfacing, memory address decoding, data transfer schemes, interrupts of 8085, Interfacing- Memory, I/O Ports, ADC/ DAC, 8255 PPI, Timer/ Counter, LED, LCD, keyboard etc.

Module II (12 Hrs) Microcontrollers

Introduction to 8 microcontrollers 8051- Introduction to 8051 Micro-controller; Basic features, Timing Diagram, Instructions Register organization, Addressing Modes; Overview of PIC and AVR Microcontrollers.

Module III (8 Hrs)

Advanced Microprocessors

Introduction to 8086/ 80286/ 80386/ 80486/ Pentium (80586) Internal Architecture, Pentium IV-Micro architecture, RISC Architecture, Introduction to ARM Processors.

Text books:

1. K M Burchandi and A K Ray, “Advanced Microprocessors and Peripherals”, 3rd edition, Tata McGraw-Hill Education, 2012, ISBN:9781259006135.

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2. The **8051** Microcontroller and Embedded Systems: Using Assembly and C. Front Cover. Muhammad Ali Mazidi, Janice GillispieMazidi, Pearson/Prentice Hall,2006.

Reference Books:

1. Steve Furber, Arm System-On-Chip Architecture, 2/E, Pearson Education,2009.
2. Fernando E. Valdes-Perez Ramon Pallas-Areny Fundamentals and Applications with PIC Microcontrollers, CRC Press, Taylor Francis, International Standard Book Number-13: 978-1-4200-7767-4.
3. DhananjayaGadre, Programming and Customizing the AVR Microcontroller, McGraw Hill Education 2003, ISBN:9780070582293.
4. Ajay V Deshmukh, Microcontrollers: Theory and Applications, McGraw Hill Education 2004, ISBN:9780070585959

CONTROLSYSTEMENGINEERING UPCIE502

Prerequisite: Basic Electrical Engineering, Circuit Theory, Laplace transform, second order differential Equation.

Course Outcomes:

On completion of the course students will be able to:

1. Analyze the basic concepts of control systems, pole, zero and can analyze system stability on thatbasis.
2. Develop electrical models/ mechanical models to design a physical system for a specific operation.
3. Implement mathematical tools (such as SFG) to analyze a completesystem.
4. Define different time domain specification parameters and thus can apply that knowledge to conclude dynamic performance of asystem.
5. Analyze system's absolute, relative, local stability using different frequency domainmethods.

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6. Design analog controllers, compensators and their selection to meet desiredresponse.

Module I (11 Hrs)

Introduction: definition, control system, open loop, close loop, automatic control, modern control, properties of transfer function Mathematical Modeling: translational, rotational systems and their electrical analogy, mechanical coupling, liquid level systems, servo motors, sensors, magnetic amplifiers, stepper motor, synchros, block diagram, signal flow graph, gain formula.

Feedback characteristics of Control Systems: Feedback and non-feedback systems, Reduction of parameter variations, Control over system dynamics, Effect of disturbance signal by use of feedback, Linearizing effect of feedback, Regenerative feedback, Sensitivity of control system, parameter variation and disturbance ofsignal.

Module II (10 Hrs)

Time Domain Analysis: typical test signals, transient analysis of second order systems, overshoot, damping, settling time and rise time, Analysis of multi-order control system with dominant poles, steady state error analysis, error confidents, generalised error series, transient analysis with derivative control, integral control and proportional control, rate feedback control, Routh Hurwitz stabilitycriteria.

Root Locus Technique: Basic conditions for root loci, rules for construction, stability and conditional stability on root locus.

Module III (12 Hrs)

Frequency Response Analysis: Polar plot, Bode-plot, frequency domain behaviour of control, gain margin and phase margin, WpandMp for second order system, stability criteria. Nyquist Criteria: Stability criteria, conformal mapping, Cauchy's theorem, Nyquist stability criteria, conditionally stable system.

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State variable Technique: state variable for continuous system, transfer function to state variable, state variable to transfer function, state transition matrix, time domain solution of single input single output system. Derivation of Transfer Function for State Model.

Diagonalization: Eigenvalues and Eigenvectors, Generalized Eigenvectors. Solution of State Equations: Properties of the State Transition Matrix, Time domain solutions of multi-input and multi- output systems

Text book(s):

1. J. Nagrath and M Gopal, Control system engineering; New Age InternationalPublisher2010.
2. K Ogata, Modern Control Engineering, PHI, 5th edition
3. Schaum's Outlines "Control Systems", 3rd edition.

Reference Book(s):

1. B S Manke, Linear Control System, Khanna Publication, 11th edition.
2. R C Dorf and R H Bishop, Modern Control Systems; Pearson Education,2009
3. B C Kuo, Automatic Control System; PHI,7th Edition

INSTRUMENTATION DEVICES&SYSTEMS–II UPCIE503

Prerequisites: One must have prior knowledge of physics.

Course Outcomes:

At the end of this course, students will be able to,

1. Select sensor for suitable measurement of low pressure, flow andTemp.
2. Select sensors/Transducers for level, humidity, viscosity, pH,acceleration.
3. Select suitable Optical source, detector and modulation techniques in optical instrumentation.

Module I (13 Hrs)

Pressure measurement: Comparison with known dead-weights, Manometer for use of pressure measurement, Hall Effect transducer, Low pressure (vacuum) measurements (Mechanical, Thermal, Ionization based).

Flow Measurement: Basics of flow measurement; differential pressure flow meters- Pitot tube, Orifice plate, Venturi tube; Rotameter, turbine type flow meter, electromagnetic flow meter. Doppler shift flowmeter.

Temperature measurement: Temperature scale, Change in Dimensions-Bimetals, liquid-in-glass thermometers, Filled system thermometers**.**

Module II (12 Hrs)

Miscellaneous Measurements:

Level measurements using floats, hydrostatic pressure gage and capacitive type; Humidity measurement: capacitive type Hygrometer. pH measurements (Indicator and Electrode method) and liquid conductivity measurements (two poles, four pole type), Viscosity Measurement (Methods of Viscosity Measurement).

Acceleration Measurement: Piezoelectric transducers: basic principle, equivalent circuit, frequency response, charge amplifier; acceleration measurement: basic principle and frequency response; piezoelectric accelerometer, Servo accelerometer (Feedback Instrumentation).

Module III (8 Hrs) Optical sensing:

Optical sources (LED, LASER), Photo detectors (photo conductive cells, photo voltaic, photo emissive and photodiodes); Radiation pyrometer: Planck's law, Stefan Boltzmann's law, broad band and narrow band pyrometer; Optical measurement systems (Modulation of intensity and phase).

Text books:

1. Introduction to Measurement and Instrumentation- A.K. Ghosh,3rd edition, PHILearning.
2. Process Control Instrumentation Technology- C.D. Johnson,8th edition, PHILearning.

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3. Principles of Measurement Systems- J.P. Bentley, 3rd edition, Pearson Education, NDelhi,
4. Measurement Systems Application and Design- E.O. Doeblin, 4th edition McGraw-Hill, International, NY.

Reference Books:

2. Transducers and Instrumentation- D.V.S. Murthy,2nd edition PHI Learning, New Delhi,2009.
3. Industrial instrumentation, D Patronabis, 2nd edition,TMH
4. Modern Control Technology Components and Systems- C.T. Kilian, 3rd edition, Cengage Learning, New Delhi, 2006.

PROCESSCONTROL-I UPCIE504

Prerequisites: Basic Electronics, Control System

Course Outcomes:

Upon successful completion of this course, a student will be able to

1. Interpret different industrialprocesses.
2. Predict the appropriate controller for a specificprocess.
3. Design electronic, hydraulic and pneumaticcontrollers.
4. Identify different final control elements used for processcontrol.
5. Analyze a control valve based on its type andcharacteristics.

Module I (12 hrs)

Introduction to process control-Process definition, what is process-control Block diagram with examples (Ch-1) [C. D Johnson]. Controller Principle-Introduction, Process characteristics-process equation, process load, process lag, self-regulation. Control system parameters-error, variable range, control parameter range, control lag, Dead Time, Cycling, Controller modes, Discontinuous controller modes-two position mode, Multi position mode, Floating control

mode. Continuous control modes: P, I, D mode. Composite control modes: PI, PD, PID (Ch-9) [C.D. Johnson]. Comparison of various controller principle. Controller tuning –process reaction curve (PRC). Ziegler Nichols tuning [K. Ogata] [(Ch-4.10) S. Bhanot]

Module II (11hrs)

Electronics Controller-Introduction, Electronics discontinuous controllers, electronic proportional controller, electronics Integral controller, electronic derivative controller, PI, PD, PID controller. [Ch- 10, C. D. Johnson][Ch-6, S. Bhanot].Hydraulic and Pneumatic Controllers-Only PID design.[Ch-10,

C. D. Johnson] [Ch-5, S. Bhanot]. Digital controller: Introduction, components and working of Direct Digital Control (DDC), benefits of DDC, Digital control realization. [Ch-7, S. Bhanot]

Module III (10 hrs)

Final control element [Ch-4, K. Kant]: Introduction, Final control operation-signal conversion, Actuator-pneumatic actuation, hydraulic actuation, Electric actuation. Control element-Control valve characteristics, control valve categories [Ch-4.6, K. Kant] [Ch-7, C. D. Johnson]

Text books:

1. Process control instrumentation technology, 8thed. by C. D. Johnson,Pearson.
2. Process control principles and applications by S. Bhanot.,Oxforduniversity Press,2010.
3. Computer based Industrial Control, 2nded. by K.Kant.PHI.

Reference Books:

1. M. Gopal, “Digital Control and State Variable Methods” Tata McGraw Hill,2003.
2. C. Johnson, “Process Control Instrumentation Technology”, PHI, NewDelhi.

OPTOELECTRONICS DEVICES&INSTRUMENTATION UPEIE501

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Prerequisite: Vector Algebra in rectangular and cylindrical system of coordinates, Field Theory, Elementary Optics

Course Outcomes:

At the end of the course, students will be able to,

1. Identifyafibretype,evaluateitsparametersandanalyzemodesassociatedwithit
2. EvaluateperformanceindicesofLED,lasers,PINandAPDtypeofphotodetectors
3. Measure physical parameters using fibre optic sensors (FoS) and finding new applicationsthereof
4. Design and analyze a givenFoS.

Module I (14 Hrs)

Wave Optics: Wave Polarization, Transmission of light through slab, Numerical aperture, Wave propagation in cylindrical waveguides, Modes in step and graded index fibres, single mode and multimode fibres, Fibre losses and dispersion characteristics (Chapter 3, 3.4-3.6 of TB-1, Chapter 4, 4.2-4.3 of TB-1/ Chapter 7, 7.2-7.5 of TB-2)Module II (10 Hrs)

Optical Components, Sources: LED, Lasers-fundamentals, conditions for oscillations, construction and principle of operation of semiconductor lasers, pulsed and continuous type lasers (Chapter 4 of TB-1, 11.2-11.4 of TB-1, Chapter 4, 4.2-4.9 of TB-2)

Detectors: photodiodes- PIN and APD. (Chapter 12, 12.1-12.4 of TB-1)

couplers, splicer, polarizer, power coupled to a fibre (Chapter 9 9.2-9.12 of TB-2)

Module III (12 Hrs)

Optoelectronic Instrumentation Modulation techniques: intensity, polarization, interference, electro-optic, electromagnetic; Sensing techniques for displacement, pressure, acceleration, flow, current and voltage measurement, Fibre optic gyroscope, Distributed fibre optic sensors- OTDR and OFDR principles. (Chapter 11, 11.2-11.3.5, 11.3.9, 11.4-11.6 and 11.9 of TB-2)

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Textbook(s):

1. A. Ghatak and K. Tyagrajan: Introduction to Fiber Optics: Cambridge University Press, New Delhi, 2004. (Chapter 2, Sections 7.2-7.3, Chapter 3, Sections 4.3,8.2, 17.2, 17.8, Section 11.3, 11.6, Chapter 12, Chapter18)
2. A. Tripathy, Opto Electronics and Systems: Studium Press, New Delhi,2016

Reference Book(s):

1. John M. Senior, Optical Fibre Communications, Principles and Practice, 3rd Edition, Pearson,2010
2. J.P. Bentley- Principles of Measurement Systems (3/e), Pearson Education, New Delhi,2007.
3. J. Wilson and J.F.B. Hawkes: Optoelectronics: An Introduction (2/e), PHI, New Delhi, 2001. (Chapter 1, Sections 3.1-3.2; 8.1-8.2, Sections 8.3-8.4, 8.5, Sections 4.6, 5.1-5.6, 5.10.2, 7.2, Sections 3.4, 3.7, 3.8, Chapter10)

3. R.P.Khare: Fibre Optics & Optoelectronics, Oxford University Press, New Delhi, 2010.

FiberOpticsInstrumentation UPEIE502

Prerequisite: A basic course on Electromagnetic Theory

Course outcome:

At the end of this course student will be able to:

(1) To expose the students to the basic concepts of optical fibres and theirproperties.
(2) To provide adequate knowledge about the Industrial applications of opticalfibres.
(3) To expose the students to the Laserfundamentals
(4) To provide adequate knowledge about Industrial application oflasers.

Module 1(11hrs)

Optical Sources:

Light emitting diodes (LED), Materials for LED, Types of LEDs, Quantum efficiency, Light Intensity,

Modulation capability, Output Power, LED drive circuits Laser Diode: Laser fundamentals, Absorption and emission of radiation, conditions for amplification by stimulated emission, threshold condition for laser oscillation, resonant frequencies, quantum efficiency, semiconductor laser, modulation of laser diode, radiation pattern, optical transmitters, laser drivers Optical Detectors: PIN photo detector, impulse response and frequency response, avalanche Photodiode(APD).

Module 2(12hrs)

Optical Fibre:

Fibre materials, modes in step index fibre (TE and TM modes only), numerical aperture in graded index ((GI)) fibres modes in GI fibre Power launching and coupling: Source-to-fibre power launching, power launching calculation, equilibrium numerical aperture, lensing schemes for coupling improvement

Module 3 (9hrs)

Industrial Application of Optical Fibres:

Fiber optic sensors – Classifications of sensors, Fiber optic instrumentation system – Different types of modulators – Interferometry method of measurement of length – Moire fringe modulation sensors for displacement measurement, interferometry sensors fiber based Fabrey-Parot interferometry sensors.

Text Books:

- John M. Senior, Optical Fiber Communications, Principles and Practice, 3rd Edition, Pearson, 2010
- Gerd Keiser, Optical Fiber Communications, 2nd Edition, McGraw Hill,Inc.

MICROPROCESSOR ANDMICROCONTROLLERLABORATORY ULCIE501

Prerequisite

Digital Electronics, Basic Programming Skills

Course Outcomes

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

1. Distinguish and analyze the working of Microprocessors &Microcontrollers.
2. Train their practical knowledge through laboratoryexperiments.
3. Do interfacing design of peripherals like I/O, A/D, D/A, timeretc.
4. Develop their skill in the use of tools like Keil, Proteusetc.

Microprocessors- 8085 (at least 5 from the list)

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1. Understanding Arithmetic and Logical OperationsAscending order/ Descendingorder
2. FibonaciSeries
3. Sum of finiteseries
4. Factorial of GivenNumbers
5. Binary to BCD/ BCD to Binary codeconversions
6. Rolling and FlashingDisplay
7. To find Largest and Smallest from a series ofnumbers
8. To control the operation of stepper motor torotate forward and reversedirection
9. Digital Analog conversion/ Analog digitalconversion
10. Traffic Lightcontrol
11. Interfacing- 8255 PPI, Timer/ Counter
12. Application of ARMProcessors

Microcontroller (8051/ AVR/ PIC) (at least 2 from the list)

2. PWMInterfacing
3. BluetoothInterfacing
4. RFID Card basedapplication
5. Ultrasonic Sensor based application

Some experiments based on Proteus (At least 1)

Miniprojects

CONTROL SYSTEMENGINEERINGLAB ULCIE502

Course Outcomes:

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

1. Analyze the first and second order systems using time domain and frequency domain analysis.

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2. Compare the stability analysis using root locus, bode, and Nyquistcriteria.
3. Design PID controller and analyze the lag, lead compensatingnetwork.
4. Design and Implement PID controller for anyapplications.

List of Experiments: (At least 10 experiments should be done)

1. Simulation of a typical second order system and determination of step response andevaluation.
2. To draw the root locus for a given transfer function and verification of breakaway point and imaginary axis crossover point usingMATLAB.
3. To study the effect of P, PI, and PID controller on step response of a feedback control system usingMATLAB.
4. To study the effect of P, PI, and PID controller on step response of a feedback control using trainerkit.
5. Design of PID Controller for first order and second ordersystems.
6. Design of PID Controller for speed control of DC Motor System.
7. To draw the Bode plot of a given transfer function usingMATLAB.
8. To draw the Nyquist plot of a given transfer function usingMATLAB.
9. To design passive RC-lag compensation network for given specification and to obtain its frequencyresponse.
10. To design passive RC-lead compensating network for given specifications is maximum phase lead and frequency at which it occurs and obtain frequencyresponse.
11. To observe the DC-position control system for different values of angular positioncommand.

PROCESS CONTROLILAB ULCIE503

Prerequisite: Control System.

Course Outcome:

At the end of the course, students will be able to,

1. Design P/PI/PID controller for temperature and flow control as a processvariable.

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2. Design lead, lag, lead-lag compensatorynetwork.
3. Realize different characteristics of I/P and P/I converter and control valves.Design of any dynamic process usingPLC.

List of experiments (Any 10 experiments should be carried out):

1) Design and simulation of linear system for differentexcitation.
2) Design of a compensatory network (lead, lag, lead-lag) for the givenspecifications.
3) Performance analysis of P/PI/PID controllers for temperature control as a processvariable.
4) Realization of the characteristics of I/P and P/Iconverter.
5) Design and implementation of water level tank system usingPLC.
6) Performance analysis of PID controller for a flow control as a processvariable.
7) Design of RLL for elevator usingPLC.
8) Performance analysis of PID controller for pressure control as a processvariable.
9) Determination of valve coefficient of a control valve and analyze itscharacteristics.
10) Realization of pneumatic system as a process controlloop.
11) Realization of feed-forward control loop and determination of its characteristics. 12)Mini Project based on experiment no 1-11.

PROCESSCONTROL-II UPCIE601

Prerequisite: Control System

Course Outcomes:

Upon successful completion of this course, a student will be able to

1. Describe an industrialprocess.
2. Analyze the techniques used to get desirable performance of aprocess.
3. Apply different safety measures to avoid hazardous condition inindustry.
4. Evaluate appropriate control strategy for a specificprocess.

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5. Design a scheme to automate simple processes using PLC /DCS.
6. Describe monitor and control of a plant using SCADAsystem.

Module I (10 Hrs)

History of process control systems- Examples of process control system (Heat exchanger, Continuous Stirred –Tank Heater/Reactor(CSTR) ,Incentives for process control: suppress the influence of external disturbances, ensure the stability of a process, optimize the performance of a process [S.K. Singh, G. Stephanopoulos(Ch.1)], Hazardous areas and instrumentation: classification, explosion protection of electrical apparatus, intrinsically safe electronic transmission. (Ch.13, Bentley & Ch.15 A.KGhosh)

Module II (12 Hrs)

Control system with multiple loops-cascade control, selective control, split range control (Ch-20) [G. Stephanopoulos] .Feed forward and ratio control-Logic of feed forward control, problem of designing feed forward controllers, practical aspects on the design of FF controllers, Feed forward-Feedback control, Ratio control.(Ch-21) [G. Stephanopoulos] .Adaptive and Inferential control systems: Adaptive control and Inferential control (Ch-22) [G. Stephanopoulos]

Module III (14 Hrs)

PLC (Programmable Logic Controllers)-Introduction, Principle of operation, Architecture, Programming (Ch-10) [K. Kant] .Distributed Digital Control-introduction, Distributed Vs. centralized control, Advantage of DCS (Ch-7-7.2) [K. Kant] .DCS(Distributed Control System):Distributed Control sub-System, local field station, presentation and monitoring device, communication options in Distributed Control System (Ch-7.5) [K. Kant].SCADA(Supervisory Control and Data AcquisitionSystems):channel scanning, conversion to engineering units, data processing, distributed SCADA system.(Ch-3.6)[K. Kant]

Text books:

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1. George Stephanopoulos, *Chemical process control*, PHI Learning Private Limited, New Delhi,2009.
2. Computer based Industrial Control, 2nded. by K.Kant.,2009
3. Industrial Instrumentation and Control, 3rded. by S KSingh.

Reference Books:

1. Process control (Instrument Engineer Handbook), by Bela G. Liptak, Butterworth Heinemann Publication, 3rdEdition.
2. Process control Systems and Instrumentation By-Terry Bartle, Cengage LearningPublication
3. D.R. Coughnowr, "Process System analysis and Control", McGrawHill.
4. Smith Carlos and Corripio, "Principles and Practice of Automatic Process Control", John Wiley & Sons,2006.
5. Jon Stenerson, "Industrial Automation and Process Control", Prentice Hall,2003.

DIGITALSIGNALPROCESSING UPCIE602

Prerequisites: Basic knowledge in Signals and systems, Fourier series and transform, differential equations

Course Outcomes:

On successful completion of the course, students will be able to,

1. Determine the spectral coefficients of discrete-timesignals.
2. Determine the frequency response and the z-transform representation of discrete-time systems.
3. Determine the discrete Fourier transform of discrete-timesignals.
4. calculate the outputs of discrete-time systems in response toinputs.
5. Design Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters,and

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evaluate the performance to meet expected system specifications using MATLAB.

6. Demonstrate an understanding of contemporary issues by reviewing recent technical articles and establishing relationships between the course material and the content of thearticle.

Module I (12 Hrs)

Introduction to Digital Signal Processing: Discrete time complex exponentials and other basic signals, scaling of the independent axis and differences from its continuous, system properties (linearity, time invariance, memory, causality, BIBO stability), LTI systems described by linear constant coefficient difference equations (LCCDE), auto correlation.**Discrete-Time Signals and Systems (Frequency Domain analysis):** Linear convolution and its properties, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems. Frequency domain representation of Discrete-Time Signals & Systems, Representation of sequences by discrete time Fourier Transform, (DTFT), Properties of discrete Time Fourier Transform, and correlation of signals.

Module II (12 Hrs)

Z Transform: Generalized complex exponentials as eigen signals of LTI systems, z-transform definition, region of convergence (ROC)properties of ROC, properties of the z-transform, inverse z- transform methods (partial fraction expansion, power series method, contour integral approach),pole, zero plots, time domain responses of simple pole, zero plots, ROC implications of causality and stability.

Discrete-Fourier Transform & Fast Fourier Transform: Representation of Periodic sequences: The discrete Fourier Series and its Properties Fourier Transform of Periodic Signals, Sampling the Fourier Transform, The Discrete-Fourier Transform, Properties of DFT, Linear Convolution using DFT. FFT-Efficient Computation of DFT, Goertzel Algorithm, radix-2 Decimation-in-Time and Decimation -in-Frequency FFTAlgorithms

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Module III (10 Hrs)

Filter Design Techniques: Design of Discrete-Time IIR filters from Continuous-Time filters Approximation by derivatives, Impulse invariance and Bilinear Transformation methods; Design of FIRfilters.

Textbook(s):

1. Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer, 3rd edition, 2010, Prentice Hall, Upper Saddle River,NJ.
2. Digital Signal Processing by John G. Proakis and Dimitris K. Manolakis, 4th edition,2007, Prentice Hall, Upper Saddle River,NJ.
3. Digital *Signal Processing* by SanjitMitra, 4th edition, 2011, McGraw-Hill, New York,NY.

Reference Book(s):

1. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH PublishingCo.
2. Digital Signal Processing, A. NagoorKani, TMH Education

ANALYTICALINSTRUMENTATION UPEIE601

Prerequisite: Basic chemistry

Course Outcomes:

Upon successful completion of this course, a student will be able to

1. Select the required instruments for spectroscopicanalysis.
2. Separate the constituents from a complex mixture using the knowledge ofchromatography.
3. Evaluate different online and offline processes and identify suitable instruments for analysis of gaseous, liquid or solidsubstance.
4. Evaluate the physical properties of samples using PH meters and conductivitymeters.
5. Measure the composition of dissolved oxygen, sodium, silica elements presentin

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the given samples quantitatively

6. Analyse the interaction of electromagnetic radiations with matter and apply analytical techniques to accurately determine the elements present in the givensample.

Module I (12 Hrs)

Statistical Analytic Techniques- Mean Variance, Covariance, Confidence Level, Chi-square Test etc.

Fundamentals of Analytical Instruments: Elements and types of Analytical Instruments, Ultraviolet and Visible Absorption Spectroscopy, Different types of Spectrophotometers, Sources of Errors and Calibration, Infrared Spectrophotometers – Basic Components and Types, Sample Handling Techniques, Flame Photometers – Principle, Constructional Details, Types and accessories, Atomic Absorption Spectrophotometers and theirinstrumentation.

Module II (12 Hrs)

Chromatography: Gas Chromatograph – Basic Parts of a Gas Chromatograph, Methods of Measurement of Peak Areas, Liquid Chromatograph – Types, High Pressure Liquid Chromatograph. **pH meters and Ion Analyzers**: Principle of pH Measurement, Electrodes for pH Measurement, pH Meters, Ion Analyzers, Blood pH Measurement.**Gas Analyzers:** Measurement of Blood pCO2 and pO2, Industrial Gas Analyzers – Types, Paramagnetic Gas Analyzer, Infrared Gas Analyzers, Industrial gas Analyzers Based on Other Methods.

Module III (10 Hrs)

Nucleonic or Radiation Techniques of Measurement

Radiochemical Instruments: Fundamentals of Radiochemical Methods, Radiation Detectors, Liquid Scintillation Counters, Gamma Spectroscopy. X-Ray Spectrometers: Instrumentation for X-Ray Spectrometry, X-Ray Diffractometers, X-Ray Absorption Meters, Electron Probe Micro analyzer.

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Text Book(s):

1. Handbook of Analytical Instruments – by R.S. Khandpur, TMH Education Pvt.Ltd.
2. Measurement and Instrumentation: Trends and Applications - M.K. Ghosh, S.Sen and S. Mukhopadhyay (ed.), Ane Books, New Delhi,2008.

Reference Book(s):

1. Instrumental Methods of Analysis – by Willard H.H., Merrit L.L., Dean J.A. and Seattle F.L., CBS Publishing and Distributors, 6/e,1999
2. Instrument Technology – by Jones B.E., Butterworth Scientific Publ., London, 1987. Mechanical and Industrial Measurements by Jain R.K., Khanna Publishing,N Delhi, 2/e, 1992.
3. Principles of Instrumental Analysis – by Skoog D.A. and West D.M., Holt Sounder Publication, Philadelphia,1985.
4. Instrumental Analysis – by Mann C.K., Vickerks T.J. &Gullick W.H., Harper andRow
5. Jone's instrument Technology (vol. 2 and 3) - B.E. Noltingk, Butterworth-Heinmann, NDelhi.
6. Instrumental Methods of Chemical Analysis - E.W. Ewing,McGraw-Hill.
7. Instrumentation, Measurement and Analysis - B.C. Nakra and K.K. Chowdhurry,TMH.

BIOMEDICALINSTRUMENTATION UPEIE602

Prerequisite: Basic circuit theory, Differential Equations, Basic time/frequency domain concepts.

Course outcomes:

At the end of this course student will be able to, Familiarize with various medical equipment and their technical aspects.

1. Introduce the measurements involved in some medicalequipment.
2. Identify, explain and judge patient safety issues related to biomedicalinstrumentation.

Abbreviations Used:L = Lectures, P = Practical or Laboratory, T = Tutorial

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Module I (12 Hrs)

Introduction to Bioengineering, Biochemical and Biomedical Engineering, Sources of Biomedical Signals, Basic medical Instrumentation system, Performance requirements of medical Instrumentation system, general constraints in design of medical Instrumentation system &Regulation of Medical devices. Bioelectrical Signals: Origin of Bioelectric Signals, Electrocardiogram, Electroencephalogram, Electromyogram, Electrode-Tissue Interface, Polarization, SkinContact Impedance, Motion Artifacts.

Module II (12 Hrs)

Electrodes for ECG: Limb Electrode, Floating Electrodes, Prejelled disposable Electrodes, Electrodes for EEG, Electrodes for EMG.

Transducers for Biomedical Applications, Displacement, Position and flow pressure and temperature Transducers, Biosensors or Biochemical Sensor (Urea, Glucose, spO2, pcO2 measurement).

Laser Based Applications.

Blood flow and Blood Pressure Measurement (Invasive and Non Invasive techniques), Pulse oximeter,

Module III (10 Hrs)

General considerations for Signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling), Biomedical Safety and Standards.

Textbook(s):

1. Biomedical Instrumentation And Measurement, 2 Ed by Cromwell, Pearson India, 2015, Paperback,9789332556911
2. Introduction to Biomedical Engineering by Michael M. Domach, Pearson Education Inc, -2004

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Reference Book:

1. Hand Book of Biomedical Instrumentation-2nd Ed by R.S.Khandpur, Tata McGraw Hill,2003

POWER ELECTRONICSANDDRIVE UPEIE603

Prerequisites: Basic Electronics, Digital Electronics

Course Outcomes:

At the end of the course students will be able to

1. Analyse Various power semiconductor devices, Controlled Rectifiers, Ac-dc, ac-ac conversion and source power factors, dc-dc, dc-acconversion
2. Evaluate Transient and steady-state analysis of controlled rectifier on R/R-L/R-L-Eb load and their effects on sourcepf.
3. Analyse Methods of power conversion and soft-switching in variousconverters
4. Implement PWM control and its use in variousconverter

Module I (12 Hrs)

Power semiconductor devices: Switching and V-I characteristic of devices Thyristor family: SCR, TRIAC, GTO, RCT, MCT, and Transistor Family: BJT, IGBT, and MOSFET

Triggering Methods: SCR: UJT and R-C triggering scheme, Power Transistor: MOSFET Gate drive, BJT base drive, IGBT gate drive, Isolation of gate and base drive.

Protection of Devices: SCR: Over voltage, over current, dv/dt, di/dt, Gate Protection.

Transistor: protection of power BJT, IGBT and power MOSFET.

Module II (12 Hrs)

AC to DC converter: Un controlled Diode rectifier: Single phase half wave and full wave rectifiers with R-L and R-L-E load ,3 phase bridge rectifier with R-L and R-L-E load

Controlled rectifiers: Principle of phase controlled converter operation, single phase full

converter with R-L and R-L-E load,3 phase full converter with R-L and R-L-E load single phase semi converter with R-L and R-L-E load, 3 phase semi converter with R-L and R-L-E load.

Single phase PWM rectifier, Three phase PWM rectifier.

AC - AC converter: AC voltage controller: Single phase bi-directional controllers with Rand R-L load, single phase cyclo-converters, ac-voltage controllers with PWM control.

Module III (12 Hrs)

DC - DC converter: Classification: First quadrant, second quadrant, first and second quadrant, third and fourth quadrant, fourth quadrant converter. Switching mode regulators: Buck regulators, Boost regulators, Buck-Boost regulators, CUK regulators, Isolated Types: Fly Back Converters, Forward converters, Push Pull Converters, Bridge Converter.

DC - AC converter: Inverters: PWM inverters, Single phase Bridge Inverters, 3-Phase Inverters-180 deg. conduction, 120 deg. conduction. voltage control of 3-Phase Inverters: Sinusoidal PWM, space vector modulation, Current Source Inverter, Soft-switching, Zero Current Switching resonant inverters, Zero Voltage Switching resonant inverter. UPS, SMPS, Battery Chargers, Electronic Ballast.

Introduction to drives

Textbooks:

1. Power Electronics: Converters, Applications, and Design by Ned Mohan, Undeland and Robbins, Wiley StudentEdition.
2. Power Electronics: Circuits, Devices and Applications by M H Rashid, 3rd Edition,Pearson

Reference Books:

1. Modern power Electronics and AC Drives, B.K. Bose,PHI
2. Power Converter Circuits by W Shepherd and L Zhang, CRC, Taylor and Francis, Special IndianEdition
3. Power Electronics, P.S. Bimbhra, KhannaPublication.

ADVANCEDELECTRONICSCIRCUITS UPEIE604

Abbreviations Used:L = Lectures, P = Practical or Laboratory, T = Tutorial

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Prerequisite: Basic Electronics, Analog Electronic Circuit.

Course Outcome:

At the end of the course, students will be able to

1. Analyze the functioning of Wave shapingcircuits
2. Analyze current flow and time base waveform of differentmultivibrators.
3. Design Schmitt trigger circuit and Time basegenerator
4. Apply NE555 timer IC and PLL in differentscenarios.

Module I (10 Hrs)

Linear Wave Shaping Circuit: High pass and low pass RC circuits and their response for Sinusoidal, Step, Pulse, Square, & Ramp inputs, High pass RC network as Differentiator, Low pass RC circuit as an Integrator, Attenuators and its application as a CRO Probe, RL and RLC Circuits and their response for Step Input, RingingCircuit.

Non-Linear Wave Shaping Circuit: Diode clippers, Transistor clippers, Clipping at two independent levels, Comparators, Applications of Voltage comparators. Clamping Operation, Clamping circuit taking Source and Diode resistances into account, Clamping Circuit Theorem, Practical Clamping Circuits, Effect of Diode Characteristics on Clamping Voltage, Synchronized Clamping.

Module II (12 Hrs)

Multivibrator: BistableMultivibrator, fixed-bias bistablemultivibrator, self-biased transistor binary, commutating capacitors, Triggering the binary, Unsymmetrical Triggering of the bistablemultivibrator, Triggering Unsymmetrically through a Unilateral Device, Symmetrical Triggering, Triggering of a Bistable Multi Symmetrically without the Use of Auxiliary Diodes, Schmitt Trigger Circuit (Emitter- coupled BistableMultivibrator).

Monostable and AstableMultivibrator: MonostableMultivibrator, Gate Width of a Collector-Coupled MonostableMultivibrator, Waveforms of the Collector-Coupled Monostable

Multivibrator, Emitter-Coupled MonostableMultivibrator, Triggering of the MonostableMultivibrator. Astable Collector-Coupled Multivibrator, Emitter-coupled Astablemultivibrator.

Module III (10 Hrs)

Negative Resistance Switching Devices: Voltage Controllable Negative resistance devices, Tunnel Diode operation and characteristics, Time-Base Generators, General features of a Time-base signal, Methods of generating a voltage time-base waveform, Exponential sweep circuit, Miller and bootstrap time base generators-Basic principles, Transistor miller time base generator, Transistor bootstrap time base generator, Current Time-Base Generators, A Simple Current sweep, Linearity Correction through adjustment of driving waveform, Transistor current time basegenerator.

Specialized IC Applications: IC 555 Timer: IC 555 Timer as a MonostableMultivibrator and its applications, IC 555 Timer as AstableMultivibrator and its applications.

Phase Locked Loop: Operating principle of PLL, Phase detectors, Exclusive-OR phase detector, Monolithic phase detector, Instrumentation Amplifier and its applications.

Text books:

1. Pulse, Digital and switching Waveforms, Second Edition - Jacob Millman, Herbert Taub and Mothiki S Prakash Rao (TMH Publication). (Selected portion from Chapter 3, 8, 9, 10, 11, 12 and13)
2. OP-Amps and Linear Integrated Circuits- Ramakant A. Gayakwad (PHI Publication). (Selected portion from Chapter 7, 8 and9)
3. Pulse & Digital Circuits by K.Venkata Rao, K Rama Sudha& G Manmadha Rao, Pearson Education,2010.

Reference Books:

1. Pulse and Digital Circuits by A. Anand Kumar,PHI.
2. OP-Amps and Linear Integrated Circuits - Robert F. Coughlin, Frederick F.Driscoll

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(Pearson Education Publication).

ADAPTIVESIGNALPROCESSING UPEIE701

Prerequisites: Discrete time system and their properties, FIR and IIR filter, DFT, Z-transform, and Fourier Transform etc.

Course Outcome:

The student will be able to:

1. Apply adaptive modeling systems for real timeapplications.
2. Realize the estimation theory for linear systems and modelingalgorithms.
3. Optimize various parameters of the electronic circuits using LMS and RLStechnique.
4. Know the difference between LMS and RLS technique and theirlimitations.
5. Evaluate the design criteria and modeling adaptive systems.Module I (8 Hrs)

Introduction: Adaptive Systems – General concept of adaptive filtering, Definition and characteristics, General properties, Open and Closed Loop Adaptations, Applications

The Adaptive Linear Combiner: Performance function, Gradient and Mean Square Error withexamples

Module II (10 Hrs)

Theory of Adaptation with Stationary Signals: Properties of the Quadratic Performance Surface, Significance of Eigen values, Eigen vectors, correlation matrix. Searching the Performance Surface: A simple gradient search algorithm, Stability and Rate of convergence, the learning curve, Gradient Estimation and its effects on Adoption: The performance penalty, Variance of the gradient estimate.

Module III (16 Hrs)

Adaptive Algorithms and Structures: The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error, Convergence, learning Curve, Performance analysis, Filtered X LMS algorithm,

Introduction to recursive least squares (RLS): Vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters **Applications:** Adaptive Modelling and System Identification using adaptive filter, Inverse Adaptive Modelling, Deconvolution, and equalization using adaptive filter, Adaptive Control Systems using Filtered X LMS Algorithm, Adaptive Noise Cancellation using Adaptivefilter

Text books:

1. Bernard Widrow and Samuel D. Stearns, Adaptive Signal Processing, Pearson Education, 2nd impression 2009.

Reference Books:

1. Simon Haykin, Adaptive Filter Theory, 4th Edn., Pearson Education.

ADVANCEDCONTROLSYSTEM UPEIE702

Prerequisites: Engineering Mathematics, Control System Engineering

Course Outcome:

After completion of the course students will be able to,

1. Analyze, design & implement SISO & MIMO systems using state spaceapproach
2. Demonstrate discrete, digital, non-linear controlsystems.
3. Apply Z- transform, pulse transfer function in digital systemanalysis.
4. Analyze digital system and non-linear system stability using different analysistools.

Module I (12 Hrs)

Discrete - Time Control Systems: Introduction: Discrete Time Control Systems and Continuous Time Control Systems, Sampling Process. Digital Control Systems: Sample and Hold.

The Z-transform: Discrete-Time Signals, The Z-transform, Z-transform of Elementary functions, Important properties and Theorems of the Z-transform. The inverse Z-transform, Z-Transform method for solving Difference Equations. Z-Plane Analysis of Discrete Time Control Systems: Impulse sampling & Data Hold, Reconstruction of Original signals from sampled signals: Sampling theorem, folding, aliasing. Pulse Transfer function: Starred Laplace Transform of the signal involving Both ordinary and starred Laplace Transforms; General procedures for obtaining pulse Transfer functions, Pulse Transfer function of open loop and closed loopsystems.

Module II (12 Hrs)

State Variable Analysis & Design: Introduction: Concepts of State, State Variables and State Model (of continuous time systems): State Model of Linear Systems, State Model for Single-Input-Single- Output Linear Systems, Linearization of the State Equation. State Models for Linear Continuous – Time Systems: State-Space Representation Using Physical Variables, State – space Representation Using Phase Variables, Phase variable formulations for transfer function with poles and zeros, State

– space Representation using Canonical Variables, Derivation of Transfer Function for State Model. **Solution of State Equations:** Properties of the State Transition Matrix, Computation of State Transition Matrix, Computation by Techniques Based on the Cayley- Hamilton Theorem. Concepts of Controllability and Observability: Controllability, Observability, Effect of Pole-zero Cancellation in Transfer Function.

Module III (10 Hrs)

Nonlinear Systems: Introduction: Behaviour of Nonlinear Systems, Investigation of nonlinear systems. Common Physical Non Linearities: Saturation, Friction, Backlash, Relay, Multivariable Nonlinearity.

The Phase Plane Method: Basic Concepts, Singular Points: Nodal Point, Saddle Point, Focus

Point, Centre or Vortex Point, Stability of Non Linear Systems: Limit Cycles, Construction of Phase Trajectories: Construction by Analytical Method, Construction by Graphical Methods.

The Describing Function Method: Basic Concepts: Derivation of Describing Functions: Dead-zone and Saturation, Relay with Dead-zone and Hysteresis, Backlash.

Text books:

1. Discrete-Time Control System, by K.Ogata,2nd edition(2009),PHI.
2. Control Systems Engineering, by I.J. Nagrath and M. Gopal., 5th Edition (2007 / 2009),New Age International (P) Ltd.Publishers.

Reference Books:

1. Design of Feedback Control Systems by Stefani, Shahian, Savant, Hostetter, Fourth Edition (2009), Oxford UniversityPress.
2. Modern Control Systems by K.Ogata, 5thEdition(2010),PHI.
3. Modern Control Systems by Richard C. Dorf. And Robert, H.Bishop, 11thEdition (2008), Pearson Education Inc.Publication.
4. Control Systems (Principles & Design) by M.Gopal, 3rdEdition (2008), TMH Publishing CompanyLtd.
5. ControlSystemsEngineeringbyNormanS.Nise,4th Edition(2008),WileyIndia(P)Ltd.

EMBEDDEDSYSTEMS UPEIE703

Prerequisites: Microprocessor and Microcontroller

Course Outcomes:

At the end of the course, students will be able to:

1. Suggest design approach using advanced controllers to real-lifesituations.
2. Design interfacing of the systems with other data handling / processingsystems.
3. Appreciate engineering constraints like energy dissipation, data exchange speedsetc.

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4. Implement simple embedded applications

Module I (10 Hrs)

Introduction to Embedded Systems- Classification, Challenges, design Issues, Von Neumann versus Harvard Architecture, RISC, CISC, Application Areas, Typical Embedded System- Core of Embedded System, Memory, Sensor, Actuator, Communication interface, Embedded Firmware, Other Components, Characteristics of Embedded Systems, Quality Attributes of Embedded Systems, Embedded Systems- Application and Domain Specific.

Module II (12 Hrs)

PIC Architecture Introduction to PIC microcontrollers, PIC architecture, comparison of PIC with other CISC and RISC based systems and microprocessors, memory mapping, assembly language programming, addressing modes, instruction set. Overview of AVR Controllers and ARM Processors. I/O Programming I/O ports, I/O bit manipulation programming, timers/counters, programming to generate delay and wave form generation, I/O programming, LEDs, 7segment LED display, LCD and Keypad interfacing, Introduction to Proteus.

Module III (10 Hrs)

Real Time Operating System for Embedded Systems- Tasks, Process, Threads, Multi Processing, Multi-Tasking, Task Communication, Task Synchronization, Deadlock, Scheduling Algorithms- Pre- emptive, Non Pre-emptive, Periodic, Aperiodic. How to choose an RTOS, Embedded Product Development LifeCycle.

Case Studies: Digital Camera, Washing Machine, Automotive, Smart Card

Textbook(s):

1. Shibu K V, Introduction to Embedded Systems, Tata McGraw Hill,2009

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2. Chuck Hellebuyck, Programming PIC microcontrollers with PIC basic, Elsevier,2003

Reference Book(s):

1. Peter Marwadel, Embedded System Design, Springer,2014.

2. Embedded Systems: Architecture, Programming and Design, Tata McGraw-Hill Education,2011

MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS) UPEIE704

Prerequisites: Physics, Mechanics.

Course Outcomes:

At the end of the course, students will be able to:

1. Compute different methods for Processing MEMS materials
2. Analyze Characteristic techniques of micro system fabricationprocess
3. Elaborate the evolution of Nanotechnology
4. Impart knowledge about nano materials and various nano measurementstechniques

Module I (12 Hrs)

MEMS and Microsystems: Introduction to MEMS and Microsystems, typical MEMS and Microsystem products, Materials for MEMS and Microsystems, Microsystem fabrication processes, wafer bonding. Overview of Micro manufacturing – Bulk micromachining, Surface micromachining, LIGA Process. Working principles of Microsystems, MEMS Applications.

Module II (12 Hrs)

Microsystem Modeling and Design: Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage, Mechanical sensors and actuators: Piezo resistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, Micro actuation using SMA and Piezoelectric crystals. Mag-MEMSMaterials.

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Module III (10 Hrs)

MEMS and Microfluidic Systems: Principle of MOEMS – Light modulator, beam splitter, digital micro- mirror device, light detectors and optical switch. Micro-fluidic system – Fluid actuation method, Dielectrophoresis, Electrowetting, Micro fluid Dispenser, Micro needle, Micro pumps.

Text books:

1. Tai-Ran Hsu, "MEMS and Microsystems, Design and manufacture ", McGraw Hill,2002.
2. NitaigourPremchandMahalik, "MEMS ", McGraw Hill, fifth reprint,2011.
3. G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi,2010.

Reference Books:

1. Gabriel M. Rebeiz: RF MEMS Theory, design & Technology, Wiley India Education,2010.
Ellis Meng, "Biomedical Microsystems ", CRC Press, 2011.

VLSI UPEIE705

Pre requisites: Analog Electronics, Digital Electronics

Course Outcomes:

At the end of the course the students will be able to,

1. Interpret the submicron issues in VLSIDesign
2. Design different CMOS circuits using various logic families along with their circuitlayout.
3. Analyse parasitic effects, switching delays, power dissipation issues in VLSIdesigns.
4. Implement VLSI IC design using EDAtools.

Module I (10 Hrs)

Basic MOSFET Characteristics -The MOS Threshold Voltage, Body Bias, CV Characteristics, Scaling, Small-Device Effects-Threshold Voltage Modifications, Mobility Variations, Hot

Electrons, Small Device Model, Basic Circuit and DC Operation (CMOS) - DC Characteristics, Noise Margins, Transistor as aswitch.

Module II (12 Hrs)

Inverter Switching Characteristics-Switching Intervals, High-to-Low Time, Low-to-High Time, Maximum Switching Frequency, Transient Effects on the VTC, RC Modelling, Propagation Delay, Use of the Step-Input Waveform, Output Capacitance, Inverter Design- DC Design, Transient Design, Power Dissipation, Driving Large Capacitive Loads, Pass Transistor Logic, Pseudo-nMOS Logic Gates- Complex Logic in Pseudo-nMOS, Simplified XNOR Gate, Transmission Gate, Sequential Circuit Design, CMOS DifferentialLogic Families, Dynamic Logic, Domino Logic, NORA, ZipperLogic.

Module III (10 Hrs)

Integrated Circuit Layout: Design Rules, Parasitics, Delay: RC Delay model, linear delay model, logical path efforts, Power, interconnect and Robustness in CMOS circuit layout, Issues in Chip Design-On-Chip Interconnects-Line Parasitics, Modelling of the Interconnect Line, Clock Distribution, Coupling Capacitors and Crosstalk, Input and Output Circuits- Networks, Output Circuits, Transmission Lines- Ideal Transmission Line Analysis, Reflections and Matching, Introduction to VHDL/ Verilog.

Text books:

1. J.P.Uyemura, CMOS Logic Circuit Design, Kluwer Academic Publishers2001.
2. Kang andLeblebici
3. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India,2011.
4. J. Rabaey, AnanthaChandrakasan, Borivoje Nikolic, Digital Integrated Circuits: A Design Perspective, Pearson Education India 2016ISBN-13: 9788120322578.

Reference Books:

1. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

EntrepreneurshipDevelopment UHSMH701

Prerequisites:

1. OrganizationalBehaviour.
2. English.

Module 1: (06Hours)

Entrepreneurship: Concept of Entrepreneurship and Intrapreneurship, Types of Entrepreneur, Nature and Importance, Entrepreneurial Motivation and Achievement, Entrepreneurial Personality & Traits and EntrepreneurialSkills.

Module 2: (08Hours)

Entrepreneurial Environment, Identification of Opportunities, Converting Business, Opportunities into reality. Start-ups and business incubation, Skill Development. Setting up a Small Enterprise. Issues relating to location, Environmental Problems and Industrial Policies and Regulations.

Module 3: (08 Hours)

Basics of Accounting, Terms: Assets, Liabilities, Equity, Revenue, Expense, Working capital, Marketing Mix and STP.

HRM: Concepts and Function, Labour Laws- Factories Act, Organizational sup- port services - Central and State Government, Incentives and Subsidies.

Module 4: (08 Hours)

Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Government in reviving sick industries.

Text Books:

1. Entrepreneurship Development and Management, Vasant Desai,HPH.
2. Entrepreneurship Management, Bholanath Dutta, ExcelBooks.
3. Entrepreneurial Development, Sangeeta Sharma,PHI.
4. Entrepreneurship, Rajeev Roy, Oxford UniversityPress.

ARTIFICIALINTELLIGENCE UPEIE801

Prerequisite: Familiarity with Calculus, Theory of Probability and Statistics.

Course outcome:

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

1. Implement the ideas of intelligent agents and searchmethods.

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2. Analyze knowledge representation and reasoning.
3. Illustrate about planning and learningmethodologies.
4. Construct plans and methods for designingcontrollers.

Module I (15 Hrs)

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Overview of Al – History and developments in AI, general concepts – production systems and examples, Intelligent agents, Perception, Introduction to natural language processing.

SEARCH STRATEGIES AND ALGORITHMS

Structures and strategies for state space search- Data and Goal driven search, search techniques– BFS, DFS, DFS with iterative deepening, best first search and Heuristic search – A* algorithm, AO* algorithm, constraint satisfaction.

Module II (10 Hrs)

KNOWLEDGE REPRESENTATION AND REASONING

Representing knowledge– propositional calculus, predicate calculus, AI representational schemes, semantic networks, conceptual dependency, scripts and frames, theorem proving by resolution refutation, Basic probability notation, Axioms of probability, Baye's rule, Probabilistic reasoning.

Module III (10 Hrs)

PLANING AND LEARNING

Planning: Planning problem – Partial order planning – Planning and acting in non- deterministic domains – Learning: Learning decision trees, Knowledge in learning, Neural networks- basic architectures and types, Reinforcement learning – Passive and active.

Text books:

1. George. F, Luger, "Artificial Intelligence – Structures and Strategies for Complex Problem Solving", Fourth Edition, Pearson Education,2002.

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IA = Internal Assessment , PA =Practical Assessment, EA = End-Semester Assessment

2. Elain Rich and Kevin Knight, "Artificial Intelligence", Second Edition Tata McGraw Hill,2004.
3. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig, Prentice Hall, Englewood Cliffs, New Jersey07632

Reference Books:

1. Donald. A, Waterman, "A Guide to Expert Systems", PearsonEducation.2009.
2. Oliver Pourret, PatrikNaim and Bruce Marcot, "Bayesian Networks-A Practical guide to applications", 2008.
3. Artificial Intelligence: A New Synthesis (The Morgan Kaufmann Series in Artificial Intelligence) by Nils J Nilsson, Elsevier India, Firstedition.

SATELLITECOMMUNICATIONSYSTEM UPEIE802

Prerequisites: Basics of Analog and Digital Communication

Course Outcomes:

At the end of this course, students will be able to

1. Define orbital mechanics and launching methodologies ofsatellites.
2. Analyze the satellitesubsystems
3. Design link power budget forsatellites.
4. Compare different multiple access techniques for satellitecommunications.

Module I (8 Hrs) Satellite Orbits

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non-Geo-stationary orbits – Look Angle Determination- Limits of visibility eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

Module II (12 Hrs)

Space Segment and Satellite Link Design

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. **Satellite link budget:** Flux density and received signal power equations, Calculation

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ofSystem noise temperature for satellite receiver, noise power calculation, Drafting of satellite linkbudget and C/N ratio calculations in clear air and rainy conditions.

Module III (12 Hrs) Satellite Access

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication,

Satellite Applications

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH).

Text books:

1. Timothy Pratt and Others, "Satellite Communications", Wiley India, 2ndedition,2010.
2. S. K. Raman, "Fundamentals of Satellite Communication", Pearson Education India,2011.

Reference Books:

1. Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill,2009.
2. Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition,2008.

DIGITALIMAGEPROCESSING UPEIE803

Prerequisites: Signals and systems, Digital Signal Processing

Course Outcomes:

On successful completion of the course, students should be able to:

1. Review the fundamental concepts of a digital image processingsystem.
2. Analyze images in the frequency domain using varioustransforms.
3. Evaluate the techniques for image enhancement and imagerestoration.
4. Categorize various compressiontechniques.

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5. Interpret Image compressionstandards.
6. Interpret image segmentation and representationtechniques.

Module I (13 Hours)

Digital Image Fundamentals and Transforms: Elements of visual perception, Image sampling and quantization Basic relationship between pixels, Basic geometric transformations, Properties of 2D Fourier Transform, FFT, Separable Image Transforms, Walsh – Hadamard, Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve transforms.

Image Enhancement Techniques: Spatial Domain methods: Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging, Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters: Smoothing, Sharpening filters, Homomorphic filtering.

Image Restoration: Model of Image Degradation/restoration process, Noise models, Inverse filtering, Least mean square filtering, Constrained least mean square filtering, Blind image restoration, Pseudo inverse, Singular value decomposition.

Module II (11 Hours)

Image Segmentation: Point, Line, Edge detection, Thresholding, Region Based segmentation, Hough Transform.

Image Compression: Lossy and lossless compression schemes, prediction based compression schemes, vector quantization, sub-band encoding schemes, JPEG compression standard, Fractal compression scheme, Wavelet compression scheme.

Module III (10 Hours)

Color Image Processing: Color Representation, Laws of color matching, chromaticity diagram, color enhancement, color image segmentation, color edge detection, color demosaicing.

Morphological Image Processing: Dilation, Erosion, Duality, Opening, Closing, Hit-or-Miss Transformation, Basic morphological algorithm.

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IA = Internal Assessment , PA =Practical Assessment, EA = End-Semester Assessment

Textbook(s):

1. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing, Pearson Education2003.
2. A.K. Jain, Fundamentals of Digital Image Processing,PHI

Reference Book(s):

1. William K Pratt, Digital Image Processing, John WilleyPublishers
2. MillmanSonka, Vaclav Hlavac, Image Processing Analysis and Machine Vision,Thompson Learning(1999).

MACHINELEARNING UPEIE804

Pre-requisites: Familiarity with Theory of Probability and Statistics.

Course outcome:

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

1. Design algorithms that allow machines (e.g., a computer) to learn patterns and concepts from data without being explicitlyprogrammed.
2. Implement the ideas to the design (and some analysis) of Machine Learning algorithms, with a modern outlook focusing on recent advances, and examples of real-world applications of Machine Learningalgorithms.

Module I (10 Hours)

Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbors, Decision Trees, Naïve Bayes. Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking, Different error evaluation metrics (etc, F1 score, confusion matrix, precision, recall)

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Module II (10 Hours) Unsupervised Learning

Clustering: K-means/Kernel K-means, Density based clustering (DBSCAN), Association Rule learning, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)

Assorted Topics, Evaluating Machine Learning algorithms and Model Selection

Module III (12 Hours)

Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests), Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning, Scalable Machine Learning (Online and Distributed Learning), A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

Text books:

1. Tom Mitchell, Machine Learning,McGraw-Hill.
2. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press,2012
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of StatisticalLearning, Springer2009.
4. Christopher Bishop, Pattern Recognition and Machine Learning, Springer,2007.

Reference books:

1. SoumenChakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan- Kaufmann, 1st edition (October 23,2002)
2. Foundations of Machine Learning by MohriMehryar, AfshinRostamizadeh, and Ameet Talwalkar, MIT Press,2012
3. Machine Learning: Step-by-Step Guide To Implement Machine Learning Algorithms with Python by RudolphRussell.

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4. Hal Daumé III, A Course in Machine Learning,2015.

WIRELESSSENSORNETWORK UPEIE805

Prerequisites: Various network topology, different types of sensors, Real-time application of wireless sensor network.

Course Outcomes:

At the end of the course the students will be able to,

1. Evaluate the type of sensor nodes required in a particularapplication.
2. Apply the various network deployment techniques while designing a sensor network large amount of sensornodes.
3. Calibrate the parameters required for designing an energy-efficient sensor network keeping in- eye the effectivetime-synchronization.

MODULE I (12 Hrs)

Sensor Network Concept: Introduction, networked wireless sensor devices, Advantages of Sensor networks, Applications, Key design challenges.

Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, and Mobiledeployment.

Localization and Tracking: Issues and approaches, Coarse-grained and Fine-grained node localization. Problem formulations: Sensing model, collaborativelocalization.

MODULE II (14 Hrs)

Tracking multiple objects: State space decomposition. Synchronization: Issues and Traditional approaches.

Communication Protocols for Senor Networks: Application layer protocols for WSN, Transport Layer, Network Layer, Data Link Layer, and Physical Layer, Time synchronization. Wireless Characteristics: Link quality.

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MODULE III (10 Hrs)

Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques.

Energy-efficient and robust routing: Overview, Lifetime-maximizing energy-aware routing techniques, Geographic routing.

Text books:

1. Networking Wireless Sensors: BhaskarKrismachari, Cambridge UniversityPress

References Books:

2. Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam,TaiebZnati, Springer.

3. Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas, Morgan Kaufmann Series in Networking2004.

4. Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, Daniel Minoli, TaiebZnati, Wiley InterScience.

OPEN ELECTIVE

Digital Image and Video Processing

Module I (10 Hrs)

Image representation: Gray scale and colour Images, image sampling and quantization. Two dimensional orthogonal transforms: DFT, Haar transform, KLT, DCT. Image enhancement - filters in spatial and frequency domains, histogram-based processing, homomorphic filtering. Edge detection - non parametric and model based approaches, LOGfilters.

Image Restoration: Degradation Models, PSF, circulant and block - circulant matrices, deconvolution, restoration using inverse filtering, Wiener filtering and maximum entropy-based methods.

Module II (12 Hrs)

Image Segmentation: Pixel classification, Bi-level thresholding, Multi-level thresholding, P-tile method, Adaptive thresholding, Spectral & spatial classification, Edge detection, Region growing.

Image compression: Fundamental concepts of image compression - Compression models – Information theoretic perspective - Fundamental coding theorem - Lossless Compression: Huffman Coding- Run length coding - Lossy compression: Transform coding - Image compression standards.

Module III: (10 Hrs)

Video Processing: Representation of Digital Video, Spatio-temporal sampling; Motion Estimation; Video Filtering; Video Compression, Video coding standards.

Text Books:

1. Digital Image processing Gonzalez and Woods, 3rd edition, Pearson and Prentice Hall,2009
2. Image processing, analysis and machine vision Sonka, Hlavac and Boyle, Cengage learning,2008

References

1. W.K. Pratt: Digital image processing, 4th edition, Wiley India,2007.
2. K.R. Castleman: Digital image processing, 2nd edition, Pearson,2012.
3. A.K. Jain: Fundamentals of digital image processing, Prentice Hall,1989.

DIGITAL COMMUNICATION

MODULE – I (17 HOURS)

Sampling Theorem, Some applications of sampling theorem.

Digital Representation of Analog Signal - Quantization of Signals, Quantization error, PCM, Electrical representation of binary digits, PCM System, Companding (4); Line coding, scrambling, T1 Digital System, Multiplexing T1 lines – The T2, T3 and T4 lines (3); Differential PCM- Linear predicted design, Delta Modulation, and Adaptive Delta Modulation.

Noise in PCM and DM - Calculation of Quantization Noise, Output Signal Power, Thermal Noise, Output SNR in PCM, Quantization noise in Delta Modulation, output signal power, output SNR, Comparison with PCM and DM.

MODULE – II (7 HOURS)

Digital Modulation Technique- Generation, Transmission, Reception; Spectrum and Geometrical Representation in the Signal Space of BPSK, DPSK, QPSK, QASK, M-ary PSK, BFSK, M-ary FSK, and Minimum Shifting Keying (MSK).

MODULE – III (8 HOURS)

Principle of Digital Data Transmission- Digital Communication Systems – Source, Line coder, Multiplexer, Regenerative repeater; Line Coding- PSD of various line codes, polar signalling, constructing a DC Null in PSD by pulse shaping, On Off signalling, Bipolar signalling; Pulse shaping – ISI and effect, Nyquist first criterion for zero ISI; Scrambling, Digital receiver and regenerative repeaters; Equalizers, Timing extraction, Detection error, EyeDiagram.

TEXTBOOKS

1. Principles of Communication Systems, H Taub, D L Schilling and G Saha, TMH Education Pvt Ltd, 4th Edition2013.
2. An Introduction to Analog and Digital communications, Simon Haykin, Wiley Publication, 2nd edition, 2007

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3. Modern Digital and Analog Communication Systems, B.P. Lathi and Z Ding, Oxford University Press, New Delhi. 4th Edition2010.

REFERENCE BOOKS

1. Digital and Analog Communication System, Leon W. Couch-II, Prentice Hall of India, Pearson Education, 6th Edition2001.
2. Digital and Analog Communication System, K. Sam Shanmugam, Wiley India Pvt. Ltd2006.
3. Digital Communications – Fundamentals and applications, Bernard Sklar, Pearson education Publication, 2nd Edition,2009.
4. R N Mutagi, Digital Communication- Theory, Techniques and Applications, Oxford UniversityPress

SATELLITE COMMUNICATION

MODULE-I (12 Hours)

Introduction to satellite communication: Orbital mechanics and parameters look angle determination, Launches and Lunch vehicle, Orbital effects in communication system performance. Attitude and orbit control system (AOCS), TT&C, Description of spacecraft System ; Transponders,
Satellite Link Design: Basics of transmission theory, system noise temperature and G/T ratio, Uplink and Downlink design, design of satellite links for specified (C/N) performance.

MODULE–II (10 Hours)

Analog telephone and television transmission: Energy dispersal, digital transmission Multiple Accesses: Multiplexing techniques for satellite links, Comprehensive study on FDMA, TDMA and CDMA; Spread Spectrum Transmission and Reception; Estimating Channel requirements, SPADE, Random access

MODULE-III (10 Hours)

Propagation on satellite: Earth paths and influence on link design; Quantifying attenuation and depolarization, hydrometric & non hydrometric effects.
Satellite Antennas: Types of antenna and relationships; Basic Antennas Theory – linear, rectangular & circular aperture; Gain, pointing loss,

Text Books

1) Satellite Communication, T. Pratt, C. Bostian, John Wiley Co, 2ndEdition.
2) Satellite Communication, Principles & Applications, R.N.Mutagi, Oxford University Press, 1st Edition, 2016

Reference Books

1. Digital Communication with Satellite and Fiber Optic Application, HarlodKolimbins,PHI

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2. Satellite Communication, Robert M. Gagliardi, CBSPublishers
3. Satellitte Communication Systems, Richharia. BSP BOOKS PVTLTD.
4. Satellitte Communication Engg., MichealKolawole, BSP BOOKS PVTLTD

MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS)

Module-I (14 hrs)
Overview of MEMS and Microsystems.(Chapter 1 of Text Book 1) Micromachining Techniques:Silicon as material for micromachining, Photolithography, thin film deposition, doping,wet and dry etching, surface and bulk micromachining, Wafer bonding,LIGA packaging. (Chapter 3 and Section 8.2 of Text Book 1, Chapter 2 of Text Book2)

Module II (10 hrs)
Microsystem Modeling and Design:Mechanics of deformable bodies, Energy method, Estimation of stiffness and damping for different micro-structures, Modeling of electromechanical systems, Pull-in voltage. (Section 4.1 to 4.3 and 6.2.2 of Text Book 1, Section 3.4 of Text Book 2)

Module III (09 hrs)
MEMS Applications:Mechanical sensors and actuators: Piezoresistive pressure sensors, MEMS capacitive accelerometer, Gyroscopes, (Section 8.3 of Text Book 1 and Section 5.3 and 5.11 of Text Book 2)

Text Books:
1. G.K. Ananthsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat and V.K. Atre: Micro and Smart Systems, Wiley India, New Delhi,2010.
2. N.P. Mahalik: MEMS, Tata McGraw-Hill, New Delhi,2007.
Reference Book:
1. T. Hsu: MEMS and Microsystems: Design and Manufacture, Tata McGraw-Hill, New Delhi, 2002.
3. Gabriel M.Rebeiz: RF MEMS Theory,design&Technology,Wiley India Education,2010.

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WIRELESS SENSOR NETWORK

MODULE-I (8 Hours)
Sensor Network Concept: Introduction, Networked wireless sensor devices, Advantages of Sensor networks, Applications, Key design challenges.
Network deployment: Structured versus randomized deployment, Network topology, Connectivity, Connectivity using power control, Coverage metrics, Mobile deployment.

MODULE-II (7 Hours)
Localization and Tracking: Issues and approaches, Problem formulations: Sensing model, collaborative localization. Coarse-grained and Fine-grained node localization. Tracking multiple objects.

MODULE-III (8 Hours)
Wireless Communications: Link quality, shadowing and fading effects
Medium-access and sleep scheduling: Traditional MAC protocols, Energy efficiency in MAC protocols, Asynchronous sleep techniques, Sleep-scheduled techniques, and Contention-free protocols.

MODULE-IV (7 Hours)
Routing: Metric-based approaches, Multi-path routing, Lifetime-maximizing energy-aware routing techniques, Geographic routing.
Sensor network Databases: Data-centric routing, Data-gathering with compression,

Text Books
1) Wireless Sensor Networks: An Information Processing Approach- by Feng Zhao, Leonidas Guibas , Morgan Kaufmann Series in Networking2004.

References Books
2) Networking Wireless Sensors: BhaskarKrismachari, Cambridge UniversityPress
3) Wireless Sensor Networks: Edited by C.S Raghavendra, Krishna M, Sivalingam, TaiebZnati,Springer.
4) Wireless Sensor Networks: Technology, Protocols, and Applications: KazemSohraby, DanielMinoli, TaiebZnati, Wiley InterScience.

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ANALOG VLSI

MODULE – I (10 HOURS)

1. **Introduction to Analog Design-** General Concepts, Levels of Abstraction, Robust AnalogDesign.
2. **Single-Stage Amplifiers-** Basic Concepts, Common-Source Stage, Common- Source Stage with Resistive Load, CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Source Follower, Common-Gate Stage, Cascode Stage, FoldedCascode.
3. **Differential Amplifiers-** Single-Ended and Differential Operation, Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, GilbertCell.

MODULE – II (12 HOURS)

4. **Passive and Active Current Mirrors-** Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-ModeProperties.
5. **Band gap References-** General Considerations, Supply-Independent Biasing, Temperature-Independent References, Negative-TC Voltage, Positive-TC Voltage, BandgapReference.

MODULE-III (10 HOURS)

6. **Operational Amplifiers-** General Considerations, Performance Parameters, One- Stage Op Amps, Two-Stage Op Amps, Gain Boosting, Comparison, Common- Mode Feedback, Input Range Limitations, Slew Rate, Power SupplyRejection.
7. **Frequency Response of Amplifiers-** General Considerations, Miller Effect, Association of Poles with Nodes, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair.

Feedback- General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback, Effect ofLoading,

TEXT BOOKS

1. Design of Analog CMOS Integrated Circuits, BehzadRazavi, Tata McGraw-Hill Publishing Company Limited,2002.
2. CMOS Analog Circuit Design, D. Holberg and P. Allen, Oxford University Press, 2002.

REFERENCE BOOKS

1. Analysis and Design of Analog Integrated Circuits,P. Gray, P. Hurst, S. Lewis,and R. Meyer, John Wiley, 4th Edition, 2001.
2. Fundamentals of Microelectronics, BehzadRazavi, John Wiley, 1st Edition,2008.
3. Analog Integrated Circuit Design, D. Johns and K. Martin, John Wiley,1997.
4. Design of Analog Integrated Circuits and Systems, K.R. Laker and W.M.C.Sansen, McGraw-Hill, Inc.,1994.

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5. Microelectronic Circuits, A. Sedra and K.C. Smith, Oxford University Press,5th Edition,2004.

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