DEPARTMENT OF ELECTRICAL AND INSTRUMENTATION ENGINEERING

FOUR YEAR DEGREE PROGRAM IN ELECTRICAL ENGINEERING

Semester-I (UG)

S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1	AM-411	Engineering Mathematics	4	0	0	4	4
2	CY-411	Applied Chemistry	3	0	2	5	4
3	HU-411	Communication Skills/ Professional Communication	2	0	2	4	3
4	WS-412	Workshop Technology & Practice	2	0	4	6	4
5	ME-411	Engineering Drawing	0	0	4	4	2
6	CS-411	Elements of Computer Programming	3	0	2	5	4
7	EE-411	Principles of Electrical Engineering	3	0	0	3	3
		Total	17	0	14	31	24

Semester-II A (UG)

S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1	PH-421	Applied Physics	3	0	2	5	4
2	MC-421	Environmental Studies	2	0	0	2	2
3	EC-421	Elements of Electronics Engineering	3	0	2	5	4
4	EE-422	Circuit Theory	3	0	2	5	4
5	EE-423	Elements of Electrical Machines and Power System	3	0	2	5	4
6	EE-424	Electrical Engineering Materials	3	0	0	3	3
7	EE-425	Electrical Workshop	0	0	2	2	1
8	EE-426	Electrical Engineering Practices	0	0	2	2	1
		Total	17	0	12	29	23

Semester-II B (UG Practical Training)

	TP-401	Two weeks Practical Training during summer vacations				80	S/US

Semester-III (UG)

S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1	AM-511	Higher Engineering Mathematics	3	0	0	3	3
2	MC-513	Human Values and Professional Ethics	1	0	0	1	0
3	EE-511	Network Analysis & Synthesis	3	2	2	7	5
4	EE-512	Electrical Machines(DC machines and Transformers)	3	2	2	7	5
5	EE-513	Electrical and Electronic Measurement and Instrumentation	4	0	0	4	4
6	EE-514	Transmission and Distribution of Electrical Power	3	2	0	5	4
7	EE-515	Simulation Lab	0	0	2	2	1
		Total	17	6	6	29	22

Semester-IV (UG)

S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1	CY-521	Industrial Chemistry	3	0	2	5	4
2	PH-521	Material Science	3	0	2	5	4
3	EE-521	Digital Electronics and Logic Circuit Design	3	0	2	5	4
4	EE-522	Electrical Machine (Asynchronous)	3	2	2	7	5
5	EE-523	Electrical Power Generation(Conventional and Non-Conventional)	3	0	0	3	3
6	EE-524	Sensor and Signal conditioning	3	0	2	5	4
		Total	18	2	10	30	24

Semester-V (UG)

S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1	HU-611	Engineering Economics and Entrepreneurship	3	0	0	3	3
2	AM-611	Numerical Analysis	3	0	2	5	4
3	EE-611	Linear Control Systems	3	2	2	7	5
4	EE-612	Electrical Machines (Synchronous and special machines)	3	2	2	7	5
5	EE-613	Electromagnetic Field Theory	3	2	0	5	4
6	EE-614	Seminar	0	0	2	2	1
		Total	15	6	8	29	22

Semester-VI (UG)

S.No	Sub Code	Subject Name	L	T	P	Hrs.	Credits
1	EE-621(A-D)	Elective-I	3	0	0	3	3
2	EE-622	Power Electronics	3	2	2	7	5
3	EE-623	Non Linear and Discrete Control Systems	3	2	0	5	4
4	EE-624	Microprocessor and Applications	3	0	2	5	4
5	EE-625	Power System Protection	3	0	2	5	4
6	EE-626	Utilization of Electrical Energy	3	0	0	3	3
7	EE-627	Advance Simulation Lab-I	0	0	2	2	1
		Total	18	4	8	30	24

28/4/14

Semester- VII A (UG:Industrial Training)							
	TP-701	Industrial Training during summer vacations (6 weeks)				200	
Semester-VII B (UG)							
S.No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	EE-711(A-D)	Elective-II	3	0	0	3	3
2	EE-712	Computer Aided Power System Analysis	3	2	2	7	5
3	EE-713	Energy Management Auditing	3	0	0	3	3
4	EE-714	Microcontroller and Embedded System	3	0	2	5	4
5	EE-716	Power System Operation & Control	3	2	0	5	4
6	EE-715	Project-Minor	0	0	4	4	2
7	TP-701E	Industrial Training (Evaluation Only)					2
		Total	15	4	8	27	23
Semester-VIII (UG)							
S.No	**Sub Code**	**Subject Name**	**L**	**T**	**P**	**Hrs.**	**Credits**
1	HU-721	Technical Communication & Soft Skills	2	0	2	4	0
2	EE-721 (A-D)	Elective-III	3	0	0	3	3
3	OE-729 *	OP-Elective	3	0	0	3	3
4	EE-722	High Voltage Engineering	3	0	0	3	3
5	EE-723	Electric Drives	3	0	2	5	4
6	EE-724	Project-Major	0	0	8	8	4
7	EE-725	Advance Simulation Lab-2	0	0	2	2	1
		Total	14	0	14	28	18
			Credits	Total		180	

Elective-I

EE-621A Data Acquisition and Telemetry
EE-621B Communication System
EE-621C Industrial Instrumentation
EE-621D DSP & Application

Elective-II

EE-711A Process Dynamics and Control
EE-711B Artificial Intelligance
EE-711C Conventional and Computer Aided Electrical Machine Design
EE-711D Building Automation

Elective-III

EE-721A Biomedical Engineering
EE-721B Optimization Techniques
EE-721C FACTS & HVDC Transmission
EE-721D Distributed Control System

20/4/16.

Open Elective

OE-729* Elements of Power System
OE-729* Electrical Power Generation
OE-729* Energy Conservation Practices
OE-729* Electrical Energy Utilization
OE-729* Optimization techniques

Title of the course : **Engineering Mathematics**
Subject Code : **AM - 411**
Weekly load : 4 Hrs. LTP4-0-0
Credit : 4 (Lecture 4; Tutorial 0; Practical 0)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Matrices	Elementary transformations. Row reduced Echelon forms. Rank of a matrix. Normal form. Linearly dependent and independent vectors. System of linear equations. Linear transformations. Eigen values and eigenvectors. Properties of eigenvalues. Reduction to diagonal form. Verification of Cayley-Hamilton Theorem and its use for finding inverse of a matrix. Idempotent matrices. Complex matrices.	15
	2. Solid geometry	Cartesian co-ordinate system. Distance formula. Section formulae. Direction ratios and direction cosines. Equation of a plane. Equations of a straight line. Condition for a line to lie in a plane. Coplanar lines. Shortest distance between two lines. Intersection of three planes. Equation of a sphere. Tangent plane to a sphere. Equations of a cone and a cylinder.	15
Unit-2	3. Differential equation	Solution of differential equation by variable separable method, homogeneous differential equation of first order and their solution, Exact differential equation.	14
	4. Linear differential equations	Solution of linear differential equation of first order. Reducible to linear differential equation. Higher order linear differential equation with constant coefficients, complementary function and particular integral. Method of variation of parameters. Cauchy's and Legendre's equations.	16

Total=60

Recommended Books:

1. R.K. Jain, S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishers.
2. Denial A Murray, Elementary Course in Differential Equations, Longman.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern Limited.
4. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill.

Title of the course **: Applied Chemistry**
Subject Code **: CY-411**
Weekly load **: 5** **LTP 3-0-2**
Credit **: 4 (Lecture 3; Practical 1)**

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**Electro-analytical Chemistry**	Conductivity of electrolytes- Specific, molar and equivalent conductivity, Nernst equation for electrode potential, EMF series, hydrogen electrode, calomel electrode, glass electrode, Electrolytic and galvanic cells, cell EMF, its measurement and applications, reversible and irreversible cells, concentration cell, electrode (hydrogen gas electrode) and electrolyte concentration cell, concentration cell with and without transference. Potentiometry: Principle, instrumentation and applications.	**09**
	Fuels	Classification, examples, relative merits,Solid Fuels: Coal, Proximate and Ultimate analysis of coal. Gross and Net Calorific Value, Determination of calorific value by Bomb Calorimeter Carbonization process, Low and High Temperature Carbonization. Liquid fuels: Cracking, Thermal and Catalytic Cracking, Synthetic petrol, Knocking, Antiknocking, Octane number, Cetane Number. Antiknocking agents. Gaseous fuels: Biogas, LPG and CNG. Determination of calorific value by Junker's Calorimeter. Flue gas analysis by Orsat's apparatus, problems.	**10**
	Surface Chemistry	Adsorption, chemisorption and physisorption, application of adsorption of gases on solids. Langmuir's adsorption isotherm, Freundllch's adsorption isotherm, BET theory of multi-layer adsorption (qualitative), adsorption chromatography. Colloidal particles, surfactants, micelles. Enzyme catalysis, Criteria for choosing catalyst for industrial processes.	**09**
Unit-2	**Engineering Materials**	Abrasives – Moh's scale of hardness – natural abrasives (diamond, corundum, emery, garnets and quartz) – synthetic abrasives (silicon carbide, boron carbide) – refractories – characteristics – classification (acidic, basic and neutral refractories) – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) – manufacture of alumina magnesite and zirconia bricks.	**10**
	Lubricants	Classification of lubricant, lubricating oils, semisolid lubricants, solid and synthetic lubricants. Properties of lubricating oils (viscosity, flash and fire points, cloud and pour point, Iodine Value, Acid Value, R. M. Value, mechanical stability and saponification number).	**07**

Total=45

Recommended Books:

Text Books

1. P. C. Jain & M. Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 2005.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 2008.
3. F.W. Billmayer. Textbook of Polymer Science. 3rd Edn, Wiley. N.Y. 1991.
4. C. N. Banwell & E.M. McCash, Fundamentals of Molecular Spectroscopy, 4th Edn, Tata Mc Graw-Hill Edition, 1995.
5. S. S. Dara, S. S. Umare, A Text Book of Engineering Chemistry, S. Chand Publishing, 2011.
6. J. D. Lee, Concise Inorganic Chemistry, 5th Edn., Chapman and Hall, London, 1996.
7. Engineering Chemistry by B. Sivasankar, Tata Mcgraw Hill
8. Engineering Chemistry by A. Mallick, Viva Books, 2008.

9. Organic Chemistry by J. Clayden, Nick Greeves, S. Warren, Oxford Press 2012.
10. Levine, Physical Chemistry, 5/e (7th reprint), Tata McGraw Hill, 2006.
11. Inorganic Chemistry, Principle, structure and reactivity, J.E. Huheey, E.A. Keitler, R.L. Keita, O.K. Medhi, Pearson Education, 4th Ed.
12. Chemistry, J.E. Mcmerry and R.C. Fay, 5th Ed., Pearson Education, 2008

List of Experiments (CY-411)

1. Determination of strength of unknown solution of Mohr's salt using $KMnO_4$ and standard oxalic acid solution.
2. Determination of ferrous, ferric and total iron in a given sample using standard $K_2Cr_2O_7$
3. Determination of copper in a given solution by iodometric method using $Na_2S_2O_3$ and standard $K_2Cr_2O_7$
4. To find out the cell constant of a conductivity cell.
5. To find out the strength of the given hydrochloric acid solution by titrating it against sodium hydroxide using pH meter.
6. To prepare and describe a titration curve for phosphoric acid-solution hydroxide titration using pH-meter.
7. Determine the strength of the given hydrochloric acid solution by titrating it against sodium hydroxide conductometrically.
8. Determination of EMF/oxidation/reduction potential of a given metal/metal ion in different conditions.
9. Determination of equilibrium constant of a reaction by potentiometric method.
10. To determine moisture and volatile contents in a given coal sample by proximate analysis.
11. To determine fixed carbon and ash contents in a given coal sample by proximate analysis.
12. To study the adsorption of acetic acid on active charcoal and to verify the Freundlich and Langmuir isotherm.
13. To study the adsorption of Iodine from alcoholic solution by charcoal.
14. Determination of viscosity of heavy oil by means of Redwood Viscometer.
15. Determination of coefficient of viscosity of the given liquids by Ostwald's Viscometer method.
16. Determination of Flash point of a given sample.
17. Determination of Fire point of a given sample.
18. Determination of acid value and saponification value of an oil.
19. Determination of aniline point of a lubricating point.
20. Determination of Iodine value of oil.
21. To determine the cloud and pour point of a lubricating oil.

(Any twelve to be performed)

Title of the course : **Communication Skills**
Subject Code : HU-411
Weekly load : 4 LTP 2-0-2
Credit : 3 (Lecture 2; Practical 1)

Course Description	**Lecture(s)**
Unit- I	
Communication Techniques	
Importance of Communication, One-way and Two-way Communication, Essentials of Good and effective Communication, Barriers to Communication, Techniques to Overcome Barriers	08
Writing Skills	
Précis- writing; Essay- writing, Official e-mail writing	08
Unit- II	
Report Writing	
Reports and their importance, Types of Routine Reports along with their formats- Annual Confidential Report, Progress Report, Inventory Report, Inspection Report, Lab Report, Structure of Reports; Bibliography & References	08
Grammar & Vocabulary	
Tenses, Change of Voice, Change of Narration, Words often confused, Correct use of Prepositions, Use of Idioms and Phrases	08

Total=32

Recommended Books:

1. Bhattacharya, Indrajit**.** *An Approach to Communication Skills.* Dhanpat Rai & Co.
2. Gibaldi, Joseph. *MLA Handbook for Writers of Research Papers*. MLA.
3. Sinclair, John. *Collins Cobuild English Grammar.* Collins.
4. Wren, P.C. &H. Martin. *High School English Grammar & Composition*. S. Chand & Company Ltd.
5. Sharma, R.C. & Krishna Mohan. *Business Correspondence and Report Writing*. Tata McGraw-Hill.

List of Experiments (10-14):

1. Introducing yourself.
2. Observing and analyzing your environment/ surroundings.
3. Collecting and Using Library Resources.
4. Giving Individual Presentations.
5. English Conversation Skills.
6. Group Discussions.
7. Extempore.
8. Debates.
9. Summarizing newspaper reports.
10. Role Plays.
11. Grammar exercises.
12. Finalization of Team Project Work.
13. Collecting Materials for Project Work & Finalization of Project.
14. Presentation of Project.

Title of the course : Workshop technology & practice LTP 2-0-4
Sub code : WS-412
Weekly load : 6
Credit : 4(Lecture 2; Practical 2)

Course Description	Lecture(s)
Unit -1	
Sheet Metal	
Introduction to sheet metal work; GI sheets, aluminium, tin plate, copper, brass etc, Hand tools used in sheet metal shop like steel rule, vernier calipers, micrometer, sheet metal gauge etc., scriber, divider, punches, chisels, hammers, snips, pliers, stakes, rivets etc., Operations -shearing, bending, drawing, squeezing etc.	06
Pattern making	
Introduction to pattern making, moulding and foundry practice. Pattern materials like wood, cast iron, brass, aluminium, waxes etc., different types of patterns, pattern allowances.	06
Foundry	
Introduction to casting process, core-boxes, core prints, hand tools-shovel, riddle, rammer, trowel, slick, lifter, sprue pin, bellow, mallet,vent rod, pouring weights etc., moulding sands-green sand, dry sand, loam sand, facing sand etc., grain shape and size, properties of moulding sand, sand preparation and testing etc., casting-permanent mould casting, centrifugal casting etc.	06
Unit-II	
Carpentry	
Introduction to wood working, Types of wood, seasoning methods, Marking and Measuring Tools-rule, try square, marking gauge, mortise gauge etc., Cutting Tools-rip saw, tenon saw, firmer chisel, mortise chisel, iron jack plane, wooden jack plane etc., Drilling Tools-braces, drill bits etc., Striking Tools-hammers, mallet etc., Holding Tools-bench vice, G-cramp etc., Miscellaneous Tools- rasps, files, screw driver, pincer etc.; Operations-marking, sawing, planning, chiseling, boring, grooving etc., Joints- Corner joints, Tenon and Mortise joint, Briddle cross-joint.	06
Fitting	
Introduction to fitting, Tools used in fitting -bench vice, hammers, chisels, files-flat file, square file, half round file, round file, knife edge file, scrapers, hacksaws, try squares, drill machine, drill bits, taps, dies etc, Operations-chipping, filing, scrapping, sawing, marking, drilling, tapping, dieing etc.;	04
Machining	
Turning, Chamfering, Tapering, Facing, Knurling , Lathe	4

Total: 32

Recommended Books

1. Hajra Choudhury, Hazra Choudhary and Nirjhar Roy, 2007, Elements of Workshop Technology, vol. I, Media promoters and Publishers Pvt. Ltd.
2. W A J Chapman, Workshop Technology, 1998, Part -1, 1st South Asian Edition, Viva Book Pvt Ltd.
3. P.N. Rao, 2009, Manufacturing Technology, Vol.1, 3rd Ed., Tata McGraw Hill Publishing Company.
4. Kaushish J.P., Manufacturing Processes, 2008, Prentice Hall India

Practical: 10-14 jobs from the following list.

LIST OF PRACTICALS FOR WS-411

CARPENTRY SHOP

Making of various joints like:

a) Cross lap joint

b) T-lap joint

c) Corner lap joint

d) Mortise and tenon joint

e) Dovetail joint

FITTING SHOP

a) Study and use of instruments in fitting shop, like, vernier calipers, micrometer, height gauge and bevel protractor

b) . Exercise on simple operation viz. cutting, chipping, sawing, filing, drilling,

FOUNDRY SHOP

a) Familiarization with different patterns and hand tools.

b) Preparations of green sand mould using single piece pattern three-four exercises.

c) Preparations of green sand mould using split pattern on bench moulding.

d) .Preparations of green sand mould using solid pattern by bedded method.

PATTERN SHOP

a) 1 Familiarization with different tools and patterns in pattern shop.

b) Exercise on making of solid piece pattern

c) Exercise on making of split piece pattern

d) Exercise on making of cored pattern.

SHEET METAL SHOP

a) Study the layout and different equipment used in sheet metal shop.

b) Familiarization with different tools and processes in sheet metal shop.

c) Exercise on sheet cutting, development, folding, bending, piercing, punching, parting, notching and slitting.

d) Profile and circle cutting exercise.

MACHINE SHOP

a) To familiarize with safety aspects.
b). To familiarize with equipment and tools.
c). Practice of turning operation on lathe
d). Practice of facing operation on lathe
e). Practice of taper turning on lathe

Title of the course : **Engineering Drawing**
Subject Code : ME-411
Weekly load : 04 LTP 0-0-4
Credit : 02

Theory

Course Description	**Lecture(s)**
Unit-I	
Introduction	**04**
Introduction, Objectives, applications. Fundamentals of engineering drawing, Use and handling of different drawing instruments, title block, sheet sizes, first and third angle projections, orthographic projections.	
Lettering and Dimensioning	**04**
Free hand sketching of different types of lines in engineering drawing as per IS specifications, Free hand lettering (alphabet and numerals) - lower case and upper case, vertical and inclined at 75^0 in the ratio of 7:4, Notation of dimensioning, size and location dimensions, aligned and undirectional systems of dimensioning, general rules for dimensioning, unit of dimensioning.	
Scales	**06**
Uses of scales, sizes of scale, representative fraction, construction of plain and diagonal scales	
Projection of points, line	**12**
Introduction on theory of projections and orthographic projections, projection of a point in different quadrants, projection of straight lines in different positions (all possible cases)	
Unit-II	
Projection of Planes	**06**
Definition of plane, types of planes, traces of plane, projection of planes in different positions	
Projection of Solids	**08**
Types of solids, projections of solids in simple and typical positions, introduction on sectioning of solids	
Development of surfaces	**08**
Introduction, Development of a right prism, cylinder, pentagonal prism, and a right pyramid, truncated pentagonal pyramid.	

Total = 48

Recommended Books

Title	***Author(s)***	***Publisher***
Engineering Drawing	P S Gill	Kataria and Sons, New Delhi
Engineering Drawing	R.K.Dhawan	S. Chand & Co, New Delhi
Engineering Drawing	N.D,Bhatt	Charotar Publishing House

Title of the course : **Elements of Computer Programming**
Subject Code : **CS-411**
Weekly load : 6 LTP 2-0-4
Credit : 4 (Lecture 2, Practical 2)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	Introduction	Elements of computer processing, Hardware and software, Introduction and feature wise comparison of various Operating Systems, Including DOS, Windows and Linux, Problem solving-algorithms and flowcharts. Structured Programming vs. Object Oriented Programming.	04
	C Programming Basics	Basic program construction, Structure of a C program, Compilation process, preprocessor directives, Comments, Data types, Type conversions, Operators - arithmetic, Relational, Logical, Conditional, Increment/decrement, Library functions, Header files.	04
	Loops and Decision Statements	*for* loop, *while* loop, *do* loop, Various forms of *if* statement,*switch* statement, *break* statement, *continue* statement, *go to* statement.	03
	Arrays	arrays and strings, Declaring an array, Initializing arrays, Accessing the array elements, Working with multidimensional arrays, Declaring and initializing string variables, Arithmetic operations on characters, String handling functions.	04
Unit-2	Functions	Defining functions, Passing arguments to functions, Returning values from functions, Reference arguments, Variables and storage classes, Static functions.	05
	Pointers	Pointers, Pointers to pointers, Declaring and initializing pointers, Pointer expressions, Pointer increment and scale factor, Pointers and arrays, Pointers and strings.	05
	Structures and Union	Declaring and initializing a structure, Accessing the members of a structure, Nested structures, Array of structures, Using structures in functions, Pointers and structures, Declaring and initializing a union.	03
	Files	Reading and writing to text and binary files, Character I/O, String I/O, File pointers, Error handling, Redirection, Command line arguments.	04

Total=32

Recommended Books:

1. Kernighan Brian W. and Ritchie, Dennis M, The C Programming language, Dorling Kingsley.
2. Balagurusamy, E., Programming in ANSI C, TMH Publications

Title of the course : **Elements of Computer Programming Lab**
Subject Code : **CS-411**

LIST OF PRACTICALS

1. WAP to find multiplication of two numbers.
2. WAP to swap two numbers without using third variable.
3. WAP to calculate temperature in Fahrenheit to Celsius using formula C= (F- 32)/1.8.
4. WAP to calculate Sum and Average of N numbers using sequence of statements.
5. WAP to convert integer arithmetic to a given number of day and month using switch case.
6. WAP to find maximum out of 3 numbers a, b &c using Control Statements (if, else, nested if, nested else).
7. WAP to find minimum out of 3 numbers a, b & c using Control Statements (if, else, nested if, else)
8. WAP to find whether entered number is palindrome or not.
9. WAP to check entered number is even or odd .
10. WAP to find whether entered year is leap year or not.
11. WAP to find factorial of positive integer using for loop.
12. WAP to print all the number between 1 to 100 which are divisible by7 using the concept of loops.
13. WAP to generate Fibonacci series up to n using loops.
14. Write a program to calculate area of circle using function.
15. Write an iterative function to calculate factorial of given number.
16. Write a recursive function to calculate factorial of given number
17. WAP to find even & odd up to a given limit using the concept of array and loops.
18. WAP to reverse a string.
19. WAP to find addition of two matrix of n*n order using the concept of 2 dimensional array
20. WAP to find multiplication of two matrix of n*n order using the concept of 2 dimensional array.
21. WAP program to study the concept of structure.
22. WAP to implement the concept of switch and break statements.
23. WAP to implement the concept of continue statements.
24. WAP to create a data file, retrieve data from the file.

Title of the course : Principles of Electrical Engineering
Subject Code : EE-411
Weekly load : 3 L T P-3 0 0
Credit : 3

Theory:

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**Basic Elements**	Concepts of Electric Charge, Current and Electromotive force, Potential and Potential Difference; conductor, semiconductor insulator and dielectric, Electrical Power and Energy; Basics of Instruments used for Measuring Current, Voltage, Power and Energy, Methods and precautions in use of these and other instruments e.g. digital multimeters, oscilloscopes, signal generators etc.; Basics of various protection and safety devices e.g. Fuses, Earthing, MCBs and ELCBs	04
	Concepts of DC	Ohm's Law, Resistance, and color coding; Capacitance and Inductance, their ratings; Effects of Temperature on Resistance, Series and Parallel Connection of Resistances and capacitances, Kirchoff's Laws and Their Applications.	04
	AC Fundamentals	Concept of Alternating Voltage and Alternating Current, Difference between AC and DC, Various Terms Related with AC Waves; RMS and Average Values, Concept of Phase Difference and Phasor, Single Phase and Three Phase Supply; Alternating Voltage applied to Pure Resistance, Pure Inductance, Pure Capacitance and their combinations, Concept of Impedance and Power in AC Circuit.	07
	Three phase AC	Phasor representation of three phases, Star and Delta connections, Inter-Relation between phase and line values of voltage/current, power measurement in three phase system;	06
Unit-2	**Electromagnetic Induction**	Concept of Magnetic Field, Magnetic Flux, Reluctance, Magneto Motive Force (MMF), Permeability; Self and Mutual Induction, Basic Electromagnetic laws, Effects on a Conductor Moving in A Magnetic Field, various losses in magnetic circuits;	04
	Electrical Machines	Elementary concepts of an electrical machine, Basic principle of a motor and a generator, Torque due to interaction of two magnetic fields and the concept of torque angle, Common features of rotating electrical machines, Classification of Electrical machines; Principles, Construction and Working of various machines; Starters: Need, Construction and Operation.	09
	Transformers	Need of a transformer, classification, Principles, Construction and Working of a Transformer, Applications of Transformers	04
	Basic Troublshooting	Basic Testing and faults diagnosis in electrical systems, various tools and their applications, replacement of different passive components e.g. fuses, lamps and lamp holders, switches, cables, cable connectors, electromagnetic relays.	04

Recommended Books:

Title	**Author**	**Publisher**
Electrical Technology	Edward Hugh	Pearson Education
Basic Electrical Engineering	D P Kothari & I J Nagrath	TMH
Electrical Machines	D P Kothari & I J Nagrath	TMH
Electrical Machines	S K Bhattacharya	TMH

Title of the course : **APPLIED PHYSICS**
Subject Code : **PH-421**
Weekly load : 5 LTP 3-0-2
Credit : 4 (Lecture 3; Practical 1)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**RELATIVITY**	Newtonian mechanics and Galilean transformations, Michelson-Morley experiment, postulates of special theory of relativity, Lorentz transformations, time dilation and length contraction, space-time interval, twin paradox, relativistic addition of velocities, variation of mass with velocity, mass energy equivalence, relativity and Doppler effect	12
	QUANTUM MECHANICS	Need of quantum mechanics, Basis of quantum mechanics, wave function, Schrödinger's time-independent and time-dependent equations, expectation values of physical quantities (position, momentum and energy), applications of time independent equation; for a particle in a box (one dimensional), step potential, finite square well potential, tunnelling effect	12
Unit-2	**RADIATION PHYSICS AND LASERS**	Elementary ideas about interaction of charged particles, electromagnetic radiations and neutrons with matter, detection of radiations by: proportional counter, GM counter, scintillation detectors, solid state detectors (basic principle only), applications of radiations in industry, agriculture and health science, radiation hazards. Principle of lasers, types of lasers : He-Ne, Ruby, CO_2 and semiconductor laser, Applications of Lasers.	12
	FIBER OPTICS	Optical Fiber, physical structure and basic theory, modes in optical fibers, step index and graded index fibers, losses in optical fibers, Sources and sensors for optical fibers, applications of Optical fibers in communication.	06
	ELECTRODYNAMICS	Gauss's law in dielectric medium, Equation of continuity, displacement current, Maxwell's equations, wave equation for electromagnetic radiation, electromagnetic wave propagation in free space and isotropic dielectric medium, Poynting theorem & Poynting vector, vector potential, Lorentz gauge.	06
			Total=48

Recommended Books:

Arthur Beiser ; Concepts of Modern Physics (McGraw Hill)
C. Kittel: Introduction to Solid Satate Physics(John-Wiley&Sons) Engineer
Serway, Moses and Moyer Modern Physics (Thomson)

List of Experiments

PH-421

1. To find the value of Planck's constant by using a Photoelectric cell.

2. To verify inverse square law of radiation using a photoelectric cell.
3. To determine the frequency of an unknown signal by drawing the Lissajous patterns for various frequency ratios and evaluate the face difference between two sinusoidal signals applied to X and Y input of cathode ray oscilloscope.
4. To measure the velocity of ultrasonic waves through a given liquid medium.
5. Measurement of wavelength of given He-Ne LASER by diffraction method.
6. To determine the wavelength of a sodium (Na) light by using the Michelson's Interferometer.
7. Determination of the value of e/m of an electron by helical method.
8. To determine the numerical aperture (Na) of a given multimode optical fiber by using Laser beam.
9. To determine the g – factor by using ESR Spectrometer.

Title of the course : **Environmental Studies**
Subject Code : **MC-421**
Weekly load : 2 LTP 2-0-0
Credit : 2 (Lecture 2)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	Ecology and environment	Ecosystem; components, functioning, food chain and web, ecological pyramids. Biogeochemical cycles; water cycle, carbon cycle, nitrogen cycle. Biodiversity and its conservation.	08
	Sustainable development	Sustainable development; conflict between development and environmental conservation, international endeavors. Sustainable utilization of resources; energy resources, water resources, forest resources.	08
Unit-2	Environmental pollution	Water pollution; wastewater characterization, primary treatment, secondary biological treatment, general discharge standards. Air pollution; major pollutants, treatment devices, ambient standards. Solid waste management.	10
	Environmental Regulations	Green House Effect and Kyoto Protocol. Ozone layer depletion and Montreal Protocol. Environment Protection Act. Hazardous waste management.	06

Total=32

Recommended Books:

1. E. Bharucha, Textbook for Environmental Studies; UGC Publication.
2. K.D. Wanger, Environmental Management; W.B. Saunders Publication.
3. E.P. Odum, Fundamentals of Ecology; W.B. Saunders Publication..
4. Pollution Control Acts, Rules and Notifications; CPCB Publication.

Title of the course **: Elements of Electronics Engineering**
Subject Code **: EC-421**
Weekly load : 5 LTP 3-0-2
Credit : 4 (Lecture 3; Tutorial 0; Practical 1)
Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Semiconductors	Semiconductors p-type, n-type, pn junction diodes, pn junction as a circuit element, its characteristics, half wave and full wave and bridge type rectifier circuits basic filter circuits, Doide as voltage multiplier, clipper & clamper circuit. Zener diode as a voltage regulator. LED its characteristics construction & applications	12
	2. Amplifiers	Concept of d.c. and a.c. load line and operating point selection. Various amplifiers configurations their h-parameter equivalent circuits determination of voltage gain current gain input resistance and output resistance & power gain. Concept of feedback in amplifiers, different oscillators circuits (without analysis) Differential amplifier and its transfer characteristics.	12
Unit-2	3. Operational Amplifiers	IC Op-Amps, its ideal & practical specifications and measurement of parameters. Op-Amp in different modes as inverting amplifier non inverting amplifier scale changer, differentiator & integrator.	12
	4. Transistors	Characteristics of JFET, MOSFET, Various amplifier configurations using FET. Characteristics and Construction of SCR, TRIAC, UJT. Their basic areas applications.	12

Total=48

Recommended Books:

1. Electronic Devices & Circuits - Boylstad & Nashelsky
2. Integrated Electronics By Millman & Halkias
3. Electronic Principles – Malvino
4. Principles of Electronics – V.K. Mehta, Shalu Melta
5. Electronic Circuits – Donald L. Shilling & Charles Belowl

List of Experiments (EC-421)

1. To study single stage amplifiers and calculate its gain
2. To study the two stage R-C coupled amplifiers and calculate its gain
3. To study the two stage R-C coupled amplifier's frequency response
4. To study the frequency response of single stage amplifier
5. To study the voltage feedback amplifiers
6. To study the Wein bridge oscillator
7. To study the Hartley oscillator
8. To study the class-B push pull amplifier
9. To study the tuned collector oscillator
10. To study the crystal oscillator
11. To study the basic principles of R-C oscillator i.e. phase oscillator
12. To study the negative feedback, its merits, demerits and calculate its gain

Title of the course : Circuit Theory
Subject Code : EE-422
Weekly load : 5 LTP-3 0 2
Credit : 4

Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	BASIC CIRCUITS ANALYSIS	Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy	12
	NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS	Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem	12
Unit-2	RESONANCE AND COUPLED CIRCUITS	Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.	12
	THREE PHASE CIRCUITS	Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits	12

Recommended Books-

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6 th edition, New Delhi, 2003.
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.
3. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
4. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).
5. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
6. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

Practical: EE-422

1. OHM'S LAW AND APPLICATIONS: Ohm's law and its applications are investigated in this experiment. The V-I characteristic of linear resistors is derived. Applications of Ohm's law include voltage and current division. Measurements of the equivalent resistance of a resistive arrangement are performed.
2. ANALYSIS OF NETWORKS: The purpose of this experiment is to introduce students to the nodal voltage and mesh current methods for solving circuits.
3. NETWORK THEOREMS: This experiment verifies some important network theorems: the Thévenin equivalent of a circuit, the maximum power transfer theorem, and the source superposition.
4. FIRST ORDER R-L AND R-C CIRCUITS: The objective of this experiment is to observe the response of the first order R-C and R-L circuits. The experiment demonstrates a method for measuring the time constant.

5. SECOND ORDER RLC CIRCUITS: This experiment demonstrates the response of a series and a parallel RLC circuit. The over-damped, critically damped and under-damped responses are derived for each circuit.
6. SINUSOIDAL STEADY STATE: This experiment demonstrates the properties of ac networks. The concept of impedance is discussed. Phasors are demonstrated through oscillograms

Title of the course : Elements of Electrical Machines and Power System
Subject Code : EE-423
Weekly load : 5 L T P-3 0 2
Credit : 4

Theory:

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**Electromechanical Energy Conversion**	Magnetic Circuits, Basic calculations of MMF, flux and other parameters of magnetic circuits, Elementary concepts of Electromechanical energy Conversion, Basic principle of a motor and a generator, Torque due to interaction of two magnetic fields and the concept of torque angle, Common features of rotating electrical machines, Classification of Electrical machines;	04
	DC Machines and Transformers	Constructional details of dc machines-principle of operation of dc generator-emf equation, characteristics of different types of generators. Operation of dc motor-torque equation, characteristics of different types of motors-starting-speed control; Need of transformers, Classification, Constructional details and principles of operation of single phase and three phase transformers- equivalent circuit of single phase transformer-losses, regulation and efficiency; Autotransformers and special transformers.	07
	AC Machines	Constructional details and operating principle of 3 phase alternator and synchronous motor- synchronizing and parallel operation. Starting of synchronous motor-V curve and inverted-V curves. Constructional features and operating principle of 3 phase induction motors-slip torque characteristics-methods of starting-speed control;	07
	Single phase and Special Machines	principle of operation and type of single phase induction motors; Principle of working and special features of universal motor, repulsion motor, reluctance and hystersis motors, stepper motors, linear induction motor, ac and dc servo motors and tacho-generator	06
Unit-2	**Introduction to Electrical Power System**	Schematic representation of a power system – various components and data related to power system – per unit representation – Distinction between steady state and transient state of power system – Recent trends in power transmission – EHV AC and HVDC transmission	04
	Electric Power Generation	Introduction to power generation scenario in India and world, Introduction to various sources of power Generation – conventional and renewable, Hydro, thermal, nuclear, gas power stations, types of turbines and their applications.	08
	Components of power system	Various accessories used in power transmission system and substations, Fuses, relays, earthings, circuit-breakers, isolators, transmission towers, line insulators and other accessories.	08
	Utilization of Electrical power	Utilization concepts of Electricity for various processes e.g. electrolysis process and mettalurgy etc., Electrochemical Cells & Batteries; Application of Electricity for Heating, Ventilating and air-conditioning, Welding and illumination.	04

Recommended Books:

Title	Author	Publisher
Electrical Technology	Edward Hugh	Pearson Education
Power System	D P Kothari & I J Nagrath	TMH
Electrical Machines	D P Kothari & I J Nagrath	TMH
Electrical Machines	S K Bhattacharya	TMH

Computer Method in Power System Analysis	Stagg G.W and El.Abiad A.H	McGraw Hill

Practicals: EE-423

1. Study of three point starter of a DC motors.
2. Study of Four point starter of a DC motors.
3. Study of Star delta starter of Induction motor.
4. To perform Open circuit test on a single phase transformer.
5. To perform short circuit test on a single phase transformer.
6. To perform speed control of a DC motor using field control method.
7. To perform speed control of a DC motor using armature control method.
8. To Draw the OCC of a DC shunt generator.
9. To draw the Load characteristic of a DC shunt generator.
10. To study the constructional details of a single phase Induction motor.
11. To study various types of earthings.
12. To study various types of Fuses.
13. To study various types of Line Insulators.
14. To study the components of an electrical substation.

Title of the course : Electrical Engineering materials
Subject Code : EE-424
Weekly load : 3 LTP-3 0 0
Credit : 3
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Dielectric Materials**	Static dielectric constant, Polarization, atomic interpretation of the dielectric constant of mono-atomic and poly atomic gases, internal fields in the solids and liquids, static dielectric constants of solids, ferroelectricmaterials and spontaneous polarization, piezo- electricity. frequency dependence of electronics, ionic and orientational polarization, complex dielectric constant and dielectric losses.	12
	Conductivity of Metals	Ohm's Law and relaxation time of electrons, collision time and mean free path. Electron scattering and resistivity of metals. Heat developed in current carrying conductor, thermal conductivity of metals, superconductivity.	12
Unit-2	**Magnetic Materials**	Magnetisation from microscopic view point, orbital magnetic dipole movement and angular momentum materials, diamagnetism, origin of permanent magnetic dipoles in material. paramagnetic spin systems.	12
	Properties of ferromagnetic materials	Spontaneous magnetisation and the curie-WeilsLaw. Ferromagnetic Domains and coercive force, antiferromagnetic and ferromagnetic materials. magnetic materials for electrical devices, introduction to permanent magnets	12

Recommended Books-

1. Electrical Engineering materials by A.J. Dekker.
2. Electrical Engineering Materials by G.P. Chhalotra.
3. Electrical Engineering materials by S.P. Seth and P.V. Gupta.

Title of the course	**:**	**Electrical Workshop**	
Subject Code	**:**	**EE-425**	
Weekly load	**:**	**2**	**LTP-0 0 2**

Credit : 1

Practical:

1. Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, ceiling roses, battens, cleats and allied items, tools and accessories.
2. Study of electrical safety measures and demonstration about use of protective devices.
3. Identification of phase, neutral and earth of domestic appliances and their connection to two pin/three pin, plugs.
4. Lay out of complete wiring of a house (i) batten wiring (ii) plastic casing and capping.
5. Study of common electrical appliances such as electric iron, electric kettle, ceiling fan/ table fan, electric mixer, electric Geyser, desert cooler etc.
6. Testing and rectification of simulated faults in above said electrical appliances.
7. Introduction to a Lead-acid battery and its working.
8. Installation of a battery and to connect in series and parallel
9. Charging a battery and testing it with the help of hydrometer and cell tester.
10. Importance of three-phase wiring and its effectiveness.
11. Job I Laying out 3 phase wiring for an electric motor or any other 3 phase machine.
12. Estimating and costing of power consumption.
13. Connecting single-phase energy meter and testing it. Reading and working out the power consumption and the cost of energy.
14. Checking continuity of connection (with tester and lamp) location of faults with a multimeter) and their rectification in simple machines and/or other electric circuits fitted with earthing.
15. Demonstration of dismantling, servicing and reassembling a table fan/ceiling fan/air cooler/mixer/electric iron, Electric heater, geyser, electric oven, air conditioner etc.
16. Dismantling, servicing serving and reassembling of any of the above electrical appliances.
17. Testing Single phase/three phase electrical motor by using voltmeters, ammeter, clip on meter, tachometer etc.
18. Reversing the rotation of a motor.

Recommended Books-

1. H Partab, *Electrical Gadgets,*
2. D K Sharma, Basic *Electrical & Electronics Engineering*, CBS publisher
3. Singh R P, *Electrical Workshop: A text Book*, I K International Publisher House Pvt. Ltd

Title of the course	**:**	**Electrical Engineering Practices**	
Subject Code	**:**	**EE-426**	
Weekly load	**:**	**2**	**LTP-0 0 2**
Credit	**:**	**1**	

Practical:

1. Study of various passive components, protection devices e.g. fuses, MCBs and ELCBs and measuring instruments used in electrical circuits.
2. Verification of Ohm's Law and equivalent resistances in series and parallel connections.
3. Verification of Kirchoff's laws (KCL & KVL).
4. Measurement of various characteristic values of a Sinusoidal waveform with the help of CRO.
5. Measurement of voltage, current and power in pure R, pure L and pure C circuits and Verification of phase angle concept.
6. Measurement of voltage, current and power in RL, RC and RLC circuits and Verification of phase angle and power factor concept.
7. Measurement of power and power factor in a three phase circuit by different methods and Verification of voltage/current relationship in star and delta connections of three phases.
8. Verification of Faraday's laws and Lenz's law.
9. Study of various types of DC motors and their starters.
10. Study of various types of AC motors and their starters.
11. Study of various types of transformers and Verification of turns ratio.
12. Verification of concepts of starting and reversing various AC and DC motors.
13. Testing of various passive components using electrical measuring instruments.
14. Fault diagnosis and removal in general electrical connection /apparatus.

Recommended Books-

Title	**Author**	**Publisher**
Electrical Technology	Edward Hugh	Pearson Education
Basic Electrical Engineering	D P Kothari & I J Nagrath	TMH
Electrical Machines	D P Kothari & I J Nagrath	TMH
Electrical Machines	S K Bhattacharya	TMH

Title of the course : **Higher Engineering Mathematics**
Subject Code : **AM - 511**
Weekly load : 3 Hrs. LTP 3-0-0
Credit : 3 (Lecture 3; Tutorial 0; Practical 0)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Laplace transforms	Laplace transforms of elementary functions. Properties of Laplace transform. Transform of derivatives and integrals. Evaluation of integrals by Laplace transforms. Inverse Laplace transforms. Convolution theorem. Solution of ordinary differential equations. Unit step function and unit impulse function. Engineering applications.	7
	2. Fourier series	Fourier series. Change of interval. Even and odd functions. Half-range series.	5
	3. Partial derivatives and expansions	Functions of two or more variables. Partial derivatives. Homogenous functions. Euler's Theorem. Total derivative. Derivative of an implicit function. Tangent and normal to a surface. Change of variables. Jacobians. Taylor's and Maclaurin's series expansions for a function of two variables.	9
Unit-2	4. Complex functions	Limit of a complex function. Differentiation. Analyticity. Cauchy-Riemann equations. Harmonic functions. Conformal mapping. Some special transformations- translation, inversion and rotation. Bilinear transformation.	7
	5. Multiple integral	Double integral. Change of order of integration. Triple integral. Change of variables. Applications to area and volume. Beta and Gamma functions.	8
	Vector Calculus	Differentiation of a variable vector. Scalar and vector point functions. Vector operator - Del. Gradient, curl and divergence - their physical interpretation and applications. Directional derivative. Line, surface and volume integrals. Theorems of Green (in plane), Gauss and Stoke (without proof) - their verification and applications.	9

Total=45

Recommended Books:

1. R.K. Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publishers.
2. G.B. Thomas & R.L. Finney, Calculus: Analytical Geometry, Addison Wesley.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern.
4. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill.

Title of the course : **Human values and professional ethics**
Subject Code : **MC-511/ MC-521**
Weekly load : 01 Hr Lecture LTP 1-0-0
Credit : 0

Course Description	**Lecture(s)**
Unit-I	
Values and Self Development	
Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non moral valuation, Standards and principles, Value judgments. Importance of cultivation of values, Sense of duty, Devotion, Self reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.	04
Personality and Behavior Development	
Soul and scientific attitude, God and scientific attitude, Positive thinking, Integrity and discipline, Punctuality, Love and kindness, Avoiding fault finding, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering love for truth, Aware of self destructive habits, Association and cooperation, Doing best, Saving nature.	04
Unit-II	
Character and Competence	
Science vs. God, Holy books vs. blind faith, Self management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of women, All religions and same message, Mind your mind, Self control, Honesty, Studying effectively.	03
Human Rights	
Jurisprudence of human rights nature and definition, Universal protection of human rights, Regional protection of human rights, National level protection of human rights, Human rights and vulnerable groups.	02
Competence in professional ethics	
Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems	03
	Total=16

Recommended Books:

1) S.K.Chakraborty, Values and Ethics for Organizations Theory and Practice; Oxford University Press, New Delhi,2001.
2) S.K. Kapoor, Human rights under International Law and Indian Law; Prentice Hall of India, New Delhi, 2002.
3) D.D. Basu, Indian Constitution; Oxford University Press, New Delhi, 2002.
4) W.K. Frankena, Ethics; Prentice Hall of India, New Delhi, 1990.
5) R. R. Gaur, R. Sangal, G. P. Bagaria, A Foundation Course in Value Education. 2009,
6) M Govindrajran, S Natrajan, V.S. Senthil Kumar, Engineering Ethics(including Human Values); Eastern Economy Edition, Prentice Hall of India Ltd.

Title of the course : Network Analysis and Synthesis
Subject Code : EE-511
Weekly load : 7 LTP-3 2 2
Credit : 5
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Circuits Concepts**	Circuits Elements, Independent and dependent sources, signals and wave forms; periodic and singularity voltages, step, ramp, impulse, Doublet. Loop currents and loop equations, node voltage and node equations, Network Theorems, Superposition, Thevenin's, Norton's, Maximum Power Transfer, Reciprocity. Fourier transforms and series, Laplace transform, its properties and applications, Concept of one port, two-port networks, characteristics and parameters	12 Hrs
	Time and Frequency Domain Analysis	Representation of basic circuits in terms of generalised freq. & their response, Laplace transform of shifted functions, transient & steady response, Time domain behaviors from poles and zeros, Convolution Theorem.	12 Hrs
Unit-2	**Filters Synthesis**	Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T section, IT section, terminating half section. Pass bands and stop bands. Design of constant-K, m-derived filters.	12 Hrs
	Network Synthesis	Composite filters, Network functions, Impedance & Admittance function, Transfer functions, Relationship between transfer and impulse response, poles and zeros and restrictions, Network function for two terminal pair network, Sinusoidal network in terms of poles & zeros. Real liability condition for impedance synthesis of RL & RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms	12 Hrs

Recommended Books-

1.Temes& LaPatra – Introduction to circuit Synthesis & Design, McGraw Hill.
2. V. Valkenberg – Modern Network Synthesis, PHI.
3. Weinberg – Network Analysis & Synthesis, McGraw Hill.
4. Peikari – Fundamentals of Network Analysis & Synthesis, Wiley.
5. V. Atre-- Network Theory and Filter design, TMH.

Practicals: EE-511

1Verification of principle of superposition with dc and ac sources
2 Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits
3 Verification of Tellegin's theorem for two networks of the same topology
4 Determination of transient response of current in RL and RC circuits with step voltage input
5 Determination of transient response of current in RLC circuit with step voltage input for underdamp, critically damp and overdamp cases
6 Determination of frequency response of current in RLC circuit with sinusoidal ac input
7 Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters
8 Determination of driving point and transfer functions of a two port ladder network

and verify with theoretical values
9 Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests
Write Demo for the following (in Ms-Power point)
10 Verification of parameter properties in inter-connected two port networks : series, parallel and cascade also study loading effect in cascade
11 Determination of frequency response of a Twin – T notch filter

Title of the course : Electrical Machine (DC Machines & Transformers)
Subject Code : EE-512
Weekly load : 7 LTP-3 2 2
Credit : 5

Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**TRANSFORMERS**	Effect of saturation on exciting current and in-rush current phenomenon. Parallel operation of single phase transformers.	08
	AUTO TRANSFORMERS	Principle of operation, equivalent circuit and phasor diagrams, comparison with two winding transformer.	08
	THREE-PHASE TRANSFORMERS	Different types of winding connections, Voltage and current ratios, Parallel operation of three phase transformers. Three winding transformer's equivalent circuit, off-load and on-load tap changing transformer, Scott connections. Testing of transformers.	08
Unit-2	**D.C. GENERATOR**	Working principle , construction of DC Machines, Armature windings, single and double layer winding diagrams, E.M.F. and torque equations, armature reaction, effect of brush shift, compensating winding, commutation, causes of bad commutation, methods of improving commutation, methods of excitation of d.c. generators and their characteristics.	12
	D.C. MOTOR	Working principle characteristics, starting of shunt and series motor, starters, speed control methods: field and armature control. Braking: plugging, dynamic and regenerative braking, Testing: Swinburn's test, Hopkinson test, Field test. Estimation of losses and efficiency.	12

Recommended Books-

1. Bimbhra P.S., *Electrical Machinery, Khanna Publishers*
2. Fitzgerald A.E., Kingsley C. and Umans S.D., *Electric Machinery*, 6th Edition, McGraw Hill
3. Langsdorff E.H., *Principles of D.C. machines*, McGraw Hill
4. Nagrath I.J. and Kothari D.P., *Electrical Machines*, 4th Edition, Tata McGraw Hill,
5. Say M G, *Alternating Current Machines*, 5th edition, Sir Isaac Pitman & Sons Ltd.

Practical: EE-512

1.To Load test on a single phase transformer.
2. To perform Open circuit and short circuit tests on a single phase transformer and hence find equivalent
circuit, voltage regulation and efficiency.
3. To find the efficiency and voltage regulation of single phase transformer under different loading conditions.
4. To perform parallel operation of two single phase transformers.
5. To study the various connections of three phase transformer.
6. To perform Scott connections on three phase transformer to get two phase supply.
7. To study the constructional details of direct current (DC) machine and to draw sketches of different components.
8. To measure armature and field resistance of direct current (DC) shunt generator and to obtain its open
circuit characteristics.
9. To obtain load characteristics of direct current (DC) shunt/series /compound generator.
10. To draw speed-torque characteristics of direct current (DC) shunt/series /compound generator.

11. To study direct current (DC) motor starters.
12. To perform Swinburne's test (no load test) to determine losses of direct current (DC) shunt motor

Title of the course :Electrical and Electronics Measurement and Instrumentation
Subject Code : EE-513
Weekly load : 4 LTP-4 0 0
Credit : 4
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Introduction**	Elements of generalized measurement system, characteristics of instruments, accuracy, precision, sensitivity, range span. Construction and working of CRT, Block diagram of CRO, measurement of voltage and frequency with CRO, basic CRO circuit, measurement of voltage, current, phase, frequency, time period. dual track oscilloscope, specification of a CRO and their significance, front panel controls.	10
	Basic Indicating Instruments	Classification of analog, concept of deflecting, controlling and damping torque, control and damping system, construction and principle of moving iron and moving coil instruments, construction of ammeter and voltmeter and extension of their range and Electro dynamometer instruments, Principles of operation PMMC ohm meters and their types.	12
	Measurement of Resistance	Potentiometers: Basic principles, types of potentiometers, their functions and applications, Classification of resistance, measurement of low, medium and high resistance, ammeter-voltmeter method, wheat-stone bridge, digital LCR meter for measurement of resistance, insulation tester.	10
Unit-2	**Bridges**	Sources and Detectors, General equation for bridge balance, Measurement of R,L,C,M, F etc by Wheatstone,Kelvin, Maxwell, Hay's, Anderson, Owen, Heaviside, Campbell, schering, Wien bridges. Bridge sensitivity. Errors, Wagner Earthing Device.	10
	Magnetic Measurements	Flux meter, B-H Curve, Hystersis loop, Permeameters, AC Testing of Magnetic materials, Separation of iron losses, iron loss measurement by Wattmeter and Bridge methods.	10
	Instrument Transformers	Theory and construction of current and potential transformers, ratio and phase angle errors and their minimization, Characteristics of CTs. &PTs., Testing of CTS &PTS..	10

Recommended Books-

Electrical and electronic measurement and instrumentation	AK Sawhney	DhanpatRai and Co.
Electrical Measurement	JB Gupta	SK Kataria

Electronic	Measurement and Instrumentation	Dr.Rajendra Prasad	S.Chand

Title of the course : Transmission and Distribution of Electrical Power
Subject Code : EE-514
Weekly load : 5 LTP-3 2 0
Credit : 4
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	Introduction	Generation of Electric Power- Brief description of Thermal, hydro nuclear and gas power plants & other non-conventional power plants. Transmission and Distribution Systems- DC 2 –wire and 3 – wire systems, AC single phase, three phase and 4-wire systems, comparison of copper efficiency. Distribution Systems: primary and secondary distribution systems, concentrated & uniformly distributed loads on distributors fed at one and both ends, ring distribution, submains and tapered mains, voltage drop and power loss calculations, voltage regulators	06
	Overhead Transmission Lines	Types of Conductors, Line parameters; calculation of inductance and capacitance of single and double circuit transmission lines, three phase lines with stranded and bundle conductors, Generalized ABCD constants and equivalent circuits of short, medium & long lines. Line Performance: regulation and efficiency of short, medium and long lines, Series and shunt compensation, Introduction to FACTS	08
	Overhead Line Insulators	Type, string efficiency, voltage distribution in string of suspended insulators, grading ring, preventive maintenance	06
	Mechanical Design of Transmission Lines	Different types of tower, sag-tension calculations, sag-template, string charts, vibrations & damaging Corona-corona losses, radio & audio noise, transmission line – communication line interference	08
Unit-2	Tariffs & Load Curves	Definition & different tariffs for domestic, commercial, industrial application, Different Load and Load duration curves. Curves their significance	10
	Introduction to EHV/HVDC transmission	Brief description of both the systems with working & constructional details	10

Recommended Books-

1. Grainger John, J. and Stevenson, Jr. W.D., “Power System Analysis”, McGraw Hill, 1994.
2. Harder Edwin, I., “Fundamentals of Energy Production”, John Wiley and Sons, 1982.
3. Deshpande, M.V., “Elements of Electric Power Station Design”, A.H. Wheeler and Co. Allahabad, 1979.
4. Burke James, J., “Power Distribution Engineering; Fundamentals and Applications” Marcel Dekker 1996.
5. Wadhwa, C.L., “Electric Power Systems”, Second Edition, Wiley Eastern Limited, 1985.
6. Nagrath, I.J. and Kothari, D.P., “Power System Engineering”, Tata McGraw Hill, 1995.

Title of the course	**:**	**Simulation Lab**	
Subject Code	**:**	**EE-515**	
Weekly load	**:**	**2**	**LTP-0 0 2**
Credit	**:**	**1**	

Practicals:

1. To perform various arithmetic operations in Microsoft Excel and create various types of 2D plots.
2. To create arrays and matrices in MATLAB and perform various arithmetic operations.
3. To write a programme in MATLAB for getting the desired data (largest, smallest, a range etc) from a set.
4. To write a programme in MATLAB for creating various types of 2D plots (single and multiple) from a set of data.
5. To measure and plot the Instantaneous, RMS and average values of current/voltage, power, power factor, crest factor, frequency and various other waveform parameters while simulation of behaviour of basic circuit components supplied from a DC and an AC source in MATLAB.
6. To simulate the steady state and transient behaviour of circuits having a pure resistance or pure inductance or pure capacitance supplied from a DC and an AC source in MATLAB. Plot their source and load current and voltage waveforms and comment on it.
7. To simulate the steady state and transient behaviour of circuits having RL, RC and RLC series combinations fed from a DC and an AC source in MATLAB. Plot their source and load current and voltage waveforms and comment on it.
8. To simulate the steady state and transient behaviour of circuits having RL, RC and RLC parallel combinations fed from a DC and an AC source in MATLAB. Plot their source and load current and voltage waveforms and comment on it.
9. To simulate the steady state and transient behaviour of a diode bridge rectifier (single phase and three phase) in MATLAB for R and RL load. Plot their current/voltage waveforms at source, diodes and load and comment on it.
10. To simulate the steady state and transient behaviour of DC Motors (shunt, series and compound) in MATLAB. Plot various current/voltage waveforms and characteristics and comment on it.
11. To simulate the steady state and transient behaviour of Transformers (single phase/three phase) in MATLAB. Plot various current/voltage waveforms and comment on it.
12. To simulate the steady state and transient behaviour of a single phase center tapped transformer based diode rectifier in MATLAB for R and RL load. Plot their current/voltage waveforms at source, diodes and load and comment on it.
13. To simulate the speed control of DC Motors (shunt, series and compound) in MATLAB using variable AC source and diode bridge rectifier and by armature and field control methods. Plot various current/voltage waveforms and comment on it.
14. To model a multiphase transformer using single phase/three phase Transformers in MATLAB and simulate its steady state and transient behaviour. Plot various current/voltage waveforms and comment on it.
15. Introduction to Labview and examples.

Recommended Books:

Title	**Author**	**Publisher**
Getting Started with MATLAB	Rudra Pratap	Oxford University Press
Mastering MATLAB 7	Hanselman & Littlefield	Prentice Hall
Electric Machinery	Fitzgerald, Kingslay and Umans	McGraw Hills

Title of the course : Industrial Chemistry
Subject Code : CY-521
Weekly load : 3 LTP 3-0-2
Credit : 4 (Lecture 3; Practical 1)

Unit	Main Topics	Course outlines	Lecture (s)
Unit-1	**Water and its Treatment**	Water and its Treatment: Introduction, Hardness and its determination, Degree of Hardness, Treatment and Purification of water for domestic and Industrial purposes- Sedimentation, Filtration, Sterilization, Break point chlorination, Ozonization , Permutit or Zeolite process, Deionization or Demineralization, Desalination of Brackish Water. Numerical Problems	**10**
	Solid State Chemistry	Introduction to Solid State Chemistry, Band theory of solids, semiconductors and insulators crystallography, crystal systems, polymorphism, Law of rational indices, Miller indices, Interplanar spacing, Structure of crystals, X-ray diffraction, Bragg method, x-ray analysis of sodium chlorideSolid State **,** Stoichiometric Defects	**08**
	Molecular Electronics	Need for molecular devices, molecular electronics, definition, molecular wires and rectifiers, types of molecular wires with examples, insulation of molecular wires, preliminary idea about measurement of conductivity by various methods(AFM, optical electron transfer etc.), molecular switches : types(pH, optical, temperature, fluorescence with example), logic gates: YES, NOT,AND and OR logic gates with examples, self-assembly.	**08**
Unit-2	**Spectroscopic Techniques for Analysis**	Introduction,interaction of EMR radiation and matter, atomic and molecular spectroscopy, Absorption laws,Atomic absorption spectroscopy:Basic principles, instrumentation, interferences, typical applications.Atomic emission spectroscopy: Basic principle, instrumentation and applications.UV-VIS and IR Spectroscopy-Introduction, theory, instrumentation, applications of UV & IR spectroscopy (including finger print region in IR)	**12**
	Thermal Analysis	Thermogravimetricanalysis(TGA), Derivative thermogravimetric analysis(DTG), Differential thermal analysis(DTA), Differential Scanning Calorimetry-Basic principles , Instrumentation and analytical applications.	**07**

Total=45

List of Experiments (CY-521)

1.) Determination of Total Hardness of water (tap, lake, pond, river) using standard EDTA solution and
Eriochrome Black T (EBT) indicator.
2.) Determination of available Chlorine in treated and untreated water titrimetrically.
3.) Determination of available Chlorine in Bleaching Powder titrimetrically
4.) Analysis of water samples by BOD and COD.
5.) Estimation of Iron in water.
6.) Investigation of rusting of iron in different conditions of rusting.
7.) Investigation of the effect of metal coupling on rusting of iron.
8.) To determine the acidity of water sample.
9.) To determine the alkalinity of a given water sample.
10.) Determination of free CO_2 in a given sample of water.
11.) To sketch a typical DTA plot for the melting of a pure metal.
12.) To sketch a typical DSC plot for the melting of a pure metal.
13.) To study of the phase changes (glass transition temperature, melting, phase separation) in solid and gel polymer electrolytes of different composition for lithium power sources.

14.) Determination of the Curie point, crystallization temperature and energy in metal glasses
15.) Identification of functional group by FT-IR spectroscopy
16.) Determination of concentration of an unknown sample of UV spectroscopy.
17.) To determine λ_{max} (wavelength of maximum absorption) of a solution of $KMnO_4$ using a spectrometer.
18.) To determine the concentration of ferrous ions in a given sample spectrophotometrically by O-phenanthroline method.

Recommended Books:

1.P. C. Jain & M. Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi, 2005.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Company, 2008.
3. F.W. Billmayer. Textbook of Polymer Science. 3rd Edn, Wiley. N.Y. 1991.
4. C. N. Banwell & E.M. McCash, Fundamentals of Molecular Spectroscopy, 4th Edn, Tata Mc Graw-Hill Edition, 1995.
5. S. S. Dara, S. S. Umare, A Text Book of Engineering Chemistry, S. Chand Publishing, 2011.
6. J. D. Lee, Concise Inorganic Chemistry, 5th Edn., Chapman and Hall, London, 1996.
7. Engineering Chemistry by B. Sivasankar, Tata Mcgraw Hill
8. Engineering Chemistry by A. Mallick, Viva Books, 2008.
9. Organic Chemistry by J. Clayden, Nick Greeves, S. Warren, Oxford Press 2012.
10. Levine, Physical Chemistry, 5/e (7th reprint), Tata McGraw Hill, 2006.
11. Inorganic Chemistry, Principle, structure and reactivity, J.E. Huheey, E.A. Keitler, R.L. Keita, O.K. Medhi, Pearson Education, 4th Ed.
12. Chemistry, J.E. Mcmerry and R.C. Fay, 5th Ed., Pearson Education, 2008

Title of the course :**Material Science**
Subject Code : **PH-511/PH-521**
Weekly load : 5 LTP 3-0-2
Credit : 4 (Lecture 3; Practical 1)

Unit	MAIN TOPICS	Course outlines	Lecture(s)
Unit-1	**ELEMENTS OF CRYSTALLOGRAPHY**	A brief Introduction to material science, Space lattices, Unit cell, primitive cell, Bravais lattice, Atomic packing factor, Miller Indices, directions and planes in crystal lattice (cubic and hexagonal only), distribution of atoms in lattice planes (in cubic crystal only), Important structures (NaCl, CsCl, Diamond and ZnS), structure determination; X-ray diffraction, Neutron and electron diffraction	08
	IMPERFECTIONS IN CRYSTALS	Point imperfections, Frenkel, and Schottky defects and their equilibrium concentration determination, Color centres, types of color centres, generation of color centres, Edge and screw dislocation, Burger vector, Surface defects	05
	BAND THEORY OF SOLIDS	Free electron theory, Concept of energy bands, Bloch theorem, Electron in a periodic field of crystal (The Kronig – Penny Model) distinction between metal, semiconductor and insulator, effective mass of an electron, Hall effect.	06
	NANO-MATERIALS	Fundamentals of nonmaterial's and nanotechnology, nano particles, properties of nonmaterial's, synthesis and characterisation, applications of nonmaterials.	05
Unit-11	**DIELECTRIC MATERIALS**	Introduction of dielectric materials, Polarization, Different types of polarization, Electronic, ionic, orientational and space charge polarization, polarizability, Clausius-Mossotti relation, temperature and frequency dependence of polarizability, dielectric breakdown, measurement of dielectric properties, Dielectric constant, Dielectric loss, ferroelectric and piezoelectric materials, examples of materials and their applications.	08
	MAGNETIC MATERIALS	Terminology and classification of engineering materials, Type of magnetism (dia, para, ferro, ferri and anti ferromagnetisms), Theory of para, dia and ferromagnetic materials, magnetic anisotropy and magnetrostriction, magnetic domains, hard and soft magnetic materials, ferrites and their applications	08
	SUPERCONDUCTIVITY	Introduction, type I & type II superconductors, Meissner's effect, isotope effect, effects of magnetic field, London's equations, penetration depth, specific heat, BCS theory (electron-lattice-electron interaction, Cooper-pair, coherence length, energy gap), high temperature superconductors, applications of superconductivity.	08

Theory **Total=48**

Recommended Books:
Raghvan :Materials Science

Srinivasan &Srivastava :Science of Engineering Materials
Callister JR Materials Science and Engg.: An Introduction
Askeland &Phule :The Science and Engineering of Materia

List of Experiments

PH-511/PH-521

1. To prepare a metallic sample and measure the grain size using the metallurgical microscope.
2. To study the creep nature in metallic wires at room temperature.
3. To find the mobility and carrier concentration in a semiconductor sample using Hall Effect experiment.
4. To study the B-H curves of different materials using B-H curve tracer.
5. To determine the Stefan's constant using Stefan's constant kit.
6. To find the resistivity of a given semiconductor material using four probe method.
7. To find the Curie temperature of the given ferrite material.
8. To find the Curie temperature of the given ferroelectric material.
9. To calculate the dielectric constant of the given dielectric material.
10. To find the capacitance and permittivity of the given material.

Title of the course : Digital Electronics & Logic Circuit Design
Subject Code : EE-521
Weekly load : 5 LTP-3 0 2
Credit : 4
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**NUMBER SYSTEM & CODES**	Binary number system, octal number system, hexadecimal number system, BCD Code, Gray code, signed & unsigned binary numbers, 1's & 2's complement of a number, Floating point representation, Binary operations- addition, subtraction, multiplication, division, Parity for error detection, Check sum and Hamming Code for error detection and correction.	08
	COMBINATIONAL CIRCUITS	Concept of positive and negative logic, Introduction to Boolean variables, Boolean theorems and DeMorgan Theorem, Sum of product and Product of sum form of Logic expressions, Duality, Logical functions using Karnaugh map and Quine-McClusky methods, multiplexers, demultiplexers, encoders, decoders, adders, subtractors, parity generators, parity checkers, code converters.	08
	SEQUENTIAL LOGIC CIRCUITS	Flip-flops, JK flip-flops, D flip-flops, T flip- flops, SR flip- flops, edge triggered and clocked flip-flops. Registers and Counters: Series and Parallel registers; Synchronous & Asynchronous counters, Up and Down counters, Ring counters & Mod- Counters. Design of Synchronous and asynchronous logic circuits	08
Unit-2	**INTRODUCTION TO VHDL**	Overview of digital design with very-high-speed integrated circuits (VHSIC) hardware description language (VHDL), HDL format and Syntax, entity, Data representation in VHDL, Truth table using VHDL, Decision Control structure and Sequential Circuit using VHDL.	08
	DIGITAL TO ANALOG (D/A) AND ANALOG TO DIGITAL (A/D) CONVERTERS	Introduction, weighted register *D/A* converter, binary ladder, *D/A* converter, specifications for *D/A* converters, parallel *A/D* converter,successive approximation *A/D* converter single & dual slope *A/D* converter, *AID* converter using voltage to frequency conversion, *A/D* converter using voltage to time conversion, countertype *AID* converters.	08
	SEMICONDUCTOR MEMORIES	Introduction, memory organization, classification & characteristics of memories, sequential memories, read only memories, read & write memories, content addressable memories, Programmable array Logic, programmable logic arrays and Programmable Logic Device, Field Array Programmable Gate array	08

Recommended Books-

1. Floyd Thomas S. *Digital Fundamentals*, Pearson Education
2. Jain R.P., *Modern digital Electronics*, Tata McGraw Hill
3. Kumar Anand, *Fundamentals of Digital Circuits*, Prentice Hall of india
4. Malvino Albert Paul, *Principles of Digital Electronics*, Tata McGraw Hill
5. Mano Morris, *Digital Logic and Computer Design*, Prentice Hall of India

6. Tocci Ronald J. Widmer Neal S. and Moss Gregory L., *Digital Systems: Principles and Applications*, Prentice Hall of India

Practical: EE-521

1. Verification of the truth tables of TTL gates.
2. Verify the NAND and NOR gates as universal logic gates.
3. Design and verification of the truth tables of Half and Full adder circuits.
4. Design and verification of the truth tables of Half and Full subtractor circuits.
5. Verification of the truth table of the Multiplexer 74150.
6. Verification of the truth table of the De-Multiplexer 74154.
7. Design and test of an S-R flip-flop using NOR/NAND gates.
8. Verify the truth table of a J-K flip-flop (7476)
9. Verify the truth table of a D flip-flop (7474)
10. Operate the counters 7490, 7493.
11. Design of 4 bit shift register(shift right).
12. Design of modulo-4 counter using J K flip flop.

Title of the course : Electrical Machine(Asynchronous)
Subject Code : EE-522
Weekly load : 7 LTP-3 2 2

Credit : 5
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	Basic Concepts	Field distribution of space distributed three-phase winding, concept of rotating field, production and concept of asynchronous and synchronous torques, analogy between induction motor and transformer.	06
	Poly-phase Induction Machines	Constructional features, concept of slip and operation, rotor frequency, current and power, equivalent circuit, phasor diagram, torque-slip characteristics, effect of rotor circuit resistance, starting torque, crawling and cogging, cage motors(double cage and deep bar motor).	08
	Starting Methods	Various methods of starting	04
	Speed Control	Speed control: (i) control of speed of rotating field, (ii) control of slip speed, Effect of voltage injection in rotor circuit of slip ring induction motor, Motor tests for estimation of equivalent circuit parameters.	06
Unit-2	Induction Generator	Isolated and Grid mode operation, method of excitation, performance characteristics of three-phase self-excited induction generator.	08
	Linear Induction Machines	Construction, principle of operation and applications.	08
	Single-phase Motors	Double revolving field theory, types of single phase motors, characteristics and equivalent circuit. Shaded pole motor: working principle and characteristics, applications.	08

Recommended Books-

1. Electric Machinery — Fitzgerald A.E., Kingsley C. and Umans S.D., TMH
2. Principles of A.C. Machines — Langsdorff E.H., TMH
3. Electrical Machines — Nagrath I.J. and Kothari D.P., TMH
4. Electrical Machinery — Bimbhra P.S., Khanna Publishers
5. Alternating Current Machines — Say M. G., Sir Isaac pitman & Sons Ltd.

Practical: EE-522

1. To Perform load-test on 3 ph. Induction motor & to plot torque V/S speed characteristics.
2. To Perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalentckt. Parameters & to draw circle diagram.
3. To study the speed control of 3 ph. Induction motor by Kramer's Concept.
4. To study the speed control of 3 ph. Induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor.
5. To study star- delta starters physically and
(a) to draw electrical connection diagram
(b) to start the 3 ph. Induction motor using it.
(c) To reverse the direction of 3 ph. I.M.
6. To start a 3 phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. And to plot torque –speed characteristics.

7. To perform no-load & blocked –rotor test on 1 ph. Induction motor & to determine the parameters of equivalent ckt. Drawn on the basis of double revolving field theory.
8. To Perform load –test on 1 ph. Induction motor & plot torque –speed characteristics.
9. To Perform no load & short ckt. Test on 3- phase alternator and draw open ckt. And shortckt. Characteristics.
10. To find voltage regulation of an alternator by zero power factor (z.p.f.) method.
11. To study effect of variation of field current upon the stator current and power factor with synchronous motor running at no load and draw V & inverted V curves of motor.
12. To measure negative sequence & zero sequence reactance of Syn. Machines.

Title of the course :**Electrical Power Generation (Conventional & Non-Conventional)**
Subject Code :**EE-523**
Weekly load : **3** **LTP-3 0 0**
Credit : **3**
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**INTRODUCTION**	Energy sources conventional and non conventional, their availability, Recent trends in Power Generation, Interconnected Generation of Power Plants.	4
	HYDRO ELECTRIC GENERATION	Selection of site, basic definitions, capacity calculations, classification, elements of hydroelectric plant and operation of hydro-electric plant, hydro-electric generator choice of size and number of generating units,	5
	THERMAL POWER GENERATION	Introduction, selection of site, basic parts and general layout of steam power plant and working, efficiency, fuels, fuel handling, combustion, ash handling and dust collection, draught systems, feed water turbo alternators merits and demerits of steam power plants,	5
	NUCLEAR AND DIESEL ELECTRIC POWER GENERATION	Feasibility of nuclear power station, nuclear fuels, fission process and conditions, constituents and layout of nuclear power plant, selection of site for diesel plant, plant layout, performance and thermal efficiency of diesel plant merits and demerits of plant	7
Unit-2	**SOLAR POWER GENERA TION**	Solar radiations, solar energy collectors; flat plate and focusing type, energy balance equation and collector efficiency, photovoltaic cells applications of solar energy; solar pumping, solar furnace, solar cooking solar green houses	5
	WIND POWER GENERATION	Wind surveys, Basic principles of wind energy conversion, wind data and energy estimation, site selection, basic components of wind energy conversion systems(WECS), wind machines, schemes of wind power generation and control,	5
	MHD POWER GENERATION	Basic principles of MHD, MHD systems types of MHD material, electrical conditions; voltage and power output, gas conductivity, analysis of constant area MHD generator, practical MHD generator, application.	5
	GENERATION FROM MISCELLANEOUS SOURCES	Fuel cells, types and construction of fuel cells operation and characteristics, thermo- electric generation, Geothermal system, characteristic of geothermal resources, choice of generator set, electric equipment precautions low hydro-plants, choice of site, tidal energy, tidal power generation energy principles and components	6

Recommended Books-

1. Gupta B. R., *Generation of Electrical Energy*, S. Chand.

2. Rai, G.D., *Non Conventional Energy Sources*, Khanna Publishers (2005).
3. Rao, S. and Parulekar, *B.B., Energy Technology: Non Conventional, Renewable and Conventional*, Khanna Publishers (2005).
4. Wadhwa, C.L., *Generation, Distribution and Utilization of Electric Energy*, New Age International (P) Limited, Publishers (2007).
5. *Simon , Christopher A., Alternate Source of Energy*, Rowman and LittleField Publishers Inc.(2007).
6. *Venikov, V.A. and Putyain, E.V., Introduction to Energy Technology,* Mir Publishers (1990).
7. Chakrabarti A., Soni M. L., Gupta P. V. and Bhatnagar U. S., *Power System Engineering*, Dhanpat Rai & Co.

Title of the course : Sensor and Signal Conditioning
Subject Code : EE-524
Weekly load : 5 LTP-3 0 2

Credit : 4
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Description**	General concepts, General input-output configuration, Static and dynamic characteristics, Generalized input impedance Primary sensors	12
	Sensors with electrical output	Variable resistance sensors, Reactive and electromagnetic sensors, Generating sensors	12
Unit-2	**Conditioning circuits for sensors. Amplitude measurement approach**	DC linear conditioning circuits for resistive sensors, AC linear conditioning circuits for resistive and reactive sensors, Low drift conditioning circuits for generating sensors	12
	Conditioning circuits for sensors. Time-frequency conversion approach	Quasi-digital sensors state-of-the-art, Time and frequency based sensor conditioning techniques. Direct sensor-to-microcontroller interface, Sensor interface chips and integrated frequency-to-digital converters, Digital and smart sensors, Smart sensors systems design, IEEE 1451 standard for smart sensors and its extension for quasi-digital sensors and transducers	12

Recommended Books-

Instrumentation -Devices and Systems	Rangam, Sarma & Mani	TMH
A Course in Electrical and Electronic Measurements and Instrumentation	A.K. Sawhney	Dhanpat Rai
Measurement Systems	E.O. Doeblin	McGraw Hill
Instrument Measurement & Analysis	Nakra	PHI
Electronic instrumentation and measurement techniques	W.D. Cooper, A.D. Helfrick	PHI

Practical: EE-524

1. To study the characteristics of LVDT.
2. To study the characteristics of Variable Capacitor.
3. To study the characteristics of LDR.
4. To study the characteristics of Strain Gauge.
5. To study the characteristics of Crompton Potentiometer.
6. To study the characteristics of RTD.
7. To study the characteristics of Thermistor.
8. To study the characterstics of Thermocouple.

Title of the course : **Engineering Economics and Entrepreneurship**
Subject : HU-611/ HU-621
Weekly Load : 3 LTP 3- 0 -0
Credit : 3 (Lecture 3)

Course Description	**Lectures**
UNIT- I	
Introduction	
Engineers and Economics, Utility of its study, Managerial Economics, Nature and scope, basic terms and concept of economics like goods, kinds of goods.	02
Theory of Demand and Supply	
Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, The meaning of Supply, Supply function, Law of supply- Explanation of law of supply.	08
Environment Analysis	
Concept of National income- GDP, GNP, Monetary policy, Fiscal Policy.	05
Entrepreneurship-Enterprise	
Conceptual issues, Entrepreneurship vs. Management, Concept of Social Entrepreneurship and Women Entrepreneurship, Roles and functions of engineer in relation to the enterprise and in relation to the economy.	07
Business Excellence	
Role of creativity and innovation and business research, Sources of business idea, TQM,Six Sigma	02
UNIT- II	
The process of setting up a small business	
Preliminary screening and aspects of the detailed study of the feasibility of the business idea , Preparation of Project Report and Report on Experiential Learning of successful and unsuccessful entrepreneurs..	04
Communication skills	
Introduction, process of communication, barriers to communication, Removal of barriers, channels of communication, Verbal and non-verbal communication.	03
Issues in small business marketing.	
The concept and application of product life cycle ,Advertising and publicity, sales and distribution management, National, state level and grass-root level financial and non-financial institutions in support of small business development, MSME Act	09
Human Resource Management	
Introduction, definition, types, tools of motivation,Theories of motivation- Alderfer's ERG theory, Herzberg's theory of motivation, Mc Clelland theory. Introduction , objectives, scope, functions. Introduction to concept of IR.Regulation and abolition of Contract Labour Act 1970	08

Total= 48

RECOMMENDED BOOKS:

1. Economics – Samuelson, Pauls & W.D. Nordhan – McGraw Hill
2. Engineering Economics, R.Panneerselvam
3. Advanced Cost Accounting – Nigam, Sharma – Himalaya Publishing House
4. Managerial Economics – Mote and Paul – TMH
5. Macro Economics for management Students – A. Nag – Macmillan India Ltd
6. Dynamics of entrepreneurial development & Management, Vasant Desai/Himalaya Pub.House.
7. Entrepreneurship New venture creation, David H.Holt, PHI

8. Entrepreneurship & Small Business Management, Nicholas, Siropolis Houghton Mifflin company, Boston-Newyork
9. Management, Stephen P. Robbins, Mary(Pearson education Asia)

Title of the course : **Numerical Analysis**
Subject Code : **AM - 521/AM-611**
Weekly load : 5 Hrs. LTP 3-0-2
Credit : 4 (Lecture 3; Tutorial 0; Practical 1)

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	1. Errors	Errors in arithmetic operations and functions. Round-off error, truncation error. Absolute error. Relative error. Percentage error. Principles of equal effect. Significant digits.	4
	2. Roots of equations	Intermediate value property. Bisection method. Method of false position. Secant Method. Newton-Raphson method. Iteration method. Convergence of these methods.	6
	3. Solution of linear equations	Gauss Elimination method (with and without partial pivoting). Gauss-Seidel, Jacobi's methods. Triangularization method.	5
	4. Eigenvalue	Rayleigh's power method for finding dominant eigenvalue.	4
	5. Finite differences	Finite differences-forward, backward and central differences. Shift and averaging operators.	4
Unit-2	6. Interpolation	Newton's forward, backward and divided difference interpolation formulae. Lagrange's formula. Gauss forward and backward difference interpolation formulae. Spline interpolation–quadratic and cubic.	7
	7. Numerical differentiation and integration	Numerical differentiation using Newton's forward and backward difference formulae. Numerical integration – Trapezoidal rule, Simpson's one third and three-eighth rules. Romberg's integration. Error in integration.	8
	8. Numerical solution of ODEs	Taylor series method. Picard's method. Euler method. Modified Euler's method. Runge-Kutta methods (upto fourth order) for solution of ODE of first order.	7

Total=45

Recommended Books:

1. S.S. Sastry, Introductory Method of Numerical Analysis, PHI.
2. Gerald Wheatley, Applied Numerical Analysis, Pearsons Education.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Sc. and Engg. Computation.
4. J.H. Mathew, Numerical Methods for Maths., Science and Engg., PHI.

Experiments:

AM-521/AM-611

1. Finding roots of the equation $f(x) = 0$ using
   i) Bisection Method ii) Secant Method iii) Method of false position

2. Finding roots of the equation $f(x) = 0$ using
   i) Iterative Method ii) Newton - Raphson's Method

3. To check consistency and finding Solution of a system of linear algebraic equations using
   i) Gauss elimination Method ii) Gauss - Seidal Method iii) Jacobi Method

4. Solution of a system of linear equations by triangularization method.

5. Finding dominating Eigen value and Eigen vector using Rayleigh's power Method.

6. Interpolation using
   i) Newton's forward difference formula ii) Newton's backward difference formula

7. Interpolation using
   i) Newton's divided difference formula ii) Lagrange's interpolation formula

8. Interpolation using
   i) Gauss's forward formula ii) Gauss's backward difference formula

9. Interpolation using Splines
   i) Linear ii) Quadratic iii) Cubic

10. Numerical differentiation using
   i) Newton's forward interpolation formula ii) Newton's backward interpolation formula

11. Numerical Integration using
   i) Trapezoidal rule ii) Simpson's $1/3^{rd}$ rule
   iii) Simpson's $3/8^{th}$ rule iv) Romberg's rule

12. Solution of I^{st} order ordinary differential equations using
   i) Taylor's series method ii) Picard's method
   iii) Euler's method iv) Euler's modified method

13. Solution of I^{st} order ordinary differential equations using
   i) Runge-Kutta method of III^{rd} order ii) Runge-Kutta method of IV^{th} order

Title of the course : Linear Control System
Subject Code : EE-611
Weekly load : 7 LTP-3 2 2

Credit : 5
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**INTRODUCTORY CONCEPTS**	Plant, Systems, Servomechanism, regulating systems, disturbances, Open loop control system, closed loop control systems, linear and non-linear systems, time variant and invariant, continuous and sampled-data control systems, Block diagrams, some illustrative examples.	8 hrs
	MODELING	Formulation of equation of linear electrical, mechanical, thermal, pneumatic and hydraulic system, electrical, mechanical analogies. Use of Laplace transforms, Transfer function, concepts of state variable modeling. Block diagram representation, signal flow graphs and associated algebra, characteristics equation.	8 hrs
	TIME DOMAIN ANALYSIS	Typical test – input signals, Transient response of the first and second order systems. Time domain specifications, Dominant closed loop poles of higher order systems. Steady state error and coefficients, pole-zero location and stability, Routh-Hurwitz Criterion.	8 hrs
Unit-2	**ROOT LOCUS TECHNIQUE**	The extreme points of the root loci for positive gain. Asymptotes to the loci, Breakaway points, intersection with imaginary axis, location of roots with given gain and sketch of the root locus plot loop transfer function. Frequency response specifications, Relative stability, Relation between time and frequency response for second order systems. Log. Magnitude versus Phase angle plot, Nyquist criterion for stability.	8 hrs
	COMPENSATION:	Necessity of compensation, series and parallel compensation, compensating networks, applications of lag and lead-compensation.	8 hrs
	CONTROL COMPONENTS	Error detectors – potentiometers and synchros, servo motors, a.c. and d.c. techno generators, Magnetic amplifiers.	8 hrs

Recommended Books-

1. Dorf Richard C. and Bishop Robert H., *Modern Control System*, Addison –Wesley, Pearson New Delhi
2. Ogata K., *Modern Control Engineering* ", Prentice Hall,
3. Kuo B. C., *Automatic Control System*", Prentice Hall
4. Nagrath I.J. and Gopal M., *Control System Engineering* , Wiley Eastern Ltd.

Practical: EE-611

1.To determine response of first order and second order systems for step input for various values of constant 'K' using linear simulator unit and compare theoretical and practical

results.
2. To study P, PI and PID temperature controller for an oven and compare their performance.
3. To study and calibrate temperature using resistance temperature detector (RTD)
4. To design Lag, Lead and Lag-Lead compensators using Bode plot.
5. To study DC position control system
6. To study synchro-transmitter and receiver and obtain output V/S input characteristics
7. To determine speed-torque characteristics of an ac servomotor.
8. To study performance of servo voltage stabilizer at various loads using load bank.
9. To study behaviour of separately excited dc motor in open loop and closed loop conditions at various loads.
10. To study PID Controller for simulation proves like transportation lag.

Software based experiments (Use MATLAB, LABVIEW software etc.)

11. To determine time domain response of a second order system for step input and obtain performance parameters.
12. To convert transfer function of a system into state space form and vice-versa.
13. To plot root locus diagram of an open loop transfer function and determine range of gain ‘k’ fir stability.
14. To plot a Bode diagram of an open loop transfer function.
15. To draw a Nyquist plot of an open loop transfer functions and examine the stability of the closed loop system.

Title of the course **:Electrical Machines (Synchronous & Special Machines)**
Subject Code **: EE-612**
Weekly load **: 7** **LTP-3 2 2**

Credit **: 5**
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	General Aspects	Construction & working principle of synchronous machines, Excitation systems, production of sinusoidal E.M.F., flux & mmf phasors in syn. machines; cylindrical & salient pole rotors.	06
	Windings	Classification of windings, pitch factor, distribution factor. E.M.F. equation.	04
	Alternators	Construction, Phasor diagram of cylindrical rotor alternator, ratings, nature of armature reaction, determination of synchronous reactance; open circuit characteristics, short ckt characterstics, short ckt ratio, short ckt. loss. Effect of variation of power factor on voltage. Determination of voltage regulation: EMF method, M.M.F. method. Z.P.F. method, Alternator on infinite bus bar, operating characteristics, operation at constant load and variable excitation, power flow through inductive impedance, Power-angle characteristics of syn. machines:- cylindrical & salient pole. Two reaction theory of salient pole machines, power factor control.	12
	Parallel Operation of Alternators	Conditions for proper synchronizing for single phase and three phase alternators, conditions for parallel operation, synchronizing power, current and torque, effect of increasing excitation of one of the alternators, effect of change of speed of one of the alternators, effect of unequal voltages, load sharing, Hunting and damper windings.	10
Unit-2	Synchronous Motors	Operating characteristics, power-angle characteristics, conditions for maximum power developed , V-curves and inverted V-curves, methods of starting, synchronous motors applications, synchronous condensers.	10
	Transients	Transients Analysis, transient reactances & time constants from equivalent circuits, synchronous machine reactances & their determination,Short ckt. Oscillogram, Synchronisation with the grid system, Qualitative introduction to the transient stability of the synchronous machines.	10
	Single-phase Synchronous Motors	Reluctance & Hysteresis motors	06
	Special Purpose Machines	Construction, principle of operation and applications of stepper motors and Servo motors, Universal Motor: construction, principle of operation and applications.	06

Recommended Books-

1. Electric Machinery — Fitzgerald A.E., Kingsley C. and Umans S.D., TMH
2. Principles of A.C. Machines — Langsdorff E.H., TMH
3. Electrical Machines — Nagrath I.J. and Kothari D.P., TMH

4. Electrical Machinery Bimbhra P.S., Khanna Publishers
5. Alternating Current Machines Say M. G., Sir Isaac pitman & Sons Ltd.

Practical: EE-612

1.Regulation of alternator by EMF/ MMF methods
2. Operation of alternator on infinite busbar
3. V-curve for synchronous motor
4. Load test on three phase and single-phase induction motor
5. No load and blocked rotor tests on three phase induction motors
6. Speed control of three-phase induction motors
7. Load test on synchronous induction motor
8. Load test on three phase induction generators
9. Study and control of stepper motor
10. Study on brushless alternator.
11. Measurement of transient and sub-transient reactance in direct and quadrature axis.
12. Predetermination of performance characteristics of three-phase induction motor using computer.

Title of the course : Electromagnetic Field Theory
Subject Code : EE-613
Weekly load : 5 LTP-3 2 0

Credit : 4
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**REVIEW OF VECTOR ANALYSIS**	Vector analysis, Physical interpretation of gradient, divergence and curl; vector relations in other coordinate systems, integral theorems: divergence theorem, stoke's theorem, green's theorem and Helmholtz theorem.	5
	STATIC ELECTRIC FIELD	Introduction to fundamental relations of electrostatic field; Gauss's law and its applications; potential function; Field due to continuous distribution of charges; Equipotential surfaces; Divergence theorem; Poisson's equation and Laplace's equation, capacitance, electrostatic energy, Conditions at Boundary between dielectrics, Uniqueness theorem.	5
	STEADY MAGNETIC FIELD	Magnetic induction and Faraday's laws Ampere's work Law in differential vector form, magnetic field due to volume distribution of current and the Dirac-delta function, ampere's force law magnetic vector potential, Analogies between electric and magnetic fields, steady state equation of continuity.	6
	TIME VARYING FIELDS MAXWELL'S EQUATIONS	Equation of continuity for time varying fields, Inconsistency of ampere's law, Maxwell's equations in integral and differential form for static and time varying fields, conditions at a Boundary surface, Concept of Poynting vector, Poynting Theorem, Interpretation of ExH	5
Unit-2	**ELECTROMAGNETIC WAVES PROPAGATION**	Solutions for free-space conditions, electromagnetic waves in a homogeneous medium, propagation of uniform plane-wave, relation between E & H in a uniform plane-wave, wave equations for conducting medium, Maxwell's equations using phasor notation, wave propagation in a conducting medium, conductors, dielectrics, wave propagation in good conductor and good dielectric, depth of penetration, polarization	6
	REFLECTION OF ELECTROMAGNETIC WAVES	Electromagnetic wave Reflection by Perfect Conductor -normal and oblique incidence, Perfect Dielectric-normal incidence, Perfect Insulator – Oblique incidence;. reflection at the surfaces of a conductive medium, surface impedance	5
	REFRACTION OF	Electromagnetic wave refraction at the surface of a	5

	ELECTROMAGNETIC WAVES	perfect conductor & perfect dielectric (both normal incidence as well as oblique incidence), Brewester's angle and Total internal reflection, and applications	
	TRASMISSION LINE THEORY	Transmission line as a distributed circuit, transmission line equation, travelling & standing waves, characteristic impedance, input impedance of terminated line, reflection coefficient, VSWR, Smith's chart and its applications.	5

Recommended Books-

1. Edward C. Jordan and Keith G Balmain, *Electromagnetic Waves and Radiating Systems*, Prentice-Hall Inc.
2. Kraus John D. *Electromagnetics, McGraw-Hill Publishers*
3. EdministerJoseph A., *Schaum's Theory and Problems of Electromagnetics, McGraw-Hill*
4. RaoN. Narayana, *Elements of Engineering Electromagnetics, Pearson Education*
5. Hayt ,Engineering Electromagnetics, TMH

Title of the course : Data Acquisition and Telemetry
Subject Code : EE-621A
Weekly load : 3 LTP-3 0 0
Credit : 3

Theory:

Unit	Main Topics	Course Outline	Lectures
Unit-1	**Data Acquisition Systems**	Block diagram of data acquisition System & its applications, Analog& digital acquisition systems, signal conditioning of the inputs, single channel data acquisition, multi-channel DAS, computer based DAS, uses of data acquisition systems, use of recorders in digital systems & block diagram of digital data recording system, data logging system, compact data logger , modem digital data acquisition,digital transducer.	08
	Data Transmission System	Methods of data transmission, transmission channels & media, Modulation & demodulation, amplitude, frequency &phase modulation, Comparison between frequency & amplitude, pulse modulation (PAM, PDM, PFM, POM), delta modulation, adaptive data modulation & Companding, digital data codes, error correcting & error detecting codes, Asynchronous & synchronous data transmission, pulse code formats used in data transmission, radio link, frequency division &time division multiplexing, time division multiplexing using mechanical commutator, electronic time division multiplexing system, block diagram of AM frequency division multiplexing system.	08
	Digital Instruments	digital to analog converters, analog to digital converters, electromechanical ADC, Digital Transducers.	04
Unit-2	**Introduction to Telemetry Principles**	Definition, generalized block diagram of Telemetry System, Classification of Telemetry system, Working principle, salient features and applications of the following Telemetry System: DC Voltage, current and position telemetry system, Pulse telemetry System, Introduction to Satellite telemetry And Fibre Optic telemetry system	08
	Modems, Transmitters and receivers	Modems Introduction, Transmitters, Transmission Techniques, Inter stage Coupling, Receiver, Introduction to Antennas	08
	Display Systems	Construction, principle of operation and salient features of various kinds of display devices	04
	Recorders	Working principle, Construction, operation and salient features of Strip Chart Recorder, X-Y strip chart recorder and magnetic recorder	04

Recommended Books-

1. Sawhney AK, “Electrical and Electronic Measurement and Instrumentation”, Dhanpat Rai and Sons, 1993
2. Patranabis D, “Telemetry Principles”, Tata McGraw Hill.
3. Munez-Ruiz, Angel; Vromans, Herman, “Data Acquisition and Measurement Techniques”, CRC Press
4. Doebelin EO, “Measurements Systems- Application and Design”, Tata McGraw Hill.
5. Gruenberg EL, “Handbook of Telemetry & Remote Control”, Tata McGraw Hill.
6. Kalsi HS, “Electronic Instrumentation”, Tata McGraw Hill.

Title of the course : Communication Systems
Subject Code : EE-621B
Weekly load : 3 LTP-3 0 0

Credit : 3
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	Base Band Signals and Systems	Introduction, Elements of communication system, Noise and its types, Noise figure and Noise factor, Noise equipment temperature, Modulation & Demodulation, Mixing, Need of modulation, Types of modulation systems, AM, FM their sidebands, Comparison, Sampling theorem, Different Pulse Modulation techniques- PAM, PWM, PPM and PCM, FDM, TDM, Introduction to Fourier series and Fourier transform of periodic signals.	08
	Analog Communication: Transmitters	Block diagram explanation of low and high level AM transmitter, AM broadcast transmitter, DSB transmitter, SSB transmitter, and Independent Sideband transmitter, Block diagram explanation of Reactance tube, and Armstrong FM transmitters, Stereophonic FM broadcast transmitter.	10
	Analog Communication: Receivers	AM diode detector, characteristics of radio receiver, Sensitivity, Selectivity, Fidelity, and Image rejections, Classification of radio receivers, TRF receiver and Super Heterodyne receiver, Block diagram explanation of AM receiver, AM receiver using PLL, DSB and SSB receiver, Independent sideband receiver, AM broadcast receiver, Noise in AM systems, FM detection, Block diagram explanation of FM receiver and Stereophonic FM broadcast receiver, Noise in FM systems.	10
Unit-2	**Data Communication**	Concepts Data representation, Data transmission, Modes of data transmission, Signals encoding, Transmission channel, Directional capability of data exchange.	10
	Digital Communication	Wire pairs, Microwave, Coaxial cables, Satellite communication, Optical fibers, Modulation techniques AM, FM, PM, Digital modulation method ASK, FSK, PSK, Multilevel modulation, Synchronous and asynchronous modulation, Modems and Line Drivers, Data multiplexing techniques- FDM, TDM, STDM, Multiplexed common carrier system, Multiplexing satellite signals concentrations, Data compression Hoffman code Adaptive scanning, Facsimile Compression	10

Recommended Books-

1. Simon Haykin ,**Analog communication system** , Prentice hall.
2. J.S Chitode ,**Communication Engineering**,Technical Publications.

3. A.P.Godse U.A.Bakshi ,**Communication Engineering** , Technical Publications

Title of the course : Industrial Instrumentation
Subject Code : EE-621C
Weekly load : 3 LTP-3 0 0
Credit : 3
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Introduction**	Units of pressure and vacuum, Different type of manometers, diaphragm gauges bellows and force balance type sensors, Boudern guage, Piezoelectric, Capacitive and Inductive Pressure pickups. **Vacuum pressure measurements:** Meleod gauge, Pirani gauge, thermocouple gauge, Knudsen gauge Ionization calibration procedures, Temperature measurements, standards and calibration procedures.	12
	Temperature measurements	Temperature measurementsStandards and calibration, thermal expansion methods, bimetallic thermometer, Liquid-in-gas (thermocouples) common thermocouples, Resistance thermometers: bulk semiconductor sensors. Radiation thermometers, automatic null balance radiation thermometers. Optical pyrometers.	12
Unit-2	**Flow Measurement**	Differential pressure flowmeters: Bernoulli's theorem: pitut tube orifice, vanturi, flow nozzle, Hot wire and hot film anemometers, constant pressure drop, variable area meters (rotameter), turbine meters, Electromagnetic flow meters, Ultrasonic flowmeters, Measurement of level, Float type gauge, purge method, differential pressure method, conductive and capacitive method; electromechanical method, use of radioscope for level measurement.	10
	Miscellaneous Measurement	Measurement of weight- Load cell method, strain gauge, LVDT; piezoelectric, pneumatic and hydraulic load cell, null balance method. Conveyor belt weighting for on line measurement of viscosity, definition of absolute and kinematic viscosity, industrial viscosity meter.	10
		Measurement of Moisture, Thermal Dying Method, Distillation Method, Chemical Reaction Method, Electrical Method.	04

Recommended Books-

1. Doeblin/Measurements systems: Applications and Design, 4th ed. / Mc.Graw Hill.
2. Beckwith & Beck/Mechanical Measurements/Narona Publishers, 1988.
3. Eckman/Industrial Instrumentation/Wiley Eastern Ltd.
4. Nakra/Instrumentation: Measurements & Analysis/Tata Mc. Graw Hill

Title of the course : DSP and applications
Subject Code : EE-621D
Weekly load : 3 L T P-3 0 0
Credit : 3

Theory:

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**Discrete Time Signals And System**	Signals**,** Systems and signal processing. Classification of signals, Concept of frequency in continuous and discrete time signals, linearity, causality, frequency domain representation, convolution and its properties, quantization, aliasing, sampling theorem, ADC and DAC; Correlation of discrete time signals.	06
	Z-Transform	Z-transforms, properties of Z-transforms, Rational Z-transforms, Inverse Z-transform, Analysis of linear time invariant systems in Z-domain.	06
	Fourier Transforms	Discrete Fourier series representation, properties of DFT, Fourier representation of finite duration sequences, linear convolution using DFT, Fast Fourier Transform (FFT) and its advantages.	12
Unit-2	**Digital Filters**	Introduction to digital filters, Digital filter classification, implementation techniques, Basic network structure of IIR and FIR system.	04
	Digital Filter Design	General considerations, Design of FIR filters, and IIR filters from analog filters, Frequency transformations, Comparison of IIR & FIR filters.	08
	Applications of DSP	DSP architecture, number system, peripherals and Instruction sets, General purpose I/O functionality, Interrupts Applications of DSP to Audio and image processing, Telemedicine and biomedical applications, Control of Electrical power system and Drives	12

Recommended Books:

Title	Author	Publisher
Understanding Digital Signal Processing	R. G. Lyons	Pearson Education
Digital Signal Processing: Principles, algorithms & Applications	Proakis & Manolakis	PHI
Digital Signal Processing	Oppenheim & Schafer	PHI
The Scientist and Engineer's Guide to Digital Signal Processing	Steven W. Smith	California Technical publishing
DSP-Based Electromechanical Motion control	H A Toliyat and S Campbell	CRC Press

Title of the course : Power Electronics
Subject Code : EE-622
Weekly load : 7 L T P-3 2 2
Credit : 5

Theory:

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**Basics Concepts**	Need of switching and role of power electronic switches, properties and characteristics of various power Electronic switches i.e. power Diode, Thyristor, GTO, Power transistor, Power MOSFET, IGBT, MOS controlled Thyristor, Static Induction Devices, their firing and protection circuits, selection criteria of these switches for various applications, Basic concept of Phase control, Power quality indices.	09
	AC-DC Converters	Analysis and design of Converters : Un-controlled and controlled, Half wave and Full wave, Half controlled and full controlled, Single Phase and three phase, with R, RL and RLC Load, with and without Free wheeling Diode, Effect of Source Impedance on Converters, Dual converters.	09
	AC-AC Converters	Analysis and design of AC controllers: single phase and three phase; Cyclo-converters: Single phase and three phase, Matrix converters.	06
Unit-2	**DC-DC Converters**	Analysis and design of DC-DC converters i.e. Buck, Boost, Buck-Boost; Isolated and non-isolated; push-pull, half bridge, full bridge, Flyback, Cuk, SEPIC Zeta and Luo, in continuous conduction and discontinuous conduction modes of operation, review of choppers.	09
	Resonant Converters	Converter Classification, Sinusoidal analysis of resonant converters, series and parallel resonant converters, soft switching, ZVS/ZCS concepts and applications, quasi-resonant converters, topologies operation and control.	06
	DC-AC Converters (Inverters)	Analysis and design of Inverters: Voltage source and current source, single phase and three phase, Half Bridge and Full Bridge; Line Commutated & Forced Commutated; Series and Parallel; for square wave and Pulse Width Modulation (PWM) controlled outputs, Topologies for Harmonic Reduction or true sine wave Inverters	09

Recommended Books:

Title	Author	Publisher
Power Electronics: Converters, Applications and Design	Ned Mohan, Undeland & Robbins	John Wiley and Sons
Power Electronics Handbook	M H Rashid	Academic Press
Fundamentals of Power Electronics	R. W. Erickson	Kluwer Academic Publishers
Power Electronics design handbook	Nihal Kularatna	Newnes Publishers
Modern Power Electronics and AC drives	B K Bose	PHI

Practicals: EE-622

1. To plot and comment on V-I Characteristics of Diode and Diac.
2. To plot and comment on V-I Characteristics of Thyristor and Triac.
3. To study various turn on methods of Thyristor.
4. To study various commutation methods of Thyristor.
5. To study various protection circuits of Thyristor.
6. To observe and comment on the waveforms of a single phase Full Wave Thyristor converter with R, RL and RLC load. Also comment on the operation with and without free wheeling diode.

7. To observe and comment on the waveforms of a single phase Half controlled Thyristor Bridge converter with R, RL and RLC load. Also comment on the operation with and without free wheeling diode.
8. To observe and comment on the waveforms of a single phase full controlled Thyristor Bridge converter with R, RL and RLC load. Also comment on the operation with and without free wheeling diode.
9. To observe and comment on the waveforms of a three phase half controlled Thyristor Bridge converter with R, RL and RLC load. Also comment on the operation with and without free wheeling diode.
10. To observe and comment on the waveforms of a three phase full controlled Thyristor Bridge converter with R, RL and RLC load. Also comment on the operation with and without free wheeling diode.
11. To observe and comment on the waveforms of a single phase Bridge inverter with PWM controlled output. Also comment on its operation for true sine wave output.
12. To observe and comment on the waveforms of non-isolated DC-DC converter in buck/boost mode under CCM and DCM operation.
13. To observe and comment on the waveforms of an isolated DC-DC converter in buck/boost mode under CCM and DCM operation.
14. To observe and comment on the waveforms of resonant converters in ZVS/ZCS mode.

Title of the course : Non-Linear and Discrete Control System
Subject Code : EE-623
Weekly load : 5 LTP-3 2 0

Credit : 4
Theory:

Unit	Main Topics	Course Outline	Lectures
Unit-1	**State space analysis & design**	Review of state space representation for linear continuous time system, solution of linear time invariant state equations, controllability and observability, solution of state equation for discrete system, state space analysis of discrete time systems, pole placement techniques	08
	Non-linear control systems	Introduction to non-linear feedback control system, different types of non linearities, special features of non-linear systems: limit cycles, jump resonance and sub harmonics resonance etc. Definition of describing function.(D.F.), D.F.'s for various non-linearities, D.F. analysis of non-linear control systems, stability analysis using Limit cycles, and jump resonance.	08
	Phase Plane Analysis	Phase-plane analysis for non linear systems. Singular points, Construction of phase-plane plots for non -linear systems.	08
Unit-2	**Liapunov's Stability Analysis**	Introduction, Concept of local, gloal and asymptotic stability, Liapunov's Stability criterion, The direct method of Liapunov and the linear systems, Methods of constructing Liapunov function for non-linear system.	08
	Discrete time control systems (Part-I)	Basic elements of a discrete data control system & its advantages over the continuous time systems A/D and D/A conversions, Spectrum analysis of sampling process and signal reconstruction Sample and hold device, Z-transforms, Inverse Z-Transform, Pulse transfer function, Pulse transfer functions of cascaded elements, Pulse transfer function of close loop system	08
	Discrete time control systems (Part-II)	Modified Z-transform, Stability analysis of close loop systems in Z-domain, Stability criterion by Jury's test, schur-cohn method, Stability analysis by bilinear transformation and Routh's stability criterion, state space representation of discrete time systems.	08

Recommended Books-

1. Control Systems Engineering By Nagrath IJ and Gopal M, New Age International Publishers
2. Modern Control Engineering By Ogata K, PHI
3. Digital Control System By Kuo BC, Pearson Education
4. Digital Control Engineering By Gopal M, Willey Eastern

Title of the course : Microprocessor and Applications
Subject Code : EE-624
Weekly load : 5 LTP-3 0 2
Credit : 4

Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Introduction to Microprocessors**	Types of computers, Microprocessor Evolution and types, CPU operation and terminology, idea of 8- bit, 16-bit, 32-bit and 64- bit Microprocessors from Intel, Motorola and Zilog and their comparisons.	08
	Introduction to 8-bit Microprocessor	8085 Microprocessor architecture, Instruction format, Addressing Techniques, classification of instructions, and overview of the 8085 instruction set. Simple programs.	08
	Introduction to 16-bit Microprocessor	8086 Internal Architecture, Instruction Format, Addressing modes, program development steps, and 8086 instruction set, Assembler directives, Assembly language, program development tools.	08
Unit-2	**Programming of 8086**	Simple sequence programs, jumps, flags, conditional Jumps, IF THEN, IF-THEN-ELSE, Multiple IF-THEN-ELSE, WHILE-DO, REPEAT-UNTIL, Instruction Timing and delay loops, strings, procedures, Macros.	08
	8086 System Connections, Timing, Troubleshooting	Pin-diagram, max/min. modes, timing diagrams, use of logic analyzer to observe Bus Signals, troubleshooting a simple 8086 based system**,** 8086 Interrupts, responses & applications.	08
	Interfacing of 8086	Memory Interfacing, Programmable parallel ports & handshake, 8254 software- programmable timer/counter, 8259 A priorities Interrupt Controller, Interfacing a Microprocessor to Keyboards and alphanumeric displays, D/A converter operation, interfacing and applications, *A/D* converter specifications	08

Recommended Books-

1. Gaonkar, Ramesh S. *Microprocessor Architecture, Programming and Applications with the 8085*, Penram International
2. Ram B, *Fundamentals of Microprocessors and Microcomputers*, Dhanpat Rai & Sons,
3. Hall, Douglas V. *Microprocessors and interfacing: Programming and Hardware*, Tata McGraw Hill
4. Brey, Barry B.Bray, *The INTEL Microprocessors 8086/88, 80186, 286, 386, 486, Pentium Pro Processors, Architecture, Programming and Interfacing*, 4th Edition, Prentice Hall (India)
5. Ray A.K. and Bhurchandi K.M., *Advanced Microprocessors and Peripherals*, Tata McGraw Hill

Practical: EE-624

1.Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers.
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers.
3. To perform multiplication and division of two 8 bit numbers using 8085.
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a program to arrange an array of data in ascending and descending order.
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8085 instruction set.
7. To write a program to initiate 8251 and to check the transmission and reception of character.
8. To interface 8253 programmable interval timer to 8085 and verify the operation of 8253 in six different modes.

9. To interface DAC with 8085 to demonstrate the generation of square, saw tooth and triangular wave.
10. Serial communication between two 8085 through RS-232 C port.

Title of the course : Power System Protection
Subject Code : EE-625
Weekly load : 5 LTP-3 0 2
Credit : 4
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**INTRODUCTION**	Types of faults, short circuit current, percentage reactance and base KVA, per unit quantities, method for short circuit calculations, symmetrical components, sequence impedances,	5
	CIRCUIT BREAKERS	Theory of arc interruption, circuit breaker, circuit breaker ratings, restriking voltage, transients, current chopping, duties of switch gear, automatic switch, air circuit breaker, bulk oil CB, minimum oil CB, air blast CB, SF6 CB, vacuum and DC circuit breakers.	5
	PROTECTIVE RELAYS	Introduction, classification, constructional features; and Characteristics of Electromagnetic, Induction,Thermal, Overcurrent relays, Directional relays, Distance relays, Differential, Translay, Negativesequence relay, introduction to static and up-based relays.	6
	PROTECTION OF FEEDERS	Time graded protection, Differential and Distance protection of feeders, choice between Impedance,Reactance and Mho relays, Elementary idea about carrier current protection of lines.	5
Unit-2	**PROTECTION OF GENERATORS**	Types of faults on alternator, Stator and rotor protection, Negative sequence protection, Loss ofexcitation and overload protection..	6
	PROTECTION OF TRANSFORMERS	Types of fault on transformers, percentage differential protection, restricted earth fault protection Gas relays	5
	PROTECTION AGAINST OVER VOLTAGE AND EARTHING	Ground wires, Rod gap, Impulse gap, Valve type and Metal Oxide Arresters, Line Arrester/SurgeAbsorber. Ungrounded neutral system, Grounded neutral system and Selection of Neutral Grounding.	5
	STATIC & DIGITAL RELAYS	Classification of static relays, amplitude and phase comparators, block-spike and block-average comparators, rectifier type relays, Introduction to digital relay: basic principles, Application of microprocessors and computers	5

Recommended Books-

1. Rao S., *Switchgear and Protection,* Khanna Publishers
2. Chakrabarti A., Soni, M.L. Gupta P.V. and Bhatanagar U.S., *A Textbook on Power System Engineering,* Dhanpat Rai & Co.
3. Wadhawa C.L. ,*A Course in Electrical Power*, New Age international Pvt. Ltd
4. Badri Ram and Vishwakarma D.N., *Power system Protection & Switchgear*, Tata McGraw Hill

5. Deshpande M.V., *Switchgears & Protection*, Tata McGraw Hill
6. Ram B., Vishvakarma D.N., Power System Protection and Switchgear –: (TMH.)

Practical: EE-625

1.To study the performance of a transmission line. Also compute its ABCD parameters.
2. Study of Characteristics of over current and earth fault protection.
3. To study the operating characteristics of fuse. (HRC or open type)
4. To find the earth resistance using three spikes
5. To study over current static relay.
6. To study the different types of faults on transmission line demonstration panel/model.
7. To study the radial feeder performance when
(a) Fed at one end.
(b). Fed at both ends
8. To study the performance of under voltage and over voltage relay.
9. To study the characteristics of bimetal mini circuit breakers.
10. To study the characteristics of Distance Relay.
11. To find the breakdown strength of transformer oil.

Title of the course : Utilization of Electrical energy
Subject Code : EE-626
Weekly load : 3 LTP-3 0 0
Credit : 3
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**ELECTRIC HEATING**	Introduction, Advantages of electrical heating, Heating methods like Resistance heating – Direct resistance heating, indirect resistance heating, electric ovens, different types of heating materials, temperature control of resistance furnaces, design of heating element, domestic water heaters and other heating appliances. Induction heating – Principle, core type and coreless induction furnaces. Electric arc heating – Direct and indirect arc heating, arc furnaces. Dielectric heating –Principle and applications in various industrial fields.	(5 Hrs)
	ELECTRIC WELDING	Welding methods–Electric arc wielding and resistance wielding. Modern wielding techniques like ultrasonic wielding and laser welding	(3 Hrs)
	ELECTROCHEMICAL PROCESS	Need of electro-deposition. Applications of Faraday's laws in electro-deposition. Factors governing electro-deposition. Objectives of electroplating. Equipments and accessories for electroplating plant, Electroplating on non-conducting material, Principle of anodizing and its applications.	(2 Hrs)
	CONTROL DEVICES	Construction and working of push button, limit switches, float switches pressure switches, contactors, thermostats, timers, relays Application of above devices in 1)Automatic water level controller 2) reverse forward operation of 3-ph induction motor 3) Temperature controller in electric furnace 4) Air compressor circuit.	(3 Hrs)
Unit-2	**ELECTRICAL CIRCUITS**	USED IN REFRIGERATION, AIR CONDITIONING & WATER COOLERS:- Brief description of vapour compression refrigeration cycle. Description of electrical circuits used in – Refrigerator, Air Conditioner, Water Cooler	(3 Hrs)
	ILLUMINATION:	Definitions of flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor; Laws of illumination. Calculation of number of light points for interior illuminations; Calculation of illumination at different points, considerations involved in simple design problems and illumination schemes, indoor and outdoor illumination level. different sources of light: differences in incandescent and discharge lamps – their construction and characteristics; fittings required for filament lamp, mercury lamp, fluorescent lamp, sodium lamp, halogen lamp,	(8 Hrs)

		compact fluorescent lamp, metal halide lamp, electroluminescent lamp-LEDs, types, LASERs .Comparison of all above luminaries. Main requirements of proper lighting, absence of glare contrast and shadow. Principles of street lighting. (	
	ELECTRIC TRACTION	Advantages of electric traction. Traction systems – i) Steam engine drive, ii) electric drive, iii) diesel electric drive. Introduction to metro system,mono rail system. Systems of track electrification: D.C. system, single phase low frequency A.C. system, 3 phase low frequency A.C. systems, composite systems – kando systems, single phase A.C. to D.C. system Different accessories for track electrification such as overhead wires, conductor rail system, current collector- pentagraph .Electrical block diagram of an electric locomotive with description of various equipments and accessories.	(8 Hrs)
	TRACTION MECHANICS	Speed time curves, trapezoidal and quadrilateral speed-time curves, average and schedule speed. Tractive efforts. Specific energy consumption. Mechanics of train movement, coefficient of adhesion.	(8 Hrs)
	TRACTION MOTORS	Control of Traction Motors, Train Lighting: Desirable characteristic of traction motors. Suitability of D.C. series motor, A.C. series motor,3 phase induction motor and linear induction motor for traction. Control of traction motors, Series-parallel control, Shunt and bridge transition. Electrical breaking, Regenerative breaking in traction, Suitability of different motors for braking. Train lighting system and Rosenberg generator. Railway signalling:- history, necessity, block system route relay interlock and necessity. Electromechanical system for route relay interlock. Introduction to train tracking system, types. Anti-collision system-brief treatment only	(8 Hrs)

Recommended Books-

1. H. Partab, *Art and science of Utilization of Electrical Energy* ' Dhanpat Rai & Co.(P) Ltd - Delhi
2. J.B. Gupta, *Utilization of Electric Power and Electric Traction* , S.K. Kataria & sons, Delhi.
3. C. L. Wadhwa, *Generation, Distribution and Utilization of Electrical Energy* ' Eastern Wiley Ltd.
4. A. Chakraborti, M. L. Soni, P. V. Gupta, U.S. Bhatnagar, *A text book on Power System Engineering* , Dhanpat Rai & Co.(P) Ltd – Delhi
5. E. O. Taylor and V.V.L. Rao, *Utilization of Electrical Energy* ' Orient Longman.
6. H. Partab, *Modern Electric Traction* , Dhanpat Rai & Co. (P) Ltd - Delhi
7. M. A. Cayless and A. M. Marsden , *Lamps and lighting*
8. BIS, IEC standards for Lamps, Lighting Fixtures and Lighting, Manak Bhavan, New Delhi
9. Joseph B. *Murdoch, Illumination Engineering from Edison's Lamp to the Laser*, Imperial

college press Clifford F. Bonntt, *Practical railway engineering*, Imperial college press.
10. Geoffrey, Kichenside and Alan Willims, *Two centuries of Railway signalling* , Oxford publishing.

Title of the course	**:**	**Advance Simulation Lab-I**	
Subject Code	**:**	**EE-627**	
Weekly load	**:**	**2**	**LTP-0 0 2**
Credit	**:**	**1**	

Theory:

1. To simulate magnetic circuits in FEMLAB for creating various types of 2D-3D plots of magnetics.
2. To simulate various core designs of transformers in FEMLAB. Get various field Plots and comment on it.
3. To simulate various core designs of rotating machines in FEMLAB. Get various field Plots and comment on it.
4. To simulate the steady state and transient response of 1^{st} and 2^{nd} order linear time invariant systems in MATLAB. Plot various responses and comment on it.
5. To simulate the behaviour of proportional (P), Integral (I), Differential (D) controllers and combinations of PI PD and PID controllers in MATLAB for 1^{st} and 2^{nd} order linear time invariant systems. Plot various responses and comment on it.
6. To simulate the behaviour of single phase Thyristorized Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
7. To simulate the behaviour of three phase Thyristorized Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
8. To simulate the behaviour of Buck DC-DC Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
9. To simulate the behaviour of Boost DC-DC Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
10. To simulate the behaviour of Buck- Boost DC-DC Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
11. To simulate the behaviour of single phase Inverter in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
12. To simulate the behaviour of three phase Inverter in MATLAB in closed loop voltage control for R and RL load. Plot various current/voltage waveforms and its step response and comment on it.
13. To simulate various types of faults in three phase transmission and distribution lines (star and delta connected systems). Plot various current/voltage waveforms and comment on it.
14. To simulate the speed control of Induction Motors (squirrel cage and wound rotor) in MATLAB using variable AC source, diode bridge rectifier and inverter. Plot various current/voltage waveforms and comment on it.

Recommended Books:

Title	**Author**	**Publisher**
Getting Started with MATLAB	Rudra Pratap	Oxford University Press
Mastering MATLAB 7	Hanselman & Littlefield	Prentice Hall
Electric Machinery	Fitzgerald, Kingslay and Umans	McGraw Hills
Linear Control Systems with Matlab Applications	B S Manke	Khanna Publishers
Power Electronics	M H Rashid	Pearson Education
Power Generation, Operation and Control	A J Wood, B F Wollenberg and G B Sheble	Wiley

Title of the course : Process Dynamics and Control
Subject Code : EE-711A
Weekly load : 3 LTP-3 0 0
Credit : 3
Theory

Unit	Main Topics	Course Outline	Lectures
Unit-1	**Introduction to process control**	Introduction, Basic components, diagrammatic representation, symbol and Terminology, process control block diagram	04
	Process dynamics and mathematical modelling	Process variables, mathematical modeling of liquid, gas, and thermal, mechanical and chemical systems, Linearizing techniques, Liquid level control in a tank, Dynamics of manometer, response of non-interacting and interacting first-order elements in series, Mixing process, Heat transfer process, Distillation column.	06
	Controller principles	control system parameters – discontinuous controller modes – two position mode – multiposition mode – floating control mode – continuous controller modes – proportional controller mode – integral control mode – derivative control mode – composite controller modes – PI, PD, and three mode controller.	08
Unit-2		**Closed loop responce and controller tuning** Single and combined modes in closed loop, static error, velocity error. Dynamic behaviour of feedback control processes for different modes, IAE, ISE, IATE criteria, Tuning of controllers, closed loop method – ultimate method – damped oscillation method – process reaction curve method – open loop tuning – variation on the open loop fit – Ziegler Nichols method – frequency response method – comparing tuning methods – integral criteria in tuning	06
	Controller Hardware	Electronic and digital controller's - design considerations and implementation, single and composite modes of controllers, Direct digital control (DDC)- components, benifits, digital controller realization.	06
	Controller Hardware	Electronic and digital controller's - design considerations and implementation, single and composite modes of controllers, Direct digital control (DDC)- components, benifits, digital controller realization.	06
	Final Control	Final control operation – signal conversion (analog and digital electrical signals) –Actuators (electrical, pneumatic and hydraulic) – Control valve classification and types, selection criteria for control valves, function (mechanical, electrical and fluid valves).	06
	Multiple loop Control	On-off Controllers, Cascade and Feed forward	

	Schemes	Controllers, Split Range Controllers, ratio controls, Single loop, multi loop & self tuning controllers, set point control (SPC)	
		Multiloop Interaction: Introduction, features and examples of Mimo Process, Design of cross controllers, Relative gain array and selection of control loop.	06

1. Bhanot S, " Process Control- Principles and Applications", Oxford University Press, 2008.
2. Process Control : Peter Harriott, TMH
3. Handbook of Instrumentation : Process control : B.G.Liptak, Chilton
4. Process Control Systems : F. G. Shinskey, TMH
5. Chemical Process Control : George Stephonopolous, PHI
6. Computer based Industrial Control :Krishna Kant, PHI
7. Process Control: Modeling, Design and Simulation : B. Wayne Bequette, PHI
8. Process Dynamics and Control : Dale E. Seborg
9. Process Instrumentation and control Handbook :Considine

Title of the course : Artificial Intelligence
Subject Code : EE-711B
Weekly load : 3 LTP-3 0 0
Credit : 3
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	Introduction	Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.	08
	Introduction to Search	Searching for solutions, Uniformed search strategies, Informed search strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning.	08
	Knowledge Representation & Reasoning	Propositional logic, Theory of first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.	08
Unit-2	**Machine Learning**	Supervised and unsupervised learning, Decision trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data – EM algorithm, Reinforcement learning,	10
	Pattern Recognition	Hough transform for line detection, Foot of normal method, Longitudinal line localization ,Hough based schemes for circular object detection	06
	Pattern matching techniques	Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering.	08

Recommended Books:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence – A Modern Approach”, Pearson Education
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, McGraw-Hill
3. E Charniak and D McDermott, “Introduction to Artificial Intelligence”, Pearson Education
4. Dan W. Patterson, “Artificial Intelligence and Expert Systems”, Prentice Hall of India,

Title of Subject Conventional and Computer Aided Electrical Machine Design
Subject Code : EE-711C
Weekly load : 3 LTP-3 0 0
Credit : 3

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**Basic Considerations**	Constructional elements of transformers and rotating machines - classification of design problems - general design procedure - standard specifications - output coefficient- choice of specific electric and magnetic loading - separation of D and L for rotating machines.	6
	Magnetic And Electric Circuit Calculations	MMF calculation - magnetization curve - magnetic leakage - MMF for air gap - effect of slot and ventilating ducts - MMF for teeth - leakage reactance - unbalanced magnetic pull -estimation of number of conductors per turn - coil slots - conductor dimension – slot dimension.	8
	DC Machines	Armature winding - magnetic circuit - choice of number of poles - length of air gap – field system - interpoles - commutator - brushes	5
	Transformers Core Section	windings- window dimension - overall dimension - cooling tubes	5
Unit -2	**Induction Machines**	Choice of L/ π ratio - air gap length - cage rotor - dispersion coefficient - end ring current - wound rotor - slip rings.	6
	Synchronous Machines:	Short circuit ratio - air gap length - salient pole rotor -cylindrical rotor.	6
	INTRODUCTION	Conventional design procedures -Limitations -Need for field analysis based design.	4
	MATHEMATICAL FORMULATION OF FIELD PROBLEMS	Development of torque/force -Electromagnetic Field Equations - Magnetic Vector/Scalar potential -Electrical Vector/Scalar potential- Stored energy in field problems –Inductances -Laplace and Poisson's Equations -Energy functional- Principle of energy conversion.	8

Recommended Books-

1. Sawhney, A.K., “A course in Electrical Machine Design”, Dhanpat Rai & Sons, New Delhi, 1996.
2. Bhattacharya, S.K, “Electrical Machines”, Tata McGraw Hill, 2nd Edition, 1998.
3. Albert E. Clayton and Hancock,N.N, “The performance and Design of Direct Current Machines”, Oxford & IBH Publishing Co., Pvt., Ltd., New Delhi, 1990
4. Say, M.G., “Alternating Current Machines”, ELBS & Pitman, London, 5th edition, 1992.
5. Rai, H.M., “Principles of Electrical Machine Design”, Sathyaprakashan , New Delhi, 4th Edition, 1995.
6. Shanmugasundaram A., “Electrical Machine Design Data Book”, Wiley Eastern Ltd,
7.Silvester and Ferrari, “Finite Elements for Electrical Engineers” Cambridge University press, 1983
8. S.R.H.Hoole, Computer- Aided, Analysis and Design of Electromagnetic Devices,Elsevier, New York, Amsterdam, London, 1989.
9. D.A. Lowther and P.P.Silvester, Computer Aided Design in Magnetics, Springer Verlag, New York, 1956.
10. S.J.Salon, "Finite Element Analysis of Electrical Machines" Kluwer Academic Publishers, London,1995.

11. C. W. Trowbridge, "An Introduction to Computer Aided Electromagnetic Analysis"' Vector Field Ltd.
12. User Manuals of COMSOL, MAGNET, MAXWELL & ANSYS. Software Packages

Title of the course	**:**	**Building Automation**	
Subject Code	**:**	**EE-711D**	
Weekly load	**:**	**3**	**LTP-3 0 0**
Credit	**:**	**3**	

Theory

Unit	Main Topics	Course Outline	Lectures
Unit-1	**Fire Alarm System**	Fundamentals: What is Fire? Fire modes, History, Components, and Principles of Operation FAS Components: Field Components, Panel Components, Applications. FAS Architectures: Types of Architectures, Examples FAS loops: Classification of loops, Examples. Power Supply design for FAS. Cause & effect matrix: Examples Fire Standards: FAS Design procedure in brief, NFPA 72A, BS 5839, IS	08
	Security Systems	Fundamentals: Introduction to Security Systems, Concepts, Access Control System: Access Components, Access control system Design.,CCTV: Camera: Operation & types, Camera Selection Criteria, Camera Applications, DVR, Based system, DVM, Network design, Storage design, CCTV Applications: CCTV Applications Perimeter Intrusion: Concept, Components, Technology, Advanced Applications Security Design: Security system design for verticals	08
	Introduction to HVAC System	Fundamentals: Introduction to HVAC, HVAC Fundamentals, Basic Processes (Heating, Cooling etc) Basic Science: Air Properties, Psychometric Chart, Heat Transfer mechanisms, Examples. Human Comfort: Human comfort zones, Effect of Heat, Humidity, Heat loss Processes: Heating Process & Applications (I.e. Boiler, Heater), Cooling Process & Applications (I.e. Chiller), Ventilation Process & Applications (I.e. Central Fan System, AHU, Exhaust Fans), Unitary Systems (VAV, FCU etc).	08
Unit-2	**Control Theory**	Control Theory: Instrumentation Basics, Field components & use, DDC & applications Architecture: Honeywell Architecture, BMS Components Control Panel: HVAC Control Panel, MCC Basics, Panel Components Communication: Communication Basics, Networks, BACNet, Modbus, LON	08
	Energy Management	ASHRAE Symbols Energy Management: Advantages of BMS, Energy Savings concept & methods, Lighting control, Building Efficiency improvement, Green Building (LEED) Concept & Examples	08
	Energy Management	Project Life Cycle: IBMS (HVAC, Fire & Security) project cycle, Project steps BMS Verticals: Applications of BMS, Examples Integration: IBMS Architecture, Normal & Emergency operation	08

Recommended Books-

1. Understanding Building Automation Systems (Direct Digital Control, Energy Management, Life Safety, Security, Access Control, Lighting, Building Management Programs) (Hardcover) by Reinhold A. Carlson (Author), Robert A. Di Giandomenico
2. Building Automation: Control Devices and Applications by In Partnership with NJATC (2008)
3. Building Control Systems, Applications Guide (CIBSE Guide) by The CIBSE (2000)
4. Design of Special Hazards and Fire Alarm Systems by Robert Gagnon (2007)
5. Security/Fire Alarm Systems: Design, Installation, and Maintenance by John E. Traister (1995)
6. Building Automation Online by McGowan; McGowan, John J.; ISBN: 0824746155
7. HVAC Control in the New Millennium by Hordeski; Hordeski, Michael F.; Marcel Dekker, ISBN: 0824709152 EAN: 9780824709150 Publisher: Fairmont Press (2001) 16
8. HVAC Control System Design Diagrams by Levenhagen, John I.; ISBN: 0070381291 EAN: 9780070381292 Publisher: McGraw-Hill Professional Publishing (1998)
9. HVAC Controls and Systems by Levenhagen, John I.Spethmann, Donald H. ISBN: 0070375097 EAN: 9780070375093 Publisher: McGraw-Hill Professional Publishing

Title of the course	**:**	**Computer Aided Power System Analysis**	
Subject Code	**:**	**EE-712**	
Weekly load	**:**	**7**	**LTP-3 2 2**
Credit	**:**	**5**	

Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**SYSTEM MODELLING**	System modelling of synchronous machines, transformers, loads etc, per unit impedance, single line diagram of electrical networks, single phase impedance diagrams corresponding to single line diagram. Formation of impedance and admittance matrices for the electrical networks.	12
	LOAD FLOW STUDIES	Data for the load flow studies, Swing Bus, Formulation of simultaneous equations, Iterative solutionsby the Gauss-Seidal Method & by Newton Raphson Method.	12
	FAULT ANALYSIS	Transients on transmission line, short circuit of synchronous machine, selection of circuit breakers,Algorithm for short circuit studies, Symmetrical Component transformation, construction of sequencenetworks of power systems. Symmetrical Analysis of Unsymmetrical LG, LL, LLG faults usingsymmetrical components.	12
Unit-2	**POWER SYSTEM STABILITY**	Steady state stability, Dynamics of a synchronous machine, Power angle equations, Transientstability, equal area criterion, Numerical solution of swing equation, factors effecting transientstability.	12

Recommended Books-

1. Elgerd O.I., *Electric Energy Systems Theory,* McGraw Hill
2. Nagrath I.J., Kolthari D.P., *Modern Power System Analysis,* McGraw Hill
3. Stevenson W.D., *Elements of Power System* Analysis, McGraw Hill
4. Nagrath I.J. and Kothari D.P., *Power System Engineering*
5. Arrillaga J. and Arnold C.P., *Computer Aided Power System*
6. Stagg Glenn W. and Elabiad, *Computer Aided Power System Analysis*
7. Kusic, *Computer Aided Power System analysis.*

Practical: EE-712

1.Short circuit analysis – symmetrical faults
2. Short circuit analysis – unsymmetrical faults
3. Transient stability analysis
4. Power plot – relay co-ordination
5. Harmonic analysis
6. Solution of load flow problem by Gauss-seidal method
7. Solution of load flow problem by Newton-Raphson method
8. Solution of economic load dispatch by Lamda iterative method
9. Simulink
10. Solution of load flow problem by fast decoupled method

Title of the course : Energy Management Auditing
Subject Code : EE-713
Weekly load : 3 L T P-3 0 0
Credit : 3
Theory:

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	**Basics of Energy Conservation**	Need of energy conservation and energy audit; Energy Intensive processes, Heating: methods/Techniques of energy Saving in Furnaces, Ovens and Boilers; Cooling: Methods/ Techniques of Energy Saving in Ventilating systems and Air Conditioners; Lighting energy: methods/Techniques of efficient lighting; Cogeneration -Types and Advantages	08
	Efficiency improvement in Motors	Losses in Electrical Machines, Methods to reduce these losses, Efficient use of energy in motors with the help of voltage reducers, automatic star/ delta converters; Energy Efficient Motors: Construction, operation and characteristics; Power factor improvement devices and soft starters/Variable Frequency Drives.	08
	Energy Conservation In T&D Systems	Reactive power compensation, demand side management, system voltage optimization and phase current balancing, Losses in transmission and distribution system and its minimization; Amorphous Core Transformers	08
Unit-2	**Tariff and Energy Conservation in Industries**	Energy cost and Recent Electricity Board tariffs, Application of Tariff System to reduce Energy bill, Energy Conservation by improving load factor and power factor;	06
	Energy and the Environment	Environment and social concerns related to energy utilization, The green house effect, Global Warming and its effect , Pollution, Acid Rains, Global Energy and environment Management	04
	Energy Audit	Procedure of Energy audit, ABC analysis, Energy Flow Diagram and its importance, Measurements in energy audit and various measuring instruments, Questionnaires for the energy audit, internal energy audit checklist, Equipment used for energy conservation, Calculation of payback period for energy conservation equipment. IE rules and regulations for energy audit, Electricity act 2003	14

Recommended Books-

Industrial Energy Management: Principles & applications	G Petrecca	Kluwer Academic Publisher
Bureau of Energy Efficiency Handbooks		Bureau of Energy Efficiency
Generation Distribution & Utilization of Electrical Energy	C.L. Wadhawa	New Age

Title of the course : Microcontroller and Embedded System

Subject Code : EE-714

Weekly load : 5 LTP-3 0 2

Credit : 4

Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Introduction**	Microprocessor, Micro-controllers and their comparison. The 8051 Architecture: Introduction, 8051 micro-controller hardware, input/ output, pins, ports and circuits, external memory, counters and timers, serial data input/ output, interrupts	12
	8051 Assembly Language Programming	Instruction format and addressing techniques, instruction set (data moving, logical operations, arithmetic operations, jump and call instructions), The mechanics of programming, assembly language programming process, programming tools and techniques,	12
Unit-2	**8051 Microcontroller Design**	Micro-controller specification, external memory and memory space decoding, reset and clock circuits, expanding I/O, memory mapped I/O, memory address decoding, memory access times, testing the design, timing subroutines, lookup tables for the 8051, serial data transmission	12
	Microcontroller Applications	Interfacing keyboards, displays, D/A and A/D, multiple interrupts, serial data communications, introduction to the use of assemblers and simulators Embedded Systems: Introduction to PLDs and FPGA- architecture, technology and design issues, implementation of 8051 core.	12

Recommended Books-

1. Kenneth J Ayola, *The 8051 Micro Controller- Architecture, Programming and Application*, Penram International Publication
2. John B Peatman, *Design with Micro Controller,* Tata McGraw Hill
3. Ray A. K. and Bhurchandi K. M., *Advanced Microprocessors & Peripherals; Architecture, Programming& Interfacing*, Tata McGraw Hill
4. Mazidi M. A. and Mazidi J. G., *The 8051 Micro-controller & Embedded System*, Pearson Education.
5. Surekha Bhanot, *Process Control*, Oxford Higher Education.
6. Otter, Job Dan, *Programmable Logic Controlle*r, P.H. International, Inc, USA
7. Dunning Gary, *Introduction to PLCs*, Tata McGraw Hill
8. Kumar Rajesh, *Module on PLCs and their Applications*, NITTTR Chandigarh

Practical: EE-714

1.Study of 8051 Microcontroller, Architecture & command.
2. Write an ALP for the Addition & Subtraction of 8 bit no's.
3. Write an ALP for multiplication of Two 8 bit no's.
4. Write an ALP for Division of Two 8 bit no's.
5. Write an ALP to find smallest & largest no in a given array.
6. Write an ALP to generate 10 KHz frequency using interrupt.
7. Write an ALP to interface intelligent LCD display with m C.
8. Write an ALP for m C & HLL for PC (VB/C++/VC++) to demonstrate/implement serial Interfacing.
9. Write an ALP to interface LED display.
10. Write an ALP to interface one m C with other using serial/parallel communication.
11. Write an ALP to switch ON alarm when m C receive interrupt

Title of the course	**:**	**Power System Operation & Control**	
Subject Code	**:**	**EE-716**	
Weekly load	**:**	**5**	**LTP-3 2 0**
Credit	**:**	**4**	

Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	**Introduction**	**Introduction to Power Generation Units:** Characteristics and its variations,	08
	Economic Operation of Power Systems	Fuel consumption, Characteristics of thermal unit, Incremental fuel rate and their approximation, minimum and maximum power generation limits.	08
	Economic Dispatch	Economic dispatch problem with and without transmission line losses, Unit Commitment, their solution methods. Environmental aspects in Economic dispatch.	08
	Hydrothermal Co-ordination	Hydro- Scheduling, Plant models, scheduling problems, Hydrothermal scheduling problems and its approach.	08
Unit-2	**Power System Control**	Power system control factors, interconnected operation, tie-line operations, Reactive power requirements, during peak and off peak hours, Elementary ideas of load frequency and voltage, reactive power control; , block diagrams of P-f and Q-V controllers, automatic load frequency control (ALFC), Static and Dynamic performance characteristics of ALFC and automatic voltage regulator (AVR) controllers, Excitation systems.	12
	Power System Security	Factors affecting security, Contingency analysis, Network sensitivity, correcting the generation dispatch by using sensitivity method and linear programming.	10
	Power flow analysis in AC/DC systems	General, modelling of DC links, solution of DC load flow, discussion, per unit system for DC quantities, solution techniques of AC-DC power flow equations.	10

Recommended Books-

1. Nagrath, I.J. and Kothari, D.P., *Power System Engineering*, Tata McGraw Hill (2007).
2. Stevenson W.D. and Grainger (APSA)., *Power System Analysis*, McGraw Hill (2007).
3. Arrilaga J. and Smith B.C., "*AC-DC Power System Analysis*", IEE Press
4. Elgerd, O.I., *Electric Energy Systems Theory: An Introduction*. 2nd Edition, Tata McGraw Hill, 1983.
6. Dhillon J.S., Kothari D.P., *Power System Optimisation*, 2nd Ed., PHI, 2010
7. Kundur P, "*Power System Stability & Control*", Third Reprint, tat McGraw Hill, 2007
8. Murthy, P.S.R., "*Power System Operation and Control*", Tata McGraw Hill, 1984.
9. Saadat Hadi, "*Power System Analysis*", Tata McGraw Hill Edition, 2002.
10. Wood, A.J., and B. Wollenberg, "*Power Generation, Operation and Control*", 2nd Edition, John Wiley, NY, 1996

Title of the course : **Technical Communication & Soft Skills**
Subject Code : HU-711/ HU-721
Weekly load : 4 LTP 2-0-2
Credit : 0 (Lecture 0; Practical 0)

Course Description	Lecture(s)
Unit- I	

Speech Mechanism	
Introduction to English Speech Sounds: Consonants and Vowels (basics only), Organs of Speech, Description & Classification of Consonant Sounds, Cardinal Vowel Scale	08
Oral Presentation and Professional Speaking	
Elements of effective presentation, Body language and use of Audio-Visual Aids during presentation, Planning and preparing a model presentation, Organizing the presentation to suit the audience and context	08
Unit- II	
Business Communication	
Business Letters-Placing, Cancelling, Complaints, Reply to Complaints, Notices, Agendas; Minutes of Meetings, Memorandums	08
Career-Oriented Communication	
Resume and Bio-data- Design and style, Applying for a job, Language and format of a job application, Job Interview- Purpose and process, How to prepare for an interview, Language and style to be used in an interview, Types of interview questions and how to answer them	08

Total=32

Recommended Books:

1. Mishra, Sunita & C. Muralikrishna. *Communication Skills for Engineers*. Pearson.
2. Gimson, A.C. *An Introduction to Pronunciation of English.* ELBS.
3. Jones, Daniel. *English Pronouncing Dictionary*. ELBS.
4. Bhattacharya, Indrajit**.** *An Approach to Communication Skills.* Dhanpat Rai & Co.
5. Sharma, R.C. & Krishna Mohan. *Business Correspondence and Report Writing*. Tata McGraw-Hill.

List of Experiments (10-14):

1. Self Description, Analysis and Interaction.
2. Oral Presentation on a Given Topic.
3. Group Discussion/ Debate on a Given Topic.
4. Reading a Literary Text and Preparing a Summary.
5. **L**earning Etiquettes in Communication: accepting/ arguing against others' views/ ideas, interrupting others' talks, addressing higher officials, colleagues, sub-ordinates.
6. Individual Power Point Presentations.
7. Team Project Work: Selecting a Survey Topic and collecting relevant material from the Library/ Internet Sources.
8. Designing a Questionnaire and Conducting the Survey.
9. Presenting the survey results and compiling the project report.
10. Visual Comprehension: Movies, Documentaries, Video Lectures and Summarizing.
11. Pronunciation Improvement Exercises.
12. Role Plays.
13. Mock Interviews.
14. Creative Writing: Poems, Articles, Stories etc.

Title of the course : Biomedical Engineering
Subject Code : EE-721A
Weekly load :3 **LTP-3 0 0**
Credit :3
Theory

Unit	Main Topics	Course Outlines	Lecture(s)
Unit-1	Physiological systems of body	Brief description of nervous, circulatory and respiratory systems, the body as a control system, the nature of bioelectricity, the origin of biopotentials.	06
	Bio electric Signals And Electrodes	Electro conduction system of the heart, the ECG Waveform, Neuron potential, muscle potential, electrodes for biophysical sensing, Skin-contact-impedance, electrodes for EEG,EMG and ECG, electrical conductivity of electrode jellies and creams.	06
	Cardiovascular measurements	The standard lead system, the ECG preamplifier; ECG machines, Cardiac monitors, , blood pressure measurements, direct and indirect, blood flow measurements, phonocardiography, defibrillators, pacemakers	06
	Measurements of Electrical Activity in Brain	Anatomy of Human Brain and Nerve Cell, EEG electrodes and the 10-20 system, EEG amplitude and frequency bands, simplified block diagram, preamplifiers and EEG system specifications, EEG diagnostic uses and sleep patterns, visual and auditory evoked potential recordings, EEG system artifacts.	06
Unit-2	EMG	Muscular system, electrical signals of motor unit and gross muscle, human motor coordination system, electrodes, signal conditioning and processing, Block diagram & description of Electromyography (EMG).	06
	Respiratory System Measurements	Respiratory anatomy,parameters of respiration, regulation of respiration, respiratory system measurements, respiratory transducers and instruments, spirometry.	06
	Medical Imaging	Introduction to Medical Imaging, Computers in Medical Imaging, Computerized Ultrasonic Diagonosis and types, X-Rays, Computerized Tomography, Computerized Emission Tomography	06
	Biotelemetry	Physiological parameters adaptable to bio-telemetry, Components of a biotelemetry system, Implantable units, Applications of telemetry system in patient care.	06

Title	Author	Publisher
Handbook of biomedical instrumentation	R S Khandpur	TMH
Biomedical instrumentation and measurement	L Cromwell	PHI
Introduction to Biomedical Equipment Technology	Joseph J Carr John M.Brown	PE
Medical Instrumentation	John G.Webster	WSE

Title of the course : **Optimization Techniques**

Subject Code : **EE-721B**

Weekly load : **3** **LTP-3 0 0**

Credit : **3**

Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit	**INTRODUCTION**	Statement of an optimization problem, Classification	08

	TO OPTIMIZATION	of optimization problems, Optimization techniques, Engineering applications of optimization.	
	CLASSICAL OPTIMIZATION TECHNIQUES	Single variable optimization, Multivariable optimization with no constraints, Multivariable optimization with equality constraints, Multivariable optimization with inequality constraints.	08
	LINEAR PROGRAMMING	Standard form of linear programming, Simplex method, Computer implementation of the Simplex method, Duality theory.	08
	TRANSPORTATION PROBLEM	North-West Corner rule, Least-cost method, Vogel approximation method, testing for optimality.	08
Unit-2	**NON-LINEAR PROGRAMMING: One–Dimensional Minimization Methods**	Unimodal function, Dichotomous search, Fibonacci search, Golden Section, Cubic interpolation method, Direct root, Newton Raphson Method	08
	Unconstrained Multivariable Optimization Techniques	Random search method, Steepest descent method, Conjugate gradient method, Newton Raphson Method, Evolutionary search, Hooke-Jeeves Method, Simplex search Method	08
	Constrained Optimization Techniques	Interior Penalty function method, Exterior penalty function method, Method of Multipliers, KKT Conditions	08
	FURTHER TOPICS IN OPTIMIZATION	Critical path method (CPM), Program evaluation and review technique (PERT). Multiobjective Optimization Techniques, Weighting method, ε-constraint method. Simulated annealing method	08

Recommended Books-

1. *Rao, S.S.,'Optimization : Theory and Application' Wiley Eastern Press, 2nd edition 1984.*
2. Deb Kalyanmoy,.*Optimisation for Engineering Design-Algorithms and Examples.*, Prentice Hall India-1998
3. *Taha,H.A., Operations Research -An Introduction,Prentice Hall of India,2003.*
4. *Fox, R.L., 'Optimization methods for Engineering Design', Addition Welsey, 1971.*
5. *Ravindran A., Ragsdell K.M. and Reklaitis G.V., Engineering Optimization: Methods And applications , Wiley, 2008*
6. *Godfrey C. Onwubolu , B. V. Babu , New optimization techniques in engineering , Springer, 2004*

Title of the course : FACTS & HVDC Transmission
Subject Code : EE-721C
Weekly load : 3 LTP-3 0 0
Credit : 3
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit	**DC power**	Introduction, comparison of AC and DC transmission,	06

	transmission technology	application of DC transmission, application of DC transmission, description of DC transmission system, Configurations, planning for HVDC transmission, modern trends in DC transmission. Introduction to Device: Thyristor valve, valve tests, recent trends.	
	Analysis of HVDC converters	Pulse number, choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, characteristics of a twelve-pulse converter, detailed analysis of converters with and without overlap.	06
	Converter and HVDC system control	General, principles of DC link control, converter control characteristics, system control hierarchy, firing angle control, current and extinction angle control, starting and stopping of DC link, power control, higher level controllers, telecommunication requirements.	06
	Converter faults and protection	Introduction, converter faults, protection against over-currents, over-voltages in a converter station, surge arresters, protection against over-voltages.	06
Unit-2	**Smoothing reactor and DC line**	Introduction, smoothing reactors, DC line, transient over voltages in DC line, protection of DC line, DC breakers, Monopolar operation, effects of proximity of AC and DC transmission lines.	06
	Reactive power control	Introduction, reactive power requirements in steady state, sources of reactive power, static var systems, reactive power control during transients. Harmonics and filters: Introduction, generation of harmonics, design of AC filters, DC filters, carrier frequency and RI noise.	06
	Component models for the analysis of ac/dc system	General, converter model, converter control, modelling of DC network, modelling of AC networks.	06
	Power Transmission control	Fundamental of ac power transmission, transmission problems and needs, the emergence of FACTS, FACTS controller & consideration. **Shunt & Series Compensation:** Shunt Static Var Compensator (SVC) principles, configuration, & control, Fundamental of series compensation, principle of operation, Application of Thyristor Controlled Series Capacitor TCSC for different problems of power system **Unified Power Flow Controllers (UPFC):** Basic operating principles & characteristics, control UPFC installation applications, UPFC model for power flow studies.	06

Recommended Books-

1. Ghosh,A. and Ledwich,G., *Power Quality Enhancement Using Custom Power Devices*, Kluwer Academic Publishers (2005).
2. Hingorani, N.G. and Gyragyi,L., *Understanding FACTS :Concepts and Technology of Flexible AC Transmission System*, Standard Publishers and Distributors (2005).
3. K.R. Padiyar, *FACTS Controllers in Power Transmission & Distribution*, New Age International Publisher, 2007.

4. Miller T.J.E., *Reactive Power Control in Electric Systems*, John Wiley
5. Kimbark, *HVDC Transmission*.
6. Kamaraju and Naidu, *H.V. Engineering.*
7. R.S. Jha, *H.V. Engineering.*
8. Kuffel & Abdullah, *H.V. Engineering*
9. Wadhwa C. L., *H. V. Engineering.*

Title of the course	**:**	**DISTRIBUTED CONTROL SYSTEM**	
Subject Code	**:**	**EE-721D**	
Weekly load	**:**	**3**	**LTP-3 0 0**
Credit	**:**	**3**	

Theory

Unit	Main Topics	Course outlines	Lecture(s)
Unit-1	INTRODUCTION	Computers in process control, Measurement and control interfaces, PC hardware structure, Direct digital control, consideration in DCS.	06
	DCS-CONFIGURATION	Hardware of a distributed control system, DCS configurations control console equipment, displays, Software configuration, algorithm libraries	06
	DCS COMMUNICATION	Industrial communication system, Field buses, standards, multiplexing and scanning, remote stations, Digital signal transmission.	06
	DCS FLOWSHEET SYBMOLS	General symbols, distributed control symbols, logic and sequential control symbols, internal system function symbols, software alarms, typical flow diagrams	06

Unit	Main Topics	Course outlines	Lecture(s)
Unit -2	DCS-I/O HARDWARE AND SET POINT STATIONS	I/O Hardware stations, digital and analog inputs, signal conditioning, set point stations and their features.	08
	DCS-SUPERVISORY TASKS and CONFIGURATIONS	Supervisor computer functions, control and optimization, control techniques, displays, advanced controls.	08
	DCS- SYSTEM INTERGARTION WITH PLC	Man machine interface, integration with PLC and compurters	08

Recommended BookS

1. LIPTAK: Instrumentation Engineering Handbook, Chilton Book Company
2. ANDREWS: Applied Instrumentation in Process Industries (Volume II & III)
3. DOEBLIN: Measurement Systems: Application and Design, TMH
4. R. K. JAIN: Mechanical and Industrial Measurements, Khanna Publishers

Title of the course : High Voltage Engineering
Subject Code : EE-722
Weekly load : 3 LTP-3 0 0
Credit : 3
Theory:

Unit	Main Topics	Course Outlines	Lecture(s)
Unit	E.H.V.	Need for EHV Transmission. Use of bundled conductors,	08

	Transmission and Corona Loss	corona characteristics of smooth bundled conductors with different configurations, Corona loss. Factors affecting the corona loss, Radio interference due to corona. Shunt and series compensation in EHV lines. Tuned power lines. Insulation Co-ordination.	
	HVDC Transmission	Advantages, disadvantages and economics of HVDC Transmission system. Types of D.C. links, converter station equipment, their characteristics.	08
	Insulating materials used in H.V. Engg.	Applications of insulating materials used in power transformers rotating machines, circuit breakers, cables, power capacitors.	08
	Conduction and breakdown in Gases, Liquids & Solid Dielectrics	Solids - Intrinsic, electromechanical and thermal breakdown composite dielectrics, solid dielectrics used in practice. Liquids:- Conduction and breakdown in pure and commercial liquids, suspended particle theory, cavitation and bubble theory, stressed oil volume theory, Liquids used in practice. Gases:- Ionization process, Townsend's current growth equations, Ist and 2nd ionization coefficients. Townsend's criterion for breakdown. Streamer theory of breakdown, Pashen's law of Gases, Gases used in practice.	08
Unit-2	Generation of High Voltages	D.C., A.C. (Power frequency and High frequency) Impulse voltage and impulse current Generation Tripping and contact of Impulse Generator.	12
	Test procedures in H.V. Engg. Lab.	Testing of cables, insulators, bushings, circuit breakers and transformers.	12

Recommended Books-

1. E.H.V. A.C. Transmission Engg. By Rakesh Das Bagamudre, New Age International Publishers.
2. HVDC Transmission by Kimbark.
3. H.V. Engg. By Kamaraju and Naidu
4. H.V. Engg. By R.S. Jha.
5. H.V. Engg, by Kuffel & Abdullah.
6. H. V. Engg. by C. L. Wadhwa.

Title of the course : Electric Drives
Subject Code : EE-723
Weekly load : 5 L T P-3 0 2
Credit : 4

Theory:

Unit	Main Topics	Course outlines	Lecture(s)
Unit-3	**DC Motor Drives**	Introduction to Drives, Rectifier and Chopper fed DC motors with	07

		closed loop control, PLL Control, Mechanical Sensorless Control of DC motors.	
	Synchronous Motor Drives	Converters-Inverter, Cycloconverter fed Wound Field Synchronous Motor Drives with closed loop control, CLM and Field Oriented control, Direct Torque control, Sensorless Control; Synchronous Reluctance Motor Drives and its control	10
	Permanent Magnet Brushless Motor Drives	Solid State Controllers of PMBLDCM and PMSM Drives with Closed loop Control, Field Oriented Control and position Sensorless Control.	07
Unit-2	**Induction Motor Drives**	Converters-Inverter and Cyclo- converter fed Induction Motor Drives with closed loop control, AC voltage controllers, Rotor Resistance control, Slip recovery drives, Field Oriented control, Direct Torque control, Sensorless Control.	12
	Special Motor Drives	Switched Reluctance Motor (SRM) Drives: Converter-Inverter controllers of SRM Drives with closed loop control, Sensorless Control; Stepper Motor Drives: Classifications, Operation, Characteristics, Stability, Converters and Closed Loop Control	08
	Power Quality issues of Electric Drives	Power Quality problems generated by various electric drives, Harmonic Mitigation techniques and Energy Efficiency Improvements in Electric Motor Drives through Solid State Controllers.	04

Recommended Books:

Title	**Author**	**Publisher**
Power Electronics and Variable Frequency Drives, Technology and Applications	B K Bose	IEEE Press
Power Semiconductor Controlled Drives	G.K.Dubey	PHI
Electric Drives	I. Boldea and S. A. Nasar	CRC Press
Power Electronics	N. Mohan, T. M. Undeland and W. P. Robbins	John Wiley and Sons
Electric Motor Drives	R. Krishnan	Pearson Education

Practicals: EE-724

1. To observe and comment on the waveforms of a single phase Bridge rectifier based DC motor drive.
2. To observe and comment on the waveforms of Isolated DC-DC converter in buck/boost mode under CCM and DCM operation.
3. To observe and comment on the waveforms of non-isolated DC-DC converter in buck/boost mode under CCM and DCM operation
4. To observe and comment on the waveforms of a Chopper based DC motor drive.
5. To observe and comment on the waveforms of a Converter Inverter based Synchronous motor drive.
6. To observe and comment on the waveforms of a Cyclo-Converter based Synchronous motor drive.
7. To observe and comment on the waveforms of a V/f control of Induction motor drive.
8. To observe and comment on the waveforms of a Converter Inverter based Induction motor drive.
9. To observe and comment on the waveforms of a Cyclo-Converter based Induction motor drive.
10. To observe and comment on the waveforms of a three phase Thyristor Bridge converter for DC motor speed control. Also comment on the operation with and without free wheeling diode.
11. To observe and comment on the waveforms of a three phase PWM converter for Induction motor speed control.
12. To observe and comment on the waveforms of a Power quality converter for Induction motor drive.
13. To observe and comment on the waveforms of a Power quality converter for special (PMBL) motor drive.
14. To observe and comment on the mechanical sensorless scheme of control of drives.

Title of the course	**:**	**Advance Simulation Lab-II**	
Subject Code	**:**	**EE-725**	
Weekly load	**:**	**2**	**LTP-0 0 2**
Credit	**:**	**1**	

Practical:

1. To simulate the behaviour of single phase IGBT/MOSFET Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.

2. To simulate the behaviour of three phase IGBT/MOSFET Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
3. To simulate the behaviour of isolated Buck DC-DC Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
4. To simulate the behaviour of isolated Boost DC-DC Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
5. To simulate the behaviour of isolated Buck- Boost DC-DC Converters in closed loop voltage control for R and RL load in MATLAB. Plot various current/voltage waveforms and its step response and comment on it.
6. To simulate the speed and torque control of DC Drive in MATLAB under variable loading conditions. Plot various current/voltage waveforms and comment on it.
7. To simulate the V/f method of speed control for Induction Motors (squirrel cage and wound rotor) in MATLAB under variable loading conditions. Plot various current/voltage waveforms and comment on it.
8. To simulate the behaviour of a solar photo voltaic system for R and RL load under variable solar radiations in MATLAB. Plot various current/voltage waveforms and comment on it.
9. To simulate the behaviour of a synchronous generator for R and RL load in MATLAB with various prime movers (such as hydel, wind, thermal plants). Plot various current/voltage waveforms and comment on it.
10. To design IIR and FIR filters in MATLAB. Simulate its various plots and comment on it.
11. To simulate the behaviour of a HVAC system in MATLAB under different operating/loading conditions. Plot various current/voltage waveforms and comment on it.
12. To simulate the behaviour of a HVDC system in MATLAB under different operating/loading conditions. Plot various current/voltage waveforms and comment on it.
13. To design and simulate the behavior of any electric drive in MATLAB for closed loop control of any one parameter (current/voltage/speed/torque) under variable loading conditions. Plot various current/voltage waveforms and comment on it.
14. To design and simulate the behavior of any Transmission/Distribution system in MATLAB for closed loop control of any one parameter (current/voltage/power) under variable loading conditions. Plot various current/voltage waveforms and comment on it.

Recommended Books:

Title	**Author**	**Publisher**
Getting Started with MATLAB	Rudra Pratap	Oxford University Press
Mastering MATLAB 7	Hanselman & Littlefield	Prentice Hall
Electric Machinery	Fitzgerald, Kingslay and Umans	McGraw Hills
Linear Control Systems with Matlab Applications	B S Manke	Khanna Publishers
Power Electronics	M H Rashid	Pearson Education
Power Generation, Operation and Control	A J Wood, B F Wollenberg and G B Sheble	Wiley