Syllabus for B.Tech(Electrical Engineering) Up to Fourth Year

Revised Syllabus of B.Tech EE (for the students who were admitted in Academic Session 2010-2011)

3rd Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	M (CS) 301	Numerical Methods	2	1	0	3	2
2	M302	Mathematics-III	3	1	0	4	4
3	EC(EE)301	Analog Electronic circuits	3	0	0	3	3
4	EC(EE)302	Digital Electronic circuit	3	0	0	3	3
5	EE-301	Electric Circuit theory	3	1	0	4	4
6	EE-302	Field theory	3	1	0	4	4
						21	20

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	EC(EE)391	Analog & Digital Electronic circuit	0	0	3	3	2
2	M (CS)391	Numerical Methods	0	0	2	2	1
3	EE-391	Electric Circuit Theory	0	0	3	3	2
4	HU-381	TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE	0	0	3	3	2
		Total of Practical / Sessional				11	7
TOTAL OF SEMESTER:						32	27

4th Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	HU-401	Values and Ethics in Profession	3	0	0	3	3
2	PH(EE)-401	Physics-II	3	1	0	4	4
3	ME(EE)411	Thermal Power Engineering	3	0	0	3	3
4	CH-401	Basic Environmental Engineering & Elementary Biology	3	0	0	3	3
5	EE-401	Electric Machine-I	3	1	0	4	4
6	EE-402	Electrical & Electronic measurement	3	0	0	3	3
						20	20

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	PH(EE)-491	Physics-II	0	0	3	3	2
2	ME(EE)481	Thermal power Engineering Lab	0	0	3	3	2
3	EE-491	Electric Machine-I	0	0	3	3	2
4	EE-492	Electrical & Electronic measurement	0	0	3	3	2
		Total of Practical / Sessional				12	8
TOTAL OF SEMESTER:						32	28

Syllabus for B.Tech(Electrical Engineering) Up to Fourth Year

Revised Syllabus of B.Tech EE (for the students who were admitted in Academic Session 2010-2011)

5th Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	HU-501	Economics for Engineers	3	0	0	3	3
2	EE-501	Electric machine-II	3	1	0	4	4
3	EE-502	Power system-I	3	1	0	4	4
4	EE-503	Control system-I	3	1	0	4	4
5	EE-504	A. Data structure & algorithm B. Computer Organization C. Micro Processor & Micro controller	3	0	0	3	3
						18	18

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	EE-591	Electric machine-II	0	0	3	3	2
2	EE-592	Power system-I	0	0	3	3	2
3	EE-593	Control system-I	0	0	3	3	2
4	EE-594	a. Data structure & algorithm b. Computer Organization c. Micro Processor & Microcontroller	0	0	3	3	2
5	EE-581	Seminar	0	0	3	3	2
		Total of Practical / Sessional				15	10
TOTAL OF SEMESTER:						33	28

EE 6th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	HU-601	Principle of Management	2	0	0	2	2
2	EE-601	Control System-II	3	1	0	4	4
3	EE-602	Power System-II	3	1	0	4	4
4	EE-603	Power Electronics	3	1	0	4	4
5	EE-604	a. Software Engineering b. Data Base Management System c. Object Oriented Programming d. Embedded Systems.	3	0	0	3	3
6	EE-605	a. Digital Signal Processing b. Communication Engineering. c. VLSI & Microelectronics	3	0		3	3
						20	20

Practical / Sessional:

Sl. No.	CODE	Paper	Contact period Per week			Total Contact Hrs	Credits
			L	T	P		
1	EE-691	Control System-II	0	0	3	3	2
2	EE-692	Power System-II	0	0	3	3	2
3	EE-693	Power Electronics	0	0	3	3	2
4	EE-694	a. Software Engineering b. Data Base Management System c. Object Oriented Programming d. Embedded Systems	0	0	3	3	2
		Total of Practical / Sessional				12	8
TOTAL OF SEMESTER:						32	28

Industrial training conducted after 6th Semester.

Syllabus for B.Tech(Electrical Engineering) Up to Fourth Year

Revised Syllabus of B.Tech EE (for the students who were admitted in Academic Session 2010-2011)

7th Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	EE-701	Electric drive	4	0	0	4	4
2	EE-702	Utilization of Electric power	3	1	0	4	4
3	EE-703	A. Power system-III B. Control system-III C. Electric Machine-III	3	0	0	3	3
4	EE-704	A. High voltage Engineering B. Power Plant Engineering C. Power generation and economics D. Renewable & Non conventional Energy	3	0	0	3	3
5	EE-705	A.Computer Network B. AI & Soft Computing C. Digital Communication D. Digital Image Processing	3	0	0	3	3
						17	17

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	EE-781	Seminar on industrial training	0	0	3	3	2
2	EE-791	Electric Drive	0	0	3	3	2
3	EE-792	A.Computer Network B. AI & Soft Computing C.Digital Communication D. Digital Image Processing	0	0	3	3	2
4	EE-782	Electrical system design-I	0	0	3	3	2
5	EE-783	Project-I	0	0	3	3	2
		Total of Practical / Sessional				9	10
TOTAL OF SEMESTER:			18	02	09	29	27

8th Semester

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	HU-801A	Organizational Behaviour	2	0	0	2	2
2	EE-801	A. HVDC transmission B. Illumination Engineering C. Energy management & audit D. DIGITAL SPEECH SIGNAL PROCESSING	3	0	0	3	3
3	EE-802	A. Power plant instrumentation & Control B. Sensors & Transducers C. Biomedical Instrumentation D. Process control	3	0	0	3	3
		TOTAL				08	08

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	EE-881	Project	0	0	12	12	6
2	EE-882	Electrical system Lab-II	0	0	6	6	4
3	EE-883	Grand Viva					3
		Total of Practical / Sessional				18	13
		TOTAL SEMESTER				26	21

III Semester

NUMERICAL METHODS
Code : M(CS) 301
Contacts : 2L+1T
Credits :2

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. (4)

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. (5)

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

Numerical solution of a system of linear equations:
Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. (6)

Numerical solution of Algebraic equation:
Bisection method, Regula-Falsi method, Newton-Raphson method. (4)

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. (6)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

References:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.

MATHEMATICS

Code: M 302

Contacts: 3L +1T = 4

Credits: 4

Note 1: The entire syllabus has been divided into four modules.
Note 2: Structure of Question Paper
There will be two groups in the paper:

Group A: Ten questions, each of 2 marks, are to be answered out of a total of 15 questions, covering the entire syllabus.

Group B: Five questions, each carrying 10 marks, are to be answered out of (at least) 8 questions.
Students should answer at least one question from each module.
[At least 2 questions should be set from each of Modules II & IV.
At least 1 question should be set from each of Modules I & III. Sufficient questions should be set covering the whole syllabus for alternatives.]

Module I: Fourier Series & Fourier Transform [8L]
Topic: Fourier Series:
Sub-Topics: Introduction, Periodic functions: Properties, Even & Odd functions: Properties, Special wave forms: Square wave, Half wave Rectifier, Full wave Rectifier, Saw-toothed wave, Triangular wave. (1)
Euler's Formulae for Fourier Series, Fourier Series for functions of period 2π, Fourier Series for functions of period 2l, Dirichlet's conditions, Sum of Fourier series. Examples. (1)
Theorem for the convergence of Fourier Series (statement only). Fourier Series of a function with its periodic
extension. Half Range Fourier Series: Construction of Half range Sine Series, Construction of Half range Cosine Series. Parseval's identity (statement only). Examples. (2)

Topic: Fourier Transform:
Sub-Topics: Fourier Integral Theorem (statement only), Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms. Fourier, Fourier Cosine & Sine Transforms of elementary functions. (1)

Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation. Examples. Fourier Transform of Derivatives. Examples. (1)

Convolution Theorem (statement only), Inverse of Fourier Transform, Examples. (2)

Module II : Calculus of Complex Variable [13L]

Topic: Introduction to Functions of a Complex Variable.

Sub-Topics: Complex functions, Concept of Limit, Continuity and Differentiability. (1)

Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient condition for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. (1)

Construction of Analytic functions: Milne Thomson method, related problems**.** (1)

Topic: Complex Integration.

Sub-Topics: Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Examples. (2)

Cauchy's theorem (statement only). Cauchy-Goursat theorem (statement only). Examples. (1)

Cauchy's integral formula, Cauchy's integral formula for the derivative of an analytic function, Cauchy's integral formula for the successive derivatives of an analytic function. Examples. (2)

Taylor's series, Laurent's series. Examples (1)

Topic: Zeros and Singularities of an Analytic Function & Residue Theorem.

Sub-Topics: Zero of an Analytic function, order of zero, Singularities of an analytic function. Isolated and non-isolated singularity, essential singularities. Poles: simple pole, pole of order m.
Examples on determination of singularities and their nature. (1)

Residue, Cauchy's Residue theorem (statement only), problems on finding the residue of a given function, evaluation of definite integrals: $\int_0^{\infty} \frac{\sin x}{x} dx$, $\int_0^{2\pi} \frac{d\theta}{a+b\cos\theta+c\sin\theta}$, $\oint_C \frac{P(z)}{Q(z)} dz$ (elementary cases, P(z) & Q(z) are polynomials of 2nd order or less). (2)

Topic: Introduction to Conformal Mapping.

Sub-Topics: Concept of transformation from z-plane to w-plane. Concept of Conformal Mapping. Idea of some standard transformations. Bilinear Transformation and determination of its fixed point. (1)

Module III: Probability [8L]
Topic: Basic Probability Theory
Sub-Topics: Classical definition and its limitations. Axiomatic definition.
Some elementary deduction: i) P(O)=0, ii) $0 \le P(A) \le 1$, iii) P(A')=1-P(A) etc. where the symbols have their usual meanings. Frequency interpretation of probability. (1)

Addition rule for 2 events (proof) & its extension to more than 2 events (statement only). Related problems. Conditional probability & Independent events. Extension to more than 2 events (pairwise & mutual independence). Multiplication Rule. Examples. Baye's theorem (statement only) and related problems. (3)

Topic: Random Variable & Probability Distributions. Expectation.
Sub-Topics: Definition of random variable. Continuous and discrete random variables. Probability density function & probability mass function for single variable only. Distribution function and its properties (without proof). Examples. Definitions of Expectation & Variance, properties & examples. (2)

Some important discrete distributions: Binomial & Poisson distributions and related problems.
Some important continuous distributions: Uniform, Exponential, Normal distributions and related problems. Determination of Mean & Variance for Binomial, Poisson & Uniform distributions only. (2)

Module IV: Partial Differential Equation (PDE) and Series solution of Ordinary Differential Equation (ODE) [13L]

Topic: Basic concepts of PDE.
Sub-Topics: Origin of PDE, its order and degree, concept of solution in PDE. Introduction to different methods of solution: Separation of variables, Laplace & Fourier transform methods. (1)

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

Sub-Topics:
PDE I: One dimensional Wave equation. (2)
PDE II: One dimensional Heat equation. (2)
PDE III: Two dimensional Laplace equation. (2)

Topic: Introduction to series solution of ODE.

Sub-Topics: Validity of the series solution of an ordinary differential equation. General method to solve $P_o\ y''+P_1\ y'+P_2\ y=0$ and related problems. (2)
Topic: Bessel's equation.

Sub-Topics: Series solution, Bessel function, recurrence relations of Bessel's Function of first kind. (2)
Topic: Legendre's equation.
Sub-Topics: Series solution, Legendre function, recurrence relations and orthogonality relation. (2)

TOTAL LECTURES : 42

Text Books:

2. Brown J.W and Churchill R.V: Complex Variables and Applications, McGraw-Hill.
3. Das N.G.: Statistical Methods, TMH.
4. Grewal B S: Higher Engineering Mathematics, Khanna Publishers.
5. James G.: Advanced Modern Engineering Mathematics, Pearson Education.
6. Lipschutz S., and Lipson M.L.: Probability (Schaum's Outline Series), TMH.

References:

1. Bhamra K. S.: Partial Differential Equations: An introductory treatment with applications, PHI
2. Dutta Debashis: Textbook of Engineering Mathematics, New Age International Publishers.
3. Kreyzig E.: Advanced Engineering Mathematics, John Wiley and Sons.
4. Potter M.C, Goldberg J.L and Aboufadel E.F.: Advanced Engineering Mathematics, OUP.
5. Ramana B.V.: Higher Engineering Mathematics, TMH.
6. Spiegel M.R. , Lipschutz S., John J.S., and Spellman D., : Complex Variables, TMH.

ANALOG ELECTRONIC CIRCUITS
EC (EE)-301

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Filters & Regulators:** Capacitor filters, π-section filter, ripple factor, series and shunt voltage regulator, percentage regulation, Concept of SMPS.	4
2	**Transistor biasing & stability:** Q point, Self Bias-CE, Compensation techniques, h-model of Transistor, Expression of voltage gain, current gain, input & output impedance, Trans-resistance & Trans-conductance, Emitter follower circuits, High frequency model of Transistor.	5
3	**Transistor amplifier:** RC coupled amplifier, Function of all components, Equivalent circuit, derivation of voltage gain, Current gain, Input impedance & output impedance, Frequency response characteristics, Lower & upper half frequencies, Bandwidth, Concept of Wide band amplifier.	5
4	**Feed back amplifier & Oscillators:** Concept of Feed back, Negative & Positive feedback, Voltage/Current, Series/Shunt feedback, Berkhausen criterion, Colpit , Hartley's, Phase shift, Wien bridge, & Crystal oscillators.	4
5	**Operational amplifier:** Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers, Voltage follower/Buffer circuits.	5
6	**Application of Operational amplifiers:** Adder, Integrator & Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog	5

	amplifier, Trans-conductance multiplier, Precision rectifier, Voltage to current & Current to voltage converter.	
7	**Power amplifier:** Class A, B, AB, C, Conversion efficiency, Tuned amplifier.	4
8	**Multivibrator:** Monostable, Bistable multivibrator, Monostable & Astable operation using 555 timer.	2
9	**Special function circuits:** VCO & PLL	2

Text Books:

1. Microelectronic Circuits, Sedra & Smith, Oxford University Press.
2. Integrated Electronics, Milman & Halkias, Mc Graw Hill Company.
3. Electronic devices & Circuits, Balbir Kumar & Shail B. Jain, PHI.
4. Op-amps and Linear IC's, R.A. Gayakwad, PHI.

Reference Books:

1. Microelectronic Circuit- Analysis & Design, Rashid, Cenage Learning.
2. Electronic Circuits: Discrete & Integrated, 3rd Edition, Schilling & Belove, Mc Graw Hill Company.
3. Electronic principles, 6th Edition, Malvino, Mc Graw Hill Company.
4. Operational Amplifier & Linear IC's, Bell, Oxford University Press.
5. 2000 Solved Problems in Electronics, Jimmie J. Cathey, Mc Graw Hill Inc.
6. Electronic Devices -System & Application, Robert Diffenderfer, Cengage Learning.
7. Op- Amps & Linear Integrated Circuits, Ravi Raj Dudeja & Mohan Dudeja, Umesh Publication.

DIGITAL ELECTRONICS CIRCUITS
EC (EE)-302

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Data and number system:** Binary, Octal and Hexadecimal representation and their conversion, BCD, ASCII, EBDIC, Gray codes and their conversion, Signed binary numbers representation with 1's and 2's complement methods, Binary arithmetic.	5
2	**Boolean algebra:** Various logic gates and their truth tables and circuits, Representation in SOP and POS forms, Minimization of logic expressions by algebraic method, K-map method.	5
3	**Combinational circuits:** Adder and sub tractor circuit, Circuit of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and parity Generator.	5
4	**Memory systems:** RAM, ROM, EPROM, EEROM	4
5	**Sequential circuits:** Basic memory elements, S-R, J-K, D, and T Flipflop, various types of Registers, Counters & their design, Irregular counter, State table & State transition diagram, Sequential circuit design methodology.	6
6	**Different types of A/D and D/A conversion techniques.**	4
7	**Logic families:** TTL, ECL, MOS & CMOS, their operation and specification.	5

Text Books:

1. Digital Principles & Application, 5th Edition, Leach & Malvino, Mc Graw Hill Company.
2. Modern Digital Electronics, 2nd Edition, R.P. Jain. Tata Mc Graw Hill Company Limited
3. Fundamental of Digital Circuits, A. Anand Kumar, PHI.

Reference Books:

1. Digital Logic Design, Morries Mano, PHI.

2. Digital Integrated Electronics, H. Taub & D. Shilling, Mc Graw Hill Company.
3. Digital Electronics, James W. Bignell & Robert Donovan, Thomson Delman Learning.
4. Fundamental of logic Design, Charles H. Roth, Thomson Delman Learning.

ELECTRIC CIRCUIT THEORY
EE-301

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Introduction:** Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals.	3
2	**Coupled circuits:** Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems.	3
3	**Laplace transforms:** Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions. Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources.	8
4	**Fourier method of waveform analysis:** Fourier series and Fourier Transform (in continuous domain only). Application in circuit analysis, Solution of Problems	8
5	**Network equations**: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem and its application in three phase unbalanced circuit analysis. Solution of Problems with DC & AC sources.	6
6	**Graph theory and Networks equations:** Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials. Duality, Solution of Problems	4
7	**Two port networks analysis:** Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems	4
8	**Filter Circuits:** Analysis and synthesis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems	4

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Network Analysis and Synthesis, C.L. Wadhwa, New Age International Publishers
3. Circuit and Networks: Analysis and synthesis, A. Sudhakar & S.S. Palli
   4th edition. Tata Mc Graw Hill Education Pvt. Ltd.
4. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

Reference Books:

1. Network Analysis, M.E. Valkenburg, Pearson Education .
2. Fundamental of Electric circuit theory, D. Chattopadhay & P.C. Rakshit, S. Chand.
3. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin, The Mc Graw Hill Company.

4. Electric Circuit, M. Nahvi & J.A. Edminister, Schum's outline series, The Mc Graw Hill Company.
5. Electric Circuit Analysis, S. Sivanagaraju, G. Kishor, C.Srinivasa Rao, Cengage Learning
6. Fundamental of Electric Circuits, Charles K. Alexander, Mathew. N.O. Sadiu, Tata Mc Graw Hill Educaton.
7. Engineering Circuit Analysis, W.H. Hayt, J.E. Kemmerly, S.M. Durbin, The Mc Graw Hill Companies
8. Introduction to Electric Circuits, Richard C. Dorf, James A. Svoboda, Wiley India Edition.
9. Electric Circuits, Syed A. Nasar, Schaum's solved problem series, Tata Mc Graw Hill Publishing Company Limited.

FIELD THEORY
EE-302

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Introduction:** Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems	3
2	**Introduction to Vector calculus:** DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Strokes theorem, Laplacian of a scalar, Classification of vector fields, Helmholtz's theorem. Solution of problems	3
3	**Electrostatic field:** Coulomb's law, field intensity, Gauss's law, Electric potential and Potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor –dielectric, Conductor-free space. Poisson's and Laplace's equation, General procedure for solving Poisson's and Laplace's equation. Solution of problems	8
4	**Magneto static fields:** Biot- savart law, Ampere's circuit law, Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetisation in material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material. Solution of problems	8
5	**Electromagnetic fields:** Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Time varying Potential, Time harmonic fields. Solution of problems	5
6	**Electromagnetic wave propagation:** Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems	6
7	**Transmission line:** Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems	4

Text Books:

1. Elements of Electromagnetic, Mathew N.O. Sadiku, 4th edition, Oxford university press.

2. Engineering Electromagnetic, W.H. Hyat & J.A. Buck, 7th Edition, TMH
3. Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH
4. Electromagnetic field theory fundamentals, Guru & Hizroglu, 2nd edition, Cambridge University Press.

Reference Books:

1. Electromagnetic with application, Krause, 5th Edition, TMH.
2. Elements of Engineering Electromagnetic, N.N. Rao, 6th Edition, Pearson Education.

Practical

Analog & Digital Electronic Circuit
EC (EE)-391

Credit: 2 **Contact: 3**

1. Study of Ripple and Regulation characteristics of full wave rectifier with and without capacitor filter.
2. Study of Zener diode as voltage regulator.
3. Construction of two stage R-C coupled amplifier & study of its gain and Bandwith.
4. Study of class A, C & Push pull amplifier.
5. Realisation V-I & I-V converter using Operational Amplifier.
6. Study of timer circuit using NE 555 and configuration of Monostable and Astable Multivibrator.
7. Study of DAC & ADC
8. Realisation of basic gates using Universal logic gates.
9. Realisation of RS-JK & D filpflop using logic gates.
10. Design of Combinational circuit for BCD to decimal conversion to drive 7-segment display using Multiplexer.
11. Realisation of Synchronous Up/Down counter.
12. Construction of simple Decoder & Multiplexer circuits using logic gates.
13. Construction of adder circuit using Shift register & Full adder.

NUMERICAL METHODS
Code : M(CS) 391
Credits :1

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.
4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.
5. Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.
6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

ELECTRIC CIRCUIT THEORY LABORATORY
EE-391

Credit: 2 **Contact: 3**

1. Transient response of R-L and R-C network: simulation with PSPICE /Hardware
2. Transient response of R-L-C series and parallel circuit: Simulation with PSPICE/ Hardware

3. Determination of Impedance (Z) and Admittance (Y) parameter of two port network: Simulation / Hardware.
4. Frequency response of LP and HP filters: Simulation / Hardware.
5. Frequency response of BP and BR filters: Simulation /Hardware.
6. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
7. Determination of Laplace transform and Inverse Laplace transform using MATLAB.
8. Amplitude and Phase spectrum analysis of different signals using MATLAB.
9. Verification of Network theorem using SPICE

PAPER NAME : TECHNICAL REPORT WRITING & LANGUAGE LABORATORY PRACTICE
PAPER CODE: HU 381
CONTACT: 1L+2P
CREDIT : 2

Guidelines for Course Execution:
Objectives of this Course: This course has been designed:

1. **To inculcate a sense of confidence in the students.**
2. **To help them become good communicators both socially and professionally.**
3. **To assist them to enhance their power of Technical Communication.**

Detailed Course Outlines:

A. ***Technical Report Writing*** : 2L+6P

1. Report Types (Organizational / Commercial / Business / Project)
2. Report Format & Organization of Writing Materials
3. Report Writing (Practice Sessions & Workshops)

B. ***Language Laboratory Practice***

I. Introductory Lecture to help the students get a clear idea of Technical Communication & the need of Language Laboratory
Practice Sessions 2L
2. Conversation Practice Sessions: (To be done as real life interactions) 2L+4P
a) Training the students by using Language Lab Device/Recommended Texts/cassettes /cd's to get their Listening Skill & Speaking Skill honed
b) Introducing Role Play & honing over all Communicative Competence
3. Group Discussion Sessions: 2L+6P
a) Teaching Strategies of Group Discussion
b) Introducing Different Models & Topics of Group Discussion
c) Exploring Live /Recorded GD Sessions for mending students' attitude/approach & for taking remedial measure
Interview Sessions; 2L+6P

- ***a) Training students to face Job Interviews confidently and successfully***
- ***b) Arranging Mock Interviews and Practice Sessions for integrating Listening Skill with Speaking Skill in a formal situation for effective communication***

4. Presentation: 2L+6P

- ***a) Teaching Presentation as a skill***
- ***b) Strategies and Standard Practices of Individual /Group Presentation***
- ***c) Media & Means of Presentation: OHP/POWER POINT/ Other Audio-Visual Aids***

5. Competitive Examination: 2L+2P

a) Making the students aware of Provincial /National/International Competitive Examinations

b) Strategies/Tactics for success in Competitive Examinations

c) SWOT Analysis and its Application in fixing Target

Books – Recommended:

Nira Konar: English Language Laboratory: A Comprehensive Manual
PHI Learning, 2011

D. Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing
Pearson Education (W.B. edition), 2011

References:

Adrian Duff et. al. (ed.): Cambridge Skills for Fluency
A) Speaking (Levels 1-4 Audio Cassettes/Handbooks)
B) Listening (Levels 1-4 Audio Cassettes/Handbooks)
Cambridge University Press 1998

Mark Hancock: English Pronunciation in Use
4 Audio Cassettes/CD'S OUP 2004

IV Semester

Theory

VALUES & ETHICS IN PROFESSION

HU-401
Contracts: 3L
Credits- 3

Science, Technology and Engineering as knowledge and as Social and Professional Activities

Effects of Technological Growth:

Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development
Energy Crisis: Renewable Energy Resources
Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics
Appropriate Technology Movement of Schumacher; later developments
Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis.
Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

Ethics of Profession:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

Profession and Human Values:

Values Crisis in contemporary society
Nature of values: Value Spectrum of a good life
Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution.
Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity
Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

PH (EE)-401 4: Physics
Contacts : 3L + 1T
Credits : 4

Topic	No of periods
Module-I	
Quantum mechanics: • Generalized co-ordinates, Lagrange's equation of motion and Lagrangian, generalized force potential, moment and energy. Hamilton's Equation of motion and Hamiltonian. Properties of Hamilton and Hamilton's equation of motion. • Concept of probability and probability density, operator, Commutator, Formulation of quantum mechanics and Basic postulates, Operator correspondence, Time dependent Schrödinger's equation, formulation of time independent Schrödinger's equation by method of separation of variables, Physical interpretation of wave function Ψ(normalization and probability interpretation), Expectation values, Application of Schrödinger equation-Particle in an infinite square well potential (1-D and 3-D potential well), Discussion on degenerate levels.	6 10
Module-II	
Statistical mechanics: • Concept of energy levels and energy states. Microstates, Macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (no deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics. Fermi distribution at zero and non –zero temperature.	4
Module-III	
Dielectric Properties: • Dielectric Material: Concept of Polarization, the relation between D, E and P, Polarizability, Electronic, Ionic, Orientation & Space charge polarization, behavior of Dielectric under alternating field, Dielectric losses. The Magnetic properties: • Magnetization M, relation between B, H & M. Bohr megneton, Diamagnetism-Larmor frequency & susceptibility, Curie law, Weiss molecular field theory & Curie-Weiss law, Hysteresis loss, Antiferromagnetism, Ferromagnetism & Ferrites (analitative).	3 4
Module-IV	

Crystal structure	
• Crystal structure- Bravais lattice, Miller indices	1
• Crystal diffraction (qualitative), Bragg's law and reciprocal lattice,Brillouin zone. (Qualitative description)	2
• Free electron theory of metal – calculation of Fermi energy, density of states.	2
• Band theory of solids- Bloch theorem, Kronig Penny model.	3
• Electronic conduction in solids-Drude's theory, Boltzmann equation, Wiedemann Frantz law.	3
• Semiconductor-Band structure, concept of electron and holes, Fermi level, density of states.	3

Text Books:

1. Perspectives of Modern Physics: A. Baiser
2. Modern Physics and Quantum Mechanics E.E. Anderson
2. Refresher course in B.Sc. Physics (Vol. III): C.L. Arora
3. Fundamentlas of Physics (Vol. III): Haliday, Resnick & Krane
4. Engineering Physics: R.K. Kar
5. Classical Mechanics: a) A.K. Roychaudhuri
   b) R.G. Takwal & P.S. Puranic
6. Quantum Mechanics: a) Eisberg & Resnic
   b) A.K. Ghatak & S. Lokanathan
   c) S.N. Ghoshal
7. Statistical Mechanics and Thermal Physics: a) Sears and Salinger
   b) Avijit Lahiri
   c) Evelyn Guha
8. Solid Sate Physics: a) A.J. Dekker
   b) C. Kittel
   c) Aschroft & Mermin
   d) S.O. Pillai

ME(EE)411: Thermal Power Engineering
Contacts : 3L
Credits : 3

Water Tube & Fire Tube boilers, Circulating Principles, Forced Circulation, Critical pressure, Superheaters, Reheaters, attemperators, induced draught, forced draught and secondary air Fans, Boiler performance analysis and heat balance. Combustion Systems, Environmental Protection – ESP, Cyclone Separator, Dust Collector etc.

Rotary Thermodynamic devices – Steam turbines & their classifications – Impulse & Reaction type Turbines, Thermodynamics of compressible fluid-flow, equation and continuity – Isentropic flow through nozzles, velocity diagram, Blade efficiency, optimum velocity ratio, multi-staging, velocity & pressure compounding, losses in turbines, erosion of turbine blades, turbine governing, performance analysis of turbine, Condensing system.
IC Engines – classification. Analysis of a standard cycle, fuel characteristic of SI & CI Engine, Combustion, Engine performance. Automotive Engine exhaust emission and their control.

Gas turbine Analysis – Regeneration - Reheating, Isentropic efficiency. Combustion efficiency.
Text:

1. P.K.Nag- Engineering Thermodynamics – TMH ,2/e
2. P K Nag- Power Plant Engg. - TMH Pub

3. P.S. Ballaney- Thermal Engineering – Khanna Pub
4. Domkundwar & Arora- Power Plant Engineering –.Dhanpat Rai & Co.

Reference:

1. Cengel --- Thermodynamics , 3/e ,TMH
2. Et-Wakil—Power Plant Engineering , MH
3. M W Zemansky & R.H.Dittman -Heat and Thermodynamics – McGraw Hill ,7/e

CH401: Basic Environmental Engineering & Elementary Biology
Contacts : 3L
Credits : 3

General

Basic ideas of environment, basic concepts, man, society & environment, their interrelationship.

1L

Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.

2L

Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function. 1L

Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.

2L

Ecology

Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. 1L

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. 2L

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. 1L

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity. 2L

Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. 1L

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. 1L

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget. 1L

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). 2L

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. 2L

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant.

Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. 2L

Smog, Photochemical smog and London smog.

Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. 1L

Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). 1L

Water Pollution and Control

Hydrosphere, Hydrological cycle and Natural water.

Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. 2L

River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. 2L

Lake: Eutrophication [Definition, source and effect]. 1L

Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L

Standard and control: Waste water standard [BOD, COD, Oil, Grease],

Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening]

Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition.

2L

Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic 1L

Land Pollution

Lithosphere; Internal structure of earth, rock and soil 1L

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.

Solid waste management and control (hazardous and biomedical waste). 2L

Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] 1L

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

Noise pollution control. 1L

Environmental Management:

Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. 2L

References/Books

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. De, A. K., "Environmental Chemistry", New Age International.

ELECTRIC MACHINE-I

EE-401 Credit: 4 3L+1T

Topic	No of periods
Module-I	
• Electromechanical Energy Conversion Principle, Singly Excited Magnetic System and Doubly Excited Magnetic system. Physical concept of torque	2

production; Electromagnetic torque and Reluctance torque. • Concept of General terms pertaining to Rotating Machines: Electrical & Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil, EMF polygon, • Distribution factor, Pitch factor. MMF produced by Distributed Windings, MMF of a coil, MMF of single phase distributed Winding, MMF waveform of Commutator machines.	2 2

Module-II

DC Machines: • EMF generated in the armature. Methods of Excitation, Armature reaction & its effect in the performance, Methods of decreasing the effects of Armature reaction, Effect of Brush shift. • Commutation process, Resistance commutation, Delayed commutation, Voltage commutation, Improvement of Commutation. • Operating Characteristics of DC Generators: Separately Excited generators, Shunt Generators, Series Generators and Compound Generators. • Torque equation of D.C motor, Operating Characteristics of Shunt, Series & Compound motors. • Losses and efficiency of DC machines, Hopkinson's and Swinburne's test. • D.C Machine application: Generator application, Motor application	3 2 2 2 2 1

Module-III

3-Phase Induction machine: • Induction motor as a Transformer, Flux and MMF phasors in Induction motors, • Equivalent circuit, Performance equations, Induction motor phasor diagram • Toque-slip characteristic, Power slip characteristic, Determination of equivalent circuit parameters. • Methods of starting of squirrel Cage and Wound rotor Motors. • Speed control of Induction motor • Polarity Test, Application of Polyphase Induction motor.	1 2 2 1 2 1

Module-IV

3-Phase Transformer: • Determination of polarity and connections (star/star, star/delta, delta/star, star/zigzag, delta/zigzag, open delta), Phasor groups. • Effect of unbalanced loading, Production of Harmonics in Transformer and its suppression, • 3 phase to 2 phase transformation, Scott connection, 3 phase to 6 phase connections, Double star and Double delta, • 3 winding transformer: Parameter estimation, application, • Parallel operation of Transformers, Introduction to Tap changing transformer and its function. • **Special Transformers:** Potential transformer, Current transformer, Pulse transformer, Audio frequency transformer, Grounding transformer, Pulse transformer.	3 1 3 2 2 2

Numerical Problems to be solved in the tutorial classes.

Text Books:

1 Electrical Machinery, P.S. Bhimra, 6th Edition, Khanna Publishers.

2 Electric machines, D.P. Kothari & I.J Nagrath, 3rd Edition, Tata Mc Graw-Hill Publishing Company Limited.
3 Electrical Machines, P.K. Mukherjee & S. Chakrabarty, Dhanpat Rai Publication.

Reference Books:

1. Electric Machinery & Transformers, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
2. Electrical Machines, R.K. Srivastava, Cengage Learning
3. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata Mc Graw Hill Edition.
4. The performance and Design of Alternating Current Machines, M.G.Say, CBS Publishers & Distributors.
5. Electric Machinery & transformer, Irving L Koskow, 2nd Edition, Prentice Hall India

ELECTRICAL & ELECTRONIC MEASUREMENT

EE-402 Credit: 3 3L

Topic	No of periods
Module-I	
Measurements:	
• Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments.	3
Analog meters:	
• General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments	3
• Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.	3
Module-II	
Instrument transformer:	
• Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors.	4
Measurement of Power:	
• Principle of operation of Electrodynamic & Induction type wattmeter. Wattmeter errors.	3
Measurement of resistance:	4
• Measurement of medium, low and high resistances, Megger.	
Module-III	

Measurement of Energy: • Construction, theory and application of AC energy meter, testing of energy meters.	3
Potentiometer: • Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer. Application.	4
AC Bridges: • Measurement of Inductance, Capacitance and frequency by AC bridges.	4

Module-IV

Cathode ray oscilloscope (CRO): • Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO.	3
Electronic Instruments: • Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator.	4
Sensors & Transducers: • Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.	3

Numerical Problems to be solved in the tutorial classes.

Text Books:

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

Reference Books:

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

Practical

Physics Lab-2
Code:PH(EE)491 PH-491
Contacts: (3P)
Credit: (2)

1. Determination of dielectric constant of a given dielectric material.
2. Determination of thermo electric power at a certain temperature of a given thermocouple.
3. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
4. Determination of Planck constant using photocell.
5. Determination of Lande'g factor using Electron spin resonance spectrometer.
6. Determination of Stefen's radiation constant.
7. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
8. Determination of Rydberg constant by studying Hydrogen –Helium spectrum.
9. Determination of Hall coefficient of semiconductor.
10. Determination of Band gap of semiconductor.
11. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

ME(EE)481: Thermal Power Engineering Lab
Contacts : 3L
Credits : 3

1. Study of Cut Models – Boilers IC Engines
   - ❖ Lanchashire Boiler
   - ❖ Bahcock & Willcox Boiler
   - ❖ Cochran Boiler
   - ❖ Vertical Tubular Boiler
   - ❖ Locomotive Boiler
   - ❖ 4S Diesel Engine
   - ❖ 4S Petrol Engine
   - ❖ 2S Petrol Engine
2. Load Test on 4 Stroke Petrol Engine & Diesel Engine by Electrical Load Box.
3. Load Test on 4 Stroke Diesel Engine by Rope Brake Dynamometer.
4. Heat Balance on 4 Stroke Diesel Engine by Rope Brake Dynamometer & by Electrical Load Box.
5. Valve Timing Diagram on 4S Diesel Engine Model & 4S Petrol Engine Model.
6. To find the Calorific Value of Diesel Fuel & Coal by Bomb Calorimeter.
7. To find the Flash Point & Fire Point of Petrol & Diesel Fuel.
8. To find the Cloud Point & Pour Point of Petrol & Diesel Fuel.
9. To find Carbon Particle Percentage in Diesel Engine Exhaust Smoke by Smokemeter and trace the BHP Vs. % Carbon Curve.
10. Measurement of the Quality of Steam – Enthalpy & Dryness fraction.

11. To find out the Boiler performance – Boiler efficiency & Steam evaporation rate.

12. To visit a Thermal Power Station & study of the followings :

a) Boiler	b) Steam pipe	c) Furnace
d) Economizer	e) Preheater	f) Steam turbines
g) Alternator	h) Water treatment plant	i) E. S. P.

ELECTRIC MACHINE LABORATORY-I

EE-491 Creidit: 2 3P

1. Study of the characteristics of a separately excited DC generator.
2. Study of the characteristics of a DC motor
3. Study of methods of speed control of DC motor
4. Study of the characteristics of a compound DC generator (short shunt).
5. Measurement of speed of DC series motor as a function of load torque.
6. Study of equivalent circuit of a single phase transformer.
7. Polarity test on a single phase transformer & study of different connections of three phase transformer.
8. Study of equivalent circuit of three phase Induction motor by no load and blocked rotor test.
9. Study of performance of wound rotor Induction motor under load.
10. Study of performance of three phase squirrel- cage Induction motor –determination of iron-loss, friction & windage loss.

Reference Books:

1. Laboratory experiments on Electrical machines, C.K. Chanda, A. Chakrabarty, Dhanpat Rai & Co.

ELECTRIC AND ELECTRONIC MEASUREMENT LABORATORY

EE-492 Credit: 2 3P

List of Experiments:

1. Instrument workshop- Observe the construction of PMMC, Dynamometer, Electrothermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2. Calibrate moving iron and electrodynamometer type ammeter/voltmeter by potentiometer.
3. Calibrate dynamometer type wattmeter by potentiometer.
4. Calibrate AC energy meter.
5. Measurement of resistance using Kelvin double bridge.
6. Measurement of power using Instrument transformer.
7. Measurement of power in Polyphase circuits.
8. Measurement of frequency by Wien Bridge.
9. Measurement of Inductance by Anderson bridge
10. Measurement of capacitance by De Sauty Bridge.
11. Measurement of capacitance by Schering Bridge.

SEMESTER – V
Theory

Economics for Engineers
HU-501
Contracts: 3L
Credits- 3

1. Economic Decisions Making – Overview, Problems, Role, Decision making process.
2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.
3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value Of Money, Debt repayment, Nominal & Effective Interest.
4. Present Worth Analysis : End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.
5. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate Of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.
6: Uncertainty In Future Events - Estimates And Their Use In Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.
7. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.
8. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life Of A New Asset, Marginal Cost, Minimum Cost Life Problems.
9. Inflation And Price Change – Definition, Effects, Causes, Price Change With Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.
10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.

Readings

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle : Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case,David B.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.Paneer Seelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

ELECTRIC MACHINE-II
EE-501

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Single Phase Induction Motor:** Construction, Double revolving field theory, Cross field theory, Starting methods, Speed-Torque characteristics, Phasor diagram, Condition of Maximum torque, Determination of equivalent circuit parameters, Testing of Single phase motors, Applications. Single phase AC series motor, Compensated and uncompensated motors.	10
2	**Synchronous machines:** Construction, Types, Excitation systems, Generator & Motor modes, Armature reaction, Theory for salient pole machine, Two reaction theory, Voltage regulation (EMF, MMF, ZPF). Operating characteristics of Alternators and their rating. Power angle characteristics of Synchronous machines. Parallel operation of Alternators, Synchronous machine connected to infinite bus, effect of change of excitation and speed of prime mover. Starting of Synchronous motor, V-curve. Damper winding, Hunting. Short circuit transients. Applications.	20
	Special Electromechanical devices: Principle and construction of switched Reluctance motor,	

3	Permanent magnet machines, Brushless DC machines, Hysteresis motor, Stepper motor, Tacho generators, Synchros & resolvers. AC servo motors, Principle, construction and operational characteristics of Induction generator & linear Induction motor.	10

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Electrical Machinery, P.S. Bhimra, Khanna Publishers.
2. Electrical Machines, Nagrath & Kothary, TMH
3. Electrical Machines, Theory & Applications, M.N. Bandyopadhyay, PHI

Reference Books:

1. Electric Machinery & Transformer, Bhag S. Guru and H.R. Hiziroglu, 3rd Edition, Oxford University press.
2. Electric Machinery & Transformes, Irving L. Kosow, PHI
3. Electric Machinery, A.E.Fitzgerald, Charles Kingsley,Jr. & Stephen D. Umans, 6th Edition, Tata McGraw Hill Edition.
4. Electrical Machines, R.K. Srivastava, Cengage Learning
5. Theory of Alternating Current Machinery, Alexander S Langsdorf, Tata Mc Graw Hill Edition
6. The performance and Design of Alternating Current Machines, M.G.Say, CBS publishers & distributors.
7. Problems in Electrical Engineering, Parker smith, 9th Edition, CBS publishers & distributors.
8. Electric Machines, Charles A. Gross, CRC press.

ELECTRIAL MACHINES-II LABORATORY
EE-591

Credit: 2 **3P**

1. Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer & Star-Delta]
2. Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltage control & frequency control].
3. Speed control of 3 phase slip ring Induction motor by rotor resistance control.
4. Determination of regulation of Synchronous machine by

a. Potier reactance method.
b. Synchronous Impedance method.

5. Determination of equivalent circuit parameters of a single phase Induction motor.
6. Load test on single phase Induction motor to obtain the performance characteristics.
7. To determine the direct axis resistance [X_d] & quadrature reactance [X_q] of a 3 phase synchronous machine by slip test.
8. Load test on wound rotor Induction motor to obtain the performance characteristics.
9. To make connection diagram to full pitch & fractional slot winding of 18 slot squirrel cage Induction motor for 6 poles & 4 pole operation.
10. To study the performance of Induction generator.
11. Parallel operation of 3 phase Synchronous generators.
12. V-curve of Synchronous motor

POWER SYSTEM-I
EE-502

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Overhead transmission line:** Choice of frequency, Choice of voltage, Types of conductors, Inductance and Capacitance of a single phase and three phase symmetrical and unsymmetrical configurations. Bundle conductors. Transposition. Concept of GMD and GMR. Influence of earth on conductor capacitance. **Overhead line construction:** Line supports, Towers, Poles, Sag, Tension and Clearance, Effect of Wind and Ice on Sag. Dampers.	12
	Insulators: Types, Voltage distribution across a suspension insulator string, String efficiency, Arching shield & rings, Methods of improving voltage distribution across Insulator strings, Electrical tests on line Insulators. **Corona:** Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential, Corona loss, advantages & disadvantages of Corona. Methods of reduction of Corona.	10

2	**Cables:** Types of cables, cable components, capacitance of single core & 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle.	
3	**Performance of lines:** Short, medium (nominal π, T) and long lines and their representation. A.B.C.D constants, Voltage regulation, Ferranti effect, Power equations and line compensation, Power Circle diagrams.	8
4	**Generation of Electric Power:** General layout of a typical coal fired power station, Hydro electric power station, Nuclear power station, their components and working principles, comparison of different methods of power generation. Introduction to Solar & Wind energy system. **Tariff:** Guiding principle of Tariff, different types of tariff. **Indian Electricity Rule-1956:** General Introduction.	10

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Electrical Power System, Subir Roy, Prentice Hall
2. Power System Engineering, Nagrath & Kothery, TMH
3. Elements of power system analysis, C.L. Wodhwa, New Age International.
4. Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors

Reference Books:

1. Electric Power transmission & Distribution, S.Sivanagaraju, S.Satyanarayana, Pearson Education.
2. A Text book on Power system Engineering, Soni, Gupta, Bhatnagar & Chakrabarti, Dhanpat Rai & Co.
3. Electric Power distribution system Engineering, 2nd Edition, T. Gonen, CRC Press.
4. www.powermin.nic.in/acts_notification/pdf/ier**1956**.pdf

POWER SYSTEM-I LABORATORY
EE-592

Credit: 2 **3P**

1. Determination of the generalized constants A.B, C, D of long transmission line.
2. Simulation of DC distribution by network analyzer.
3. Measurement of earth resistance by earth tester.
4. Dielectric strength test of insulating oil.
5. Determination of breakdown strength of solid insulating material.
6. Different parameter calculation by power circle diagram
7. Study of different types of insulator.
8. Active and reactive power control of alternator.
9. Study and analysis of an electrical transmission line circuit with the help of PSPICE.
10. Dielectric constant, tan delta, resistivity test of transformer oil.

CONTROL SYSTEM-I
EE-503

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Introduction to control system:** Concept of feedback and Automatic control, Effects of feedback, Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Types of control systems, Servomechanisms and regulators, examples of feedback control systems. Transfer function concept. Pole and Zeroes of a transfer function. Properties of Transfer function. **Mathematical modeling of dynamic systems:** Translational systems, Rotational systems, Mechanical coupling, Liquid level systems, Electrical analogy of Spring–Mass-Dashpot system. Block diagram representation of control systems. Block diagram algebra. Signal flow graph. Mason's gain formula. **Control system components:** Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tacho-generators. Actuators. Block diagram level description of feedback control systems for position control, speed control of DC motors, temperature control, liquid level control, voltage control of an Alternator.	14
	Time domain analysis: Time domain analysis of a standard second order closed loop system. Concept	

2	of undamped natural frequency, damping, overshoot, rise time and settling time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on transient response. Stability by pole location. Routh-Hurwitz criteria and applications. **Error Analysis:** Steady state errors in control systems due to step, ramp and parabolic inputs. Concepts of system types and error constants.	10
3	**Stability Analysis:** Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros. **Frequency domain analysis of linear system:** Bode plots, Polar plots, Nichols chart, Concept of resonance frequency of peak magnification. Nyquist criteria, measure of relative stability, phase and gain margin. Determination of margins in Bode plot. Nichols chart. M-circle and M-Contours in Nichols chart.	12
4	**Control System performance measure:** Improvement of system performance through compensation. Lead, Lag and Lead- lag compensation, PI, PD and PID control.	4

Numerical problems to be solved in the tutorial classes.

Text books:

1. Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education.
2. Control System Engineering, I. J. Nagrath & M. Gopal. New Age International Publication.
3. Control System Engineering, D. Roy Choudhury, PHI
4. Automatic Control Systems, B.C. Kuo & F. Golnaraghi, 8th Edition, PHI

Reference Books:

1. Control Engineering Theory & Practice, Bandyopadhyaya, PHI
2. Control systems, K.R. Varmah, Mc Graw hill
3. Control System Engineering, Norman Nise, 5th Edition, John Wiley & Sons
4. Modern Control System, R.C. Dorf & R.H. Bishop, 11th Edition, Pearson Education.
5. Control System Design, C. Goodwin Graham, F. Graebe F. Stefan, Salgado. E. Mario, PHI
6. Modeling & Control of dynamic system, Macia & Thaler, Thompson
7. Modern Control Technology Components & Systems, 3rd edition, C.T Kilian, Cengage Learning.
8. Modern Control Engineering, Y. Singh & S. Janardhanan, Cengage Learning
9. Control System Engineering, R. Anandanatarajan & R. Ramesh Babu, , SCITECH
10. Automatic Control system, A. William, Wolovich, Oxford

CONTROL SYSTEM-I LABORATORY
EE-593

Credit: 2 **3P**

1. Familiarization with MAT-Lab control system tool box, MAT-Lab- simulink tool box & PSPICE
2. Determination of Step response for first order & Second order system with unity feedback on CRO & calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response.
3. Simulation of Step response & Impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB & PSPICE.
4. Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for 2nd order system & determination of different control system specification from the plot.
5. Determination of PI, PD and PID controller action of first order simulated process.
6. Determination of approximate transfer functions experimentally from Bode plot.
7. Evaluation of steady state error, setting time , percentage peak overshoot, gain margin, phase margin with addition of Lead

Reference Books:

1. Matlab & Simulink for Engineers, Agam Kumar Tyagt, Oxford
2. Modeling & Simulatrion using Matlab-Similink, Dr. S. Jain, Wiley India
3. Matlab & its application in Engineering, Raj K Bansal, A.K. Goel & M.K. Sharma, Pearson
4. MATLAB programming for Engineers, S.J. Chapman, 3rd Edition, Cengage.

DATA STRUCTURE & ALGORITHM
EE-504A

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Importance of study of Data structure**,** Concept of data structure: Data and data structure, Abstract data type and data type. Algorithm and programs, Basic idea of pseudo-code, Algorithm efficiency and analysis, time and space analysis of algorithms-order notations. Different representation: row major, column major. Sparse matrix, its implementation and usage. Array representation of polynomials. Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.	08
2	**Stack & queue:** Stack and its implementation, (using array, using linked list) application. Queues, circular queue, dequeue, Implementation of queue- both linear and circular (using array, using linked list) applications. **Recursion:** Principle of recursion- use of stack, difference between recursion and iteration, tail recursion. Application-The Tower of Hanoi, Eight Queen Puzzle.	07
3	**Nonlinear data structure:** **Trees:** Basic terminologies, forest, tree representation (using array, using linked list). Basic trees, binary tree traversal (Pre-,in-,post-order), threaded binary tree(left, right, full), non recursive traversal algorithm using threaded binary tree, expression tree. Binary search tree-operations (creation, insertion, deletion, searching), Height balanced binary tree-AVL tree (insertion, deletion with examples only). B tree orations ((insertion, deletion with examples only) **Graph:** Graph definition and concept, (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut vertex /articulation point, pendant node, clique, complete graph, connected –strongly connected component, weakly connected component-path, shortest path, isomorphism. Graph representation/storage implementation- adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity- Depth First Search (DFS), Breadth-First Search (BFS), concept of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge, application. Minimal spanning tree-Prim's algorithm (Basic idea of greedy methods)	15
4	**Searching, Sorting:** Sorting algorithm, Bubble sort and optimization, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (Concept, of max heap, application-priority queue, radix sort. Searching, sequential search, binary search, interpolation search. Hashing, Hashing functions, collision resolution techniques.	10

Text Books:

1. Data structure using C, Reema Thareja, Oxford.
2. Data structure, S.Lipschutz.
3. Data structure and program design in C, Robert L Krusse, B.P.Leung

Reference Books:

1. Data structure using C++, Varsha H. Patil, Oxford

DATA STRUCRURE & ALGORITHM LABORATORY
EE- 594A

CREDIT: 2 **3P**

1. Implementation of array operation
2. Stack and queue: adding, deleting elements. Circular Queue: adding & deleting elements, Merging problems .
3. Evaluation of expression operation on multiple stack & queues.

4. Implementation of linked lists, inserting, deleting, inverting a linked list, implementation of stacks & queue using linked list.
5. Polynomial addition, Polynomial multiplication
6. Sparse Matrices, Multiplication, addition
7. Recursive and Nonrecursive traversal of Trees
8. Threaded binery tree traversal. AVL tree implementation.
9. Application of Trees. Application of sorting and searching algorithm.
10. Hash tables implementation, searching, inserting and deleting, searching & sorting techniques.

Experiments mentioned above are not exhaustive. More experiments may be conducted.

COMPUTER ORGANIZATION
EE-504B

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	Basic organization of the stored program in computer and operation sequence for execution of a program. Role of operating systems and compiler/ assembler. Fetch, decode and execute cycle. Concept of operator, operand, registers and storage. Instruction format. Instruction sets and addressing modes. Commonly used number systems. Fixed and floating point representation of numbers.	10
2	Overflow and underflow. Design of address- ripple carry and carry look ahead principles. Design of ALU Fixed point multiplication-Booth's algorithm Fixed point division-Restoring and non restoring algorithms. Floating point-IEEE 754 standard.	10
3	Memory unit design with special emphasis on implementation of CPU-memory interfacing. Memory organization. Static and dynamic memory, memory hierarchy, associative memory. Cache memory. Virtual memory. Data path design for read/write access.	10
4	Design of control unit-hardwired and micro programmed control. Introduction to instruction pipelining. Introduction to RISC architecture, RISC vs. CISC architecture. I/O operations-Concepts of handshaking. Polled I/O, Interrupt and DMA.	10

Text Books:

1. Computer System architecture, M.M. Mano, PHI
2. Computer Architecture, P. Behrooz, Oxford University Press.

Reference Books:

1. Computer Architecture & Organization, J.P. Hayes, Mc Graw Hill.
2. Computer Organization, Hamacher, Mc Graw Hill.
3. Computer Organization & design, P. Pal Chaudhuri, PHI
4. Computer Organization & Architecture, P. N. Basu, Vikas Pub.

COMPUTER ORGANIZATION
EE-594B

Credit: 2 **3P**

1. Familiarity with IC chips e.g.
   (a) Multiplexer
   (b) Decoder
   (c) Encoder
   (d) Comparator

   Truth table verification and clarification from Data-book.
2. Design an Adder/Sub tractor composite unit.
3. Design a BCD adder
4. Design of a Carry-Look-Ahead Adder circuit.
5. Use of a multiplexer unit to design a composite ALU.
6. Use of an ALU chip for multibit arithmetic operation.

7. Implementations of read write operation using RAM IC.
8. Cascade two RAM ICs for vertical and horizontal expansion.

MICROPROCESSOR & MICROCONTROLLER
EE-504C

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction to Computer architecture:** Architecture of a typical Microprocessor**,** Bus configuration, The CPU module, ROM & RAM families, Introduction to assembly language & machine language programming, Instruction set of typical microprocessor (e.g. 8085), Subroutine & stack, Timing diagram, Memory Interfacing, Interfacing input output- port, Interrupt & interrupt handling, Serial & parallel data transfer scheme, Programmed & interrupt driven data transfer, Direct memory access, Programmable peripheral devices, Programmable interval timer, Analog input-output using AD & DA converter.	23
2	**Assembly language programme of a typical Microprocessor:** Use of compilers, assembler, linker & debugger.	5
3	**Basic 16 bit Microprocessor (e.g. 8086):** Architecture, Min-max mode.	4
4	Introduction to microcontroller: Architecture & instruction set of a typical microcontroller (e.g. PIC16F84 device), Feature of popular controller (processor 8031/8051), its programming & interfacing.	8

Text Books:

1. Microprocessor architecture, programming & application with 8085, R. Gaonker, Penram International.
2. Advanced Microprocessors and Peripheral, Ajay Kumar Ray, Koshor M Bhurchandi, Tata MC Graw hill Publishing Company.
3. Microprocessor & Interfacing, D.V. Hall, Mc Graw Hill.
4. The 8051 microcontroller, Ayala, Thomson.

Reference Books:

1. Advanced Microprocessors, Y. Rajasree, New Age international Publishers.
2. An introduction to the Intel family of Microprocessors, James L. Antonakos, Pearson Education,
3. The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi & J. G. Mazidi, Pearson Education.
4. The 8086 Microprocessors: Programming & Interfacing the PC, K.J.Ayala, Thomson.
5. Microprocessor & Peripherals, S.P. Chowdhury & S. Chowdhury, Scitech.
6. Microchip technology data sheet, www.microchip.com

MICROPROCESSOR & MICROCONTROLER LABORATORY
EE-594C

Credit: 2 **3P**

1. Familiarization with 8085 register level architecture and trainer kit components including the memory map. Familiarization with process of storing and viewing the contents of memory as well as registers.
2. (a) Study of prewritten program on trainer kit using the basic instruction set (data transfer, load/store, arithmetic, logical)
   (b) Assignment based on that.
3. (a) Familiarization with 8085 simulator on PC
   (b) Study of prewritten program using basic instruction set (data transfer, load/store, arithmetic, logical).
   (c) Assignment based on that.
4. Programming using kit/simulator.
   (a) Lookup table
   (b) Copying a block of memory
   (c) Shifting a block of memory.
   (d) Packing and unpacking of BCD numbers.

(e) Addition of BCD number
(f) Binary to ASCII conversion
(g) String matching

5. Program using subroutine calls and using IN/OUT instruction using 8255 PPI on the trainer kit e.g. subroutine for delay, reading switch state and glowing LEDs accordingly, finding out frequency of pulse train etc.
6. Interfacing any 8 bit latch (74LS373) with trainer kit as a peripheral mapped output port with absolute address decoding.
7. Interfacing with I/O module :
   (a) ADC
   (b) Speed control of DC motor with DAC
   (c) Keyboard
   (d) Multi digit display with multiplexing.
   (e) Stepper motor
8. Study of 8031/8051 Micro controller kit and writing program for the following task using the kit
   (a) table look up
   (b) basic arithmetic and logical operation
   (c) interfacing of keyboard and stepper motor.

SEMESTER – VI

PRINCIPLE OF MANAGEMENT
HU-601

Credit: 2 **Contact: 2L**

Module	Content	Hour
1	**Basic concepts of management**: Definition – Essence, Functions, Roles, Level. **Functions of Management**: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organization Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organizational Effectiveness.	05
2	**Management and Society** – Concept, External Environment, CSR, Corporate Governance, Ethical Standards. **People Management** – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. **Managerial Competencies** – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship	05
3	**Leadership:** Concept, Nature, Styles. **Decision making**: Concept, Nature, Process, Tools & techniques. **Economic, Financial & Quantitative Analysis** – Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Interference, Forecasting, Regression Analysis, Statistical Quality Control.	05
4	**Customer Management** – Market Planning & Research, Marketing Mix, Advertising & Brand Management. **Operations & Technology Management** – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.	05

Text Books:

1. Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).
2. Essentials for Management – Koontz, Revised edition, Tata McGraw Hill (TMH)
3. Management – Stoner, James A. F. (Pearson)
4. Management - Ghuman, Tata McGraw Hill(TMH)

CONTROL SYSTEM-II
EE-601

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**State variable model of continuous dynamic systems:** Converting higher order linear differential equations into State Variable (SV) form. Obtaining SV model from Transfer Function. Obtaining characteristic equation and transfer functions from SV model. Obtaining SV equation directly for R-L-C and spring-mass-dashpot systems. Concept and properties associated with state equations. Linear transformations on state variables. Canonical forms of SV equations. Companion forms. Solutions of state equations. State transition matrix, properties of state transition matrix. Controllability and Observability. Linear state variable feedback controller, the pole allocation problems. Linear system design by state variable feedback.	15
2	**Analysis of discrete time (sampled data) systems using Z-transform:** Difference equation. Inverse Z transforms. Stability and damping in Z domain. Practical sampled data systems and computer control system. Practical and theoretical samplers. Sampling as Impulse modulation. Sampled spectra and aliasing. Anti-aliasing filters. Zero order hold. Approximation of discrete (Z-domain) controllers with ZOH by Tustin transform and other methods. State variable analysis of sampled data system. Digital compensator design using frequency response.	10
3	**Introduction to nonlinear systems:** Block diagram and state variable representation of nonlinear systems. Characteristics of common nonlinearities. Phase plane analysis of linear and nonlinear second order systems. Methods of obtaining phase plane trajectories by graphical method, isoclines method. Qualitative analysis of simple control systems by phase plane methods. Describing function analysis. Limit cycles in nonlinear systems. Prediction of limit cycles using describing function technique. Stability concepts for nonlinear systems. BIBO Vs state stability. Definitions of Lyapunov functions. Lyapunov analysis of LTI systems, Asymptotic stability, Global asymptotic stability. The first and second methods of Lyapunov to analyze nonlinear systems.	15

Problems based on the topics to be solved in the tutorial classes

Text Books:

1. Control System Engineering, D. Roy Chowdhuri, PHI
2. Control system Engineering, I.J. Nagrath & M. Gopal, New Age International.
3. Digital Control & State Variable Methods, M. Gopal, 2nd Edition, TMH
4. Introduction to Control Systems, D.K. Anand & R.B. Zmood , 3rd Edition, (Butterworth-Heinemann) Asian Books.

. **Reference Books:**

1. Control System Design, Goodwin, Pearson Education.
2. Nonlinear Control system, J.E. Gibson, Mc Graw Hill Book Co.
3. Control theory & Practice, M.N. Bandyopadhyaya, PHI
4. Digital Control system, B.C. Kuo, Oxford University Press.
5. Digital Control System, C.H. Houpis, Mc Graw Hill International.
6. Discrete Time control system, K. Ogata, Prentice Hall, 1995
7. Sampled Data Control system, E.I. Jury, John Wiley & Sons Inc.
8. System Dynamics and Control, Eronini Umez, Eronini, Thomson
9. Modern Control system, R.C. Dorf & R.H. Bishop, Pearson Education
10. Control Engineering, Ramakalyan, Vikas
11. Control System R\Engineering, A. Natarajan Reddy, Scitech
12. Control System Theory with Engineering Application, Lyshevski, Jaico

POWER SYSTEM-II
EE-602

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Representation of Power system components:** Single-phase representation of balanced three phase networks, the one-line diagram and the impedance or reactance diagram, per unit (PU) system.	02
2	**Distribution substation:** Types of substations, location of substations, substation equipments and accessories, earthling (system & equipment), feeder and distributors, radial and loop systems.	06
3	**Load flow studies:** Network model formulation, formation of Y_{bus} , load flow problem, Gauss-Siedel method, Newton-Raphson method, Decoupled load flow studies, comparison of load flow methods.	08
4	**Faults in Electrical systems:** Transient on a transmission line, short circuit of a synchronous machine under no load & loaded condition. Symmetrical component transformation, sequence impedance and sequence network of power system, synchronous machine, transmission lines and transformers. Symmetrical component analysis of unsymmetrical faults, single line-to –ground fault, line-to-line fault, double line-to- ground fault.	08
5	**Power system stability:** Steady state stability, transient stability, equal area criteria, swing equation, multi machine stability concept,	04
6	**Power system protection:** Protective zones, Relaying elements and quantities. Protective relays, basic requirements and type of protection, phase and amplitude comparator, grading (time & current), classification of Electromagnetic relays, Directional relay, Distant relay, Differential relay, basic aspects of static and digital relays, relay protection scheme for transformer, feeder, generators and motors. Circuit breakers, circuit breaking transients, transient recovery voltage, current chopping and resistance switching, circuit breaker rating, arc and arc extinction, circuit breaker types, oil circuit breaker, vacuum circuit breaker, air blast circuit breaker, SF_6 circuit breaker and operating mechanism, advantages and disadvantages of different types.	16

Problems based on the topics to be solved in the tutorial classes

Text Books:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Electrical Power Systems, Subir Ray, PHI
3. Switchgear protection and power systems, Sunil S Rao, Khanna Publications.
4. A text book on Power System Engineering, M.L.Soni, P.V.Gupta, U.S. Bhatnagar & A. Chakrabarti, Dhanpat Rai & CO.

Reference Books:

1. Protection & Switchgear, B. Bhalja, R.P. Maheshwari, N.G.Chothani, Oxford.
2. Power system protection & switchgear, B.Ram & D.N. Vishwakarma, Tata McGraw Hill.
3. Handbook of Electrical Power Distribution, G. Ramamurthy, University Press
4. Electric Power Transmission and Distribution, S. Sivanagaraju, S.Satyanarayana, Pearson Education.
5. Power Systems Stability, Vol. I,II & II, E.W. Kimbark, Wiley.
6. Power Engineering, D.P Kothari & I.J. Nagrath, Tata McGraw Hill.
7. Power Systems Analysis, A. R. Bergen & V. Vittal, Pearson Education.
8. Computer Aided Power systems analysis, Dr. G. Kusic, CEC press.

POWER ELECTRONICS
EE-603

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour

1	**Introduction:** Concept of power electronics, application of power electronics, uncontrolled converters, advantages and disadvantages of power electronics converters, power electronics systems, power diodes, power transistors, power MOSFETS, IGBT and GTO.	04
2	**PNPN devices:** Thyristors, brief description of members of Thyristor family with symbol, V-I characteristics and applications. Two transistor model of SCR, SCR turn on methods, switching characteristics, gate characteristics, ratings, SCR protection, series and parallel operation, gate triggering circuits, different commutation techniques of SCR.	05
3	**Phase controlled converters:** Principle of operation of single phase and three phase half wave, half controlled, full controlled converters with R, R-L and RLE loads, effects of free wheeling diodes and source inductance on the performance of converters. External performance parameters of converters, techniques of power factor improvement, single phase and three phase dual converters.	06
4	**DC-DC converters:** Principle of operation, control strategies, step up choppers, types of choppers circuits based on quadrant of operation, performance parameters, multiphase choppers and switching mode regulators.	05
5	**Inverters:** Definition, classification of inverters based on nature of input source, wave shape of output voltage, method of commutation & connections. Principle of operation of single phase and three phase bridge inverter with R and R-L loads, performance parameters of inverters, methods of voltage control and harmonic reduction of inverters. Brief idea of Resonant Pulse inverters.	10
6	**AC controllers:** Principle of on-off and phase control, single phase and three phase controllers with R and R-L loads. Principle of operation of cycloconverters, circulating and non circulating mode of operation, single phase to single phase step up and step down cycloconverters, three phase to single phase Cycloconverters, three phase to three phase Cycloconvetter.	06
7	**Applications:** Speed control of AC and DC motors. HVDC transmission. Static circuit breaker, UPS, static VAR controller.	04

Problems based on the topics to be solved in the tutorial classes

Text Books:

1. Power Electronics, M.D. Singh and K.B. Khanchandani, Tata Mc Graw Hill. 2007
2. Power Electronics, V.R. Moorthi, Oxford, 2005
3. Power Electronics, M.H. Rashid, PHI, 3rd Edition
4. Power Electronics, P.S. Bhimra, Khanna Publishers, 3rd Edition.

Reference Books:

1. Modern Power Electronics & AC drives, B.K. Bose, Prentice Hall
2. Power Electronics, Mohan,Undeland & Riobbins, Wiley India
3. Element of power Electronics, Phillip T Krein, Oxford, 2007
4. Power Electronics systems, J.P. Agarwal, Pearson Education, 2006
5. Power Electronics, M.S. Jamal Asgha, PHI, 2007
6. Analysis of Thyristor power conditioned motor, S.K. Pillai, University Press.
7. Power Electronics : Principles and applications, J.M. Jacob, Thomson

SOFTWARE ENGINEERING
EE-604(a)

Credit: 3 **Contact: 3L**

Module	Content	Hour

1	**Overview of system analysis & design**: Business system concept, System development life cycle, waterfall model, Spiral Model, Feasibility Analysis, Technical feasibility, Cost-benefit Analysis, COCOMO model.	10
2	**System design:** Context diagram and DFD, Problem partitioning, Top down and bottom up design, decision tree, decision table and structured English, Functional Vs object oriented approach.	05
3	**Testing:** Levels of testing, Integration testing, Test case specification, Reliability assessment, Validation & Verification metrics, Monitoring & control	08
4	**System project management:** Project scheduling, Staffing, software configuration management, Quality assurance, Project monitoring.	07
5	**Fundamentals of Object oriented design in UML:** Static and dynamic models, necessity of modeling, UML diagrams, Class diagrams, Interaction diagrams, Collaboration diagram, Sequence diagram, State chart diagram, Activity diagram, Implementation diagram.	10

Text Books:

1. Software Engineering, R.G. Pressman, TMH
2. Software Engineering Fundamental, Behforooz, OUP
3. Software Engineering, Ghezzi, PHI

Reference Books:

1. An integrated approach to Software Engineering, Pankaj Jalote, Narosa
2. Software quality, Benmenachen, Vikas
3. IEEE standard on Software Engineering.
4. Software defect Prevention, Kane, SPD.
5. Essentials of Software Engineering, Uma, Jaico

DATA BASE MANAGEMENT SYSTEM
EE-604 (b)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Concept & Overview of DBMS, Data model, Database language, Database administrator, Database users, Three Schema architecture of DBMS.	04
2	**Entity-Relationship Model:** Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity sets, Extended E-R features.	05
3	**Relational Model:** Structure of relational Databases, Relational Algebra, Relational; calculus, Extended Relational Algebra operations, Views, Modification of the Database.	05
4	**SQL and Integrity Constraints:** Concept of DDL, DML, DCL. Basic structure, Set operations, Aggregate functions, Null values, Domain constraints, Referential integrity, Constraints, assertions, views, Nested sub queries, Data base security application development using SQL, Stored procedures and triggers.	06
5	**Relational Database design:** Functional dependency, Different anomalies in designing a Database, Normalization using functional dependencies, Decomposition, Boyce-Codd normal form, 3NF, Normalization	09

	using multi-valued dependencies, 4NF, 5 NF.	
6	**Internal of RDBMS:** Physical data structures, Query optimization: join algorithm, statistics and cost base optimization, Transaction processing, Concurrency control and recovery management: transaction model properties, state serializability, look base protocols, two phase locking.	06
7	**File organization & index structures** File & records concepts, Placing file records on disk, Fixed and variable sized recotds, Types of single –Level index (primary. Secondary, clustering), Multilevel Indexes, Dynamic multilevel indexes using B tree and B+ tree.	05

Text Books:

1. Database System Concepts, F. Henry & Abraham Silderscharz, Mc Graw Hill.
2. Database Management system, Ramakrishnan, Mc Graw Hill.
3. Principles of Database Systems, J.D. Ullman, Galgotia Publication.

Reference Books:

1.Principles of Database Management Systems. Martin James. PHI.
2. Database management Systems, A.K. Majumder & Pritimay bhattacharjya, Tata Mc Graw Hill.

OBJECT ORIENTED PROGAMMING
EE-604(c)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Object oriented Design:** Concept of Object oriented programming language, Major and minor elements, Object, Class, relationship among objects, aggregation, links, relationship among classes-association, aggregation using instantiation, meta-class, grouping constructs.	10
2	**Object oriented concept:** Difference between OOP and other conventional programming, advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism.	04
3	**Basic concepts of Object oriented programming using Java:** Class & Object properties: Basic concepts of Java programming-advantages of Java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested and inner classes, basic string handling concepts, -String (discuss char(), compare(), equals(), equalsIgnorecase(), indexOf(), length(), substring(), toCharArray(),toLowercCase(), tostring(), methods), concept of mutable and immutable string, command line arguments, basics of I/O operations-keyboard input using BufferedReader & Scanner classes. Reusability properties: Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of abstract classes, & methods, interfaces. Creation of packages, importing packages, member access for packages. Exception handling & Multithreading : Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread synchronization, inter thread communication, deadlocks for threads, suspending & resuming threads.	26

	Applet Programming (using swing): Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applet in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.	

Text Books:

1. Object Oriented Modeling and design, James Rambaugh & Michael Blaha, PHI.
2. Object Oriented Programming with C++ and Java, D. Samanta, PHI
3. Programming with Java: A Primer, E. Balagurusamy, TMH.

Reference Books:

1. Object oriented system Development, Ali Bahrami, Mc Graw Hill.
2. The complete reference Java2, Patrick Naughton & Herbert Schildt, TMH

EMBEDDED SYSTEMS
EE-604(d)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction to Embedded systems:** Introduction – Features – Microprocessors – ALU - Von Neumann and Harvard Architecture - CISC and RISC - Instruction pipelining. Microcontroller: characteristics and Features, Overview and architectures of Atmel 89C52 and Microchip PIC16F877 and 18F452. Examples of embedded Systems: Bar-code scanner, Laser printer, Underground tank monitoring.	10
2	**PIC Microcontroller:** PIC Microcontrollers: 16F877 Architecture and Instruction Set. External Interrupts, Timers, watch-dog timer, I/O port Expansion, analog-to-digital converter, UART, I2C and SPI Bus for Peripheral Chips, Accessories and special features	08
3	**Software architecture and RTOS:** Software Architecture: Round Robin- Round Robin with interrupts -Function Queue. Scheduling Architecture RTOS: Architecture -Tasks and Task States -Tasks and Data -Semaphores and Shared Data - Message Queues -Mail Boxes and pipes -Timer Functions -Events -Memory Management Interrupt Routines	08
4	**Basic design using a real time operating system:** Overview. General principles. Design of an embedded system.	6
5	**Software development tools and debugging techniques:** Development Tool: Cross-Compiler, Cross-Assemblers, Linker/locator. PROM Programmers, ROM Emulator, In-Circuit Emulators. Debugging Techniques. Instruction set simulators. The assert macro. Testing using laboratory tools.	08

Text Books:

1. Embedded Systems Architecture, Programming and Design, Ral KamalTMH, 2008.
2. An Embedded Software Primer, D.E. Simon. Pearson Education, 1999.
3. Design with PIC Microcontrollers, J.B. Peatman,Pearson Education, 1998

Reference Books:
1. Embedded Systems Design, Heath Steve, Second Edition-2003, Newnes,
2. Computers as Components; Principles of Embedded Computing System Design, Wayne Wolf Harcourt India, Morgan Kaufman Publishers, First Indian Reprint. 2001.
3. Embedded Systems Design – A unified Hardware /Software Introduction, Frank Vahid and Tony Givargis, John Wiley, 2002.

DIGITAL SIGNAL PROCESSING
EE-605(a)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Discrete-time signals:** Concept of discrete-time signal, basic idea of sampling and reconstruction of signal, sampling theorem, sequences,-periodic, energy, power, unit-sample, unit step, unit ramp & complex exponentials, arithmetic operations on sequences. **LTI systems:** Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non recursive systems.	10
2	**Discrete Time Fourier Transform(DTFT):** Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain**.** **Z- Transforms:** Definition, mapping between s-plane & z-plane, unit circle, convergence and ROC, properties of Z-transform, Z-transform on sequences with examples & exercises, characteristic families of signals along with ROC, convolution, correlation and multiplication using Z- transform, initial value theorem, Perseval's relation, inverse Z-transform by contour integration, power series & partial-fraction expansions with examples and exercises. **Discrete Fourier Transform:** Concept and relations for DFT/IDFT, Relation between DTFT & DFT. Twiddle factors and their properties, computational burden on direct DFT, DFT/DFT as linear transformation, DFT/IDFT matrices, computation of DFT/IDFT by matrix method, multiplication of DFTs, circulation convolution, computation of circular convolution by graphical, DFT/IDFT and matrix methods, linear filtering using DFT, aliasing error, filtering of long data sequences-Overlap-Save and Overlap-Add methods with examples and exercises. **Fast Fourier Transforms:**	15

	Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.	
3	**Filter design:** Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transform, design of linear phase FIR filters no. of taps, rectangular, Hamming and Blackman windows. Effect of quantization.	07
4	**Digital Signal Processor:** Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs in assembly Language. **FPGA:** Architecture, different sub-systems, design flow for DSP system design, mapping of DSP alrorithms onto FPGA.	08

Numerical problems to be solved

Text Books:

1. Digital Signal Processing-A computer based approach, S. Mitra, TMH
2. Digital Signal Processing: Principles, Algorithms & Application, J.C. Proakis & M.G. Manslakis, PHI
3. Fundamental of Digital Signal Processing using MATLAB , Robert J. Schilling, S.L. Harris, Cengage Learning.
4. Digital Signal Processing-implementation using DSP microprocessors with examples from TMS320C54XX, Avtar Singh & S. Srinivasan, Cengage Leasrning

Reference Books:

1. Digital Signal Processing, Chen, OUP
2. Digital Signal Processing, Johnson, PHI
3. Digital Signal Processing using MATLAB, Ingle, Vikas.
4. Digital Signal Processing, Ifeachor, Pearson Education.
5. Digital Signal Processing, A.V. Oppenhein & R.W. Shaffer, PHI
6. Theory and application of Digital Signal Processing, L.R. Rabiner & B. Gold, PHI
7. Digital Signal Processing, Ashok Ambarder, Cengage Learning.
8. Digital Signal Processing, S. Salivahanan, A. Vallavaris & C. Gnanpruja, TMH.
9. Xilinx FPGA user manual and application notes.

COMMUNICATION ENGINEERING
EE-605(b)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Elements of communication system:** The elements of a communication system, origin of noise and its effect, importance of SNR in system design. Basic principle of linear (AM) modulation, Generation of AM waves, Demodulation of AM wave. Basic principle of nonlinear (FM, PM) modulation. Generation of FM waves. Demodulation of FM waves. Sampling theorem, sampling rate, impulse sampling, reconstruction from samples, Aliasing. Analog pulse modulation-PAM (natural & flat topped sampling), PWM, PPM. Basic concept of Pulse code modulation, Block diagram of PCM, Multiplexing-TDM, FDM.	12
	Digital transmission: Concept of Quantization & Quantization error, Uniform quantizer, Non-uniform quantizer,	08

2	A-law and μ-law. Encoding, coding efficiency. Line coding & properties, NRZ & RZ, AMI, Manchester coding, PCM, DPCM. Base band pulse transmission, Matched filter, error rate due to noise, ISI, Raised cosine function, Nyquist criterion for distortion-less base band binary transmission, Eye pattern, Signal power in binary digital signal.	
3	**Digital carrier modulation & demodulation technique:** Bit rate, Baud rate, Information capacity, Shanon's limit, M-ary encoding, Introduction to the different digital modulation techniques-ASK.FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK. Introduction to QAM, basic of 8 QAM, 16 QAM. Basic concept of Delta modulating, Adaptive delta modulation. Introduction to the concept DPCM. Basic concept of spread spectrum modulation.	12
4	**Introduction to coding theory:** Introduction, News value & Information content, Entropy, Mutual information, Information rate, Shanon-Fano algorithm for encoding, Shanon's theorem- source coding theorem, Channel coding theorem, Information capacity theorem. Basic principle of Error control & coding.	8

Numerical problems to be solved in the class.

Text Books:

1. An Introduction to Analog and Digital communication, Simon Haykin, Wiely India.
2. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
3. Principle of digital communication, P. Chakrabarti, Dhanpat Rai & Co.
4. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford university press

Reference Books:

1. Digital and Analog communication Systems, Leon W Couch II, Pearson Education Asia.
2. Communication Systems, A.B. Calson, Mc Graw Hill.

VLSI & MICROELECTRONICS
EE-605(c)

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction to VLSI Design**: VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.	8
2	**MOS structure**: E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat-band voltage, Potential balance & Charge balance, Inversion, MOS capacitances. **Three Terminal MOS Structure:** Body effect. **Four Terminal MOS Transistor**: Drain current, I-V characteristics. Current-voltage equations (simple derivation). **Scaling in MOSFET**: Short Channel Effects, General scaling, Constant Voltage & Field scaling.] **CMOS**: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.	12
3	**Micro-electronic Processes for VLSI Fabrication**: Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative photo-resist	10

	Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator **Layout Design Rule**: Stick diagram with examples, Layout rules.	
4	**Hardware Description Language** – VHDL or Verilog Combinational & Sequential Logic circuit Design.	10

Text Books:

1. Digital Integrated Circuit, J.M.Rabaey, Chandrasan, Nicolic, Pearson Education.
2. CMOS Digital Integrated Circuit, S.M.Kang & Y.Leblebici, TMH.
3. Modern VLSI Design, Wayne Wolf, Pearson Education.
4. VHDL, Bhaskar, PHI.
5. Advance Digital Design Using Verilog , Michel D. Celliti, PHI

References:

1. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons .
2. Modern VLSI Design: system on silicon, Wayne Wolf; Addison Wesley Longman Publisher
3. Basic VLSI Design, Douglas A. Pucknell & Kamran Eshranghian, PHI
4. CMOS Circuit Design, Layout & Simulation, R.J.Baker, H.W.Lee, D.E. Boyee, PHI

CONTROL SYSTEM-II LABORATORY
EE-691

Credit: 2 **Contact: 3P**

List of Experiments:

1. Study of a practical position control system obtaining closed step responses for gain setting corresponding to over-damped and under-damped responses. Determination of rise time and peak time using individualized components by simulation. Determination of un-damped natural frequency and damping ration from experimental data.
2. Tuning of P, PI and PID controller for first order plant with dead time using Z-N method. Process parameters (time constant and delay/lag) will be provided. The gain of the controller to be computed by using Z-N method. Steady state and transient performance of the closed loop plant to be noted with and without steady disturbances. The theoretical phase margin and gain margin to be calculated manually for each gain setting.
3. Design of Lead, Lag and Lead-Lag compensation circuit for the given plant transfer function. Analyze step response of the system by simulation.
4. Obtain Transfer Function of a given system from State Variable model and vice versa. State variable analysis of a physical system - obtain step response for the system by simulation.
5. State variable analysis using simulation tools. To obtain step response and initial condition response for a single input, two-output system in SV form by simulation.
6. Performance analysis of a discrete time system using simulation tools. Study of closed response of a continuous system with a digital controller and sample and hold circuit by simulation.
7. Study of the effects of nonlinearity in a feedback controlled system using time response. Determination of step response with a limiter nonlinearity introduced into the forward path of 2^{nd} order unity feedback control systems. The open loop plant will have one pole at the origin and other pole will be in LHP or RHP. To verify that
   (i) with open loop stable pole, the response is slowed down for larger amplitude input
   (ii) for unstable plant, the closed loop system may become oscillatory with large input amplitude by simulation
8. Study of effect of nonlinearity in a feedback controlled system using phase plane plots. Determination of phase plane trajectory and possibility of limit cycle of common nonlinearities.

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

Reference Books:

5. Matlab & Simulink for Engineers, Agam Kumar Tyagt, Oxford
6. Modeling & Simulatrion using Matlab-Similink, Dr. S. Jain, Wiley India
7. Matlab & its application in Engineering, Raj K Bansal, A.K. Goel & M.K. Sharma, Pearson

8. MATLAB programming for Engineers, S.J. Chapman, 3rd Edition, Cengage.

POWER SYSTEM-II LABORATORY
EE-692

Credit: 2 **Contact: 3P**

List of Experiments:

1. Study of the characteristics of on delay relay and off delay relay.
2. Test to find out polarity, ratio and magnetization characteristics of CT and PT.
3. Test to find out characteristics of
   (a) under voltage relay
   (b) earth fault relay.
4. Study on DC load flow
5. Study on AC load flow using Gauss-seidel method
6. Study on AC load flow using Newton Raphson method.
7. Study on Economic load dispatch.
8. Study of different transformer protection schemes by simulation.
9. Study of different generator protection schemes by simulation.
10. Study of different motor protection schemes by simulation.
11. Study of different characteristics of over current relay.
12. Study of different protection scheme for feeder.

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

POWER ELECTRONICS LABORATORY
EE-693

Credit: 2 **Contact: 3P**

List of Experiments:

1. Study of the characteristics of an SCR.
2. Study of the characteristics of a Triac
3. Study of different triggering circuits of an SCR
4. Study of firing circuits suitable for triggering SCR in a single phase full controlled bridge.
5. Study of the operation of a single phase full controlled bridge converter with R and R-L load.
6. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.
7. Study of performance of step down chopper with R and R-L load.
8. Study of performance of single phase controlled converter with and without source inductance (simulation)
9. Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (simulation).
10. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter.(simulation)
11. Study of performance of three phase controlled converter with R & R-L load. (simulation)
12. Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load.
13. Study of performance of three phase AC controller with R and R-L load (simulation)
14. Study of performance of a Dual converter. (simulation)
15. Study of performance of a Cycloconverter (simulation)

Institute may develop experiments based on the theory taught in addition to experiments mentioned.

. Reference books:

1. Fundamental of Power Electronics with MATLAB, Randall Shaffer, Cengage Learning.
2. SPICE for Power electronics and electric power, M.H. Rashid & H.M. Rashid, Taylor & Francis.
3. Power Electronics: Principles and application, Jacob, Cengage Learning
4. Power Electronics, Daniel W. Hart, Tata McGraw Hill Edition.
5. Modeling & Simulation using MATLAB-SIMILINK , S. Jain, Wiley India
6. MATLAB & SIMULINK for Engineers, A.K. Tyagi, Oxford University Press.

SOFTWARE ENGINEERING LABORATORY

EE-694 (a)

Credit: 2 **Contact: 3P**

Pre-requisite: For the software Engineering Lab, design a project proposal which will be used throughout the lab for performing different experiments using CASE tools.

1. Preparation of requirement document for proposed project in standard format.
2. Project schedule preparation using tools like MSP project, Generation of Gnatt and PERT chart from schedule. Prepare project management plan in standard format..
3. Draw Use case diagram, Class diagram, Sequence diagram and prepare Software design document using tools like Rational Rose.
4. Estimate project size using Function Point (FP)/Use Case Point. Use Excel/Open Office template for calculation.
5. Design Test Script/Test Plan (both Black box and White Box approach) for a small component of the proposed project. (Develop that component using programming languages like c/Java/VB etc.)
6. Generate test result and perform defect cause analysis using Pareto or Fishbone diagram.
7. Compute Process and Product Metrics (e.g. Defect Density, Defect Age, Productivity, Cost etc.)
8. Familiarization with any Version control system like CVS/VSS/PVCS etc.

Following projects can be used as dummy projects:

- Library management system
- Railway reservation system
- Employee payroll
- Online banking system
- Online Shopping Cart
- Online Examination

DATE BASE MANAGEMENT SYSTEM LABORATORY
EE-694 (b)

Credit: 2 **Contact: 3P**

1. Creating Database:

- Creating a Database
- Creating a table
- Specifying Relational Data Types
- Specifying Constraints
- Creating Indexes.

2 .Table and record Handling

1. INSERT statement
2. Using SELECT and INSERT together
3. DELETE, UPDATE, TRUNCATE statements
4. DROP, ALTER statements

3. Retrieving Data from Database

- The SELECT statement
- Using the WHERE clause
- Using Logical Operators in the WHERE clause
- Using IN, BETWEEN, LIKE, ORDER,BY GROUP BY and HAVING

4. Clause

- Using AGGREGATE function
- Combining Tables using JOINS
- Sub queries

5. Database Management.

- Creating views
- Creating Column Aliases
- Creating Database Users

- Using GRANT and REVOKE

OBJECT ORIENTED PROGRAMMING LABORATORY
EE-694 (c)

Credit: 2 **Contact: 3P**

1. Assignments on class, constructor, overloading, inheritance, overriding.
2. Assignments on wrapper, class, arrays.
3. Assignments on developing interfaces-multiple inheritance, extending interfaces.
4. Assignments on creating and accessing packages.
5. Assignments on multithreaded programming.
6. Assignment on applet programming

Note: Use Java for programming
Preferably download"**java_ee_sdk-6u4-jdk7-windows.exe"** from
http://www.oracle.com/technetwork/java/javaee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html

EMBEDDED SYSTEMS LABORATORY
EE-694 (d)

Credit: 2 **Contact: 3P**

1. Familiarization with a microcontroller kit (and its associated PC based development system). Entering and executing a program, interfacing a LED matrix and display a specific pattern (digit) on the matrix.
2. Key board-MCU interfacing: Interfacing a 4X4 switch matrix with Microcontroller. – detect keyboard operation through interrupt, take an input from the keyboard and display the data on an LED Matrix.
3. Generation of triangular wave analog signal by PWM, triggering through internal timer.
4. MCU-DAC interfacing and generation of triangular wave, triggering through timer (on chip timer).
5. MCU interfacing and displaying a string in an LCD Display.
6. Interfacing of an ADC and data transfer by software polling.
7. ADC triggering through timer (on chip timer), Interrupt driven data transfer from ADC
8. Stepper motor position control using a Microcontroller. Generating a periodic staircase triangular wave position pattern with a fixed time period. Recording the rotor position in a video.
9. Serial communication between Microcontroller and PC
10. Temperature control (PD and PID) using a microcontroller and PWM output.

Reference Books:

1. Stuart Ball, "Analog Interfacing to Embedded Microprocessors- Real World Design", Newnes & Butterworth–Heinemann, 2001.
2. Dogan Ibrahim,"Microcontroller Based Applied Digital Control",John Wiley & Sons Ltd, 2006
3. Rob Williams, "Real-Time Systems Development", Butterworth-Heinemann(Elsevier) 2006

Proposed

VII Semester
Theory
ELECTRIC DRIVES
EE-701

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Electric Drive:** Concept, classification, parts and advantages of electrical dives. Types of Loads, Components of load toques, Fundamental torque equations, Equivalent value of drive parameters for loads with rotational and translational motion. Determination of moment of inertia, Steady state stability, Transient stability. Multiquadrant operation of drives. Load equalization.	05
2	**Motor power rating:** Thermal model of motor for heating and cooling, classes of motor duty, determination of motor rating for continuous, short time and intermittent duty, equivalent current, torque and power methods of determination of rating for fluctuating and intermittent loads. Effect of load inertia & environmental factors.	05
3	**Stating of Electric Drives**: Effect of starting on Power supply, motor and load. Methods of stating of electric motors. Acceleration time Energy relation during stating, methods to reduce the Energy loss during starting. **Braking of Electric Drives:** Types of braking, braking of DC motor, Induction motor and Synchronous motor, Energy loss during braking,	08
4	**DC motor drives:** Modeling of DC motors**,** State space modeling, block diagram & Transfer function, Single phase, three phases fully controlled and half controlled DC drives. Dual converter control of DC drives. Power factor, supply harmonics and ripple in motor current chopper controlled DC motor drives.	06
5	**Induction motor drives:** Stator voltage variation by three phase controllers, Speed control using chopper resistance in the rotor circuit, slip power recovery scheme. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Vector or Field oriented control.	06
6	**Synchronous motor drives:** Variable frequency control, Self Control, Voltage source inverter fed synchronous motor drive, Vector control.	05
7	Introduction to Solar and Battery Powered Drive, Stepper motor, Switched Reluctance motor drive **Industrial application:** Drive consideration for Textile mills, Steel rolling mills, Cement mills, Paper mills, Machine tools. Cranes & hoist drives.	05

Numerical problems to be solved in tutorial classes.

Text Books:

1. Fundamental of Electrical Drives, G.K. Dubey, New Age International Publication.
2. Electric Drives, Vedam Subrahmanyam, TMH
3. A first course on Electrical Drives, S.K. Pillai, , New Age International Publication.

Reference Books:

1. Electric motor drives, R. Krishnan, PHI
2. Modern Power Electronics & Ac drives, B.K. Bose, Pearson Education.
3. Electric Motor & Drives. Austin Hughes, Newnes.

UTILISATION OF ELECTRIC POWER
EE-702

Credit: 4 **Contact: 3L+1T**

Module	Content	Hour
1	**Electric Traction :** Requirement of an ideal traction system, Supply system for electric traction, Train movement (speed time curve, simplified speed time curve, average speed and schedule speed), Mechanism of train movement (energy consumption, tractive effort during acceleration, tractive effort on a gradient, tractive effort for resistance, power & energy output for the driving axles, factors affecting specific energy consumption, coefficient of adhesion). Electric traction motor & their control: Parallel and series operation of Series and Shunt motor with equal and unequal wheel diameter, effect of sudden change of in supply voltage, Temporary interruption of supply, Tractive effort and horse power. Use of AC series motor and Induction motor for traction. Traction motor control: DC series motor control, Multiple unit control, Braking of electric motors, Electrolysis by current through earth, current collection in traction system, Power electronic controllers in traction system.	16
2	**Illumination:** The nature of radiation, Polar curve, Law of illumination, Photometry (Photovoltaic cell, distribution photometry, integrating sphere, brightness measurement), Types of Lamps: Conventional and energy efficient, Basic principle of light control, Different lighting scheme & their design methods, Flood and Street lighting.	08
3	**Electric Heating welding:** Types of heating, Resistance heating, Induction heating, Arc furnace, Dielectric heating, Microwave heating.	08
4	**Electrolytic processes**: Basic principles, Faraday's law of Electrolysis, Electro deposition, Extraction and refining of metals, Power supply of Electrolytic processes.	08

Numerical problems to be solved in the tutorial classes.

Text Books:

1. Generation Distribution and Utilization of Electrical Energy, C.L. Wadhawa, New Age International Publishers.
2. Art and Science of Utilization of Electrical Energy, H. Partab, Dhanpat Rai & Sons.
3. Utilisation of Electric Energy, E.Openahaw Taylor, Orient Longman.

Power System III
EE-703A

Credit: 4 **Contact: 3L+1T**

1. Objectives of Power System Operation **6**

Power Systems in Restructured Environment; Distributed and Dispersed Generation; Environment Aspects of Electric Power Generation.

2. Economic Operation of Energy Generation Systems **10**

Generation Cost Curves; Economic Operation of Thermal System; Plant Scheduling; Transmission Loss and Penalty Factor; Hydro-Thermal Scheduling; Concept of Reserves and Constraints; Unit Commitment.

3. Automatic Generation Control **8**

Concept of AVR and ALFC Loops, Significance of Double Loop in ALFC; Exciter and VAR Control; Single Area Load Frequency Control; Two Area Load Frequency Control; Frequency Response.

4. Compensation in Power System **8**

Reactive Power Sensitivity and Voltage Control; Load Compensation with Capacitor Banks; Line Compensation with Reactors; Shunt and Series Compensation; Fixed Series Capacitors; Thyristor Controlled Series Capacitors; Introduction to SVC and STATCOM.

5. Power System Transients **8**

Types of System Transients; Overvoltage in Transmission Lines; Propagation of Surges and Travelling Waves; Protection Against Lightning and Surges;

Text Books

1. Power System Engineering, Kothari & Nagrath, Mc Graw Hill
2. Power System Analysis, Granger and Stevension, Mc Graw Hill
3. Electric Power Genration operation and control, Wood and Woolenberg, Willey.

Reference Books:

1. Power system stability and Control, P. Kundur , Mc Graw Hill
2. Modern power system analysis, Kothari & Nagrath, Mc.Graw Hill
3. Power system Analysis, Nagsarkar & Sukhija, Pearson
4. Power system analysis, operation and control, Chakrabarti and Halder, PHI
5. Book of Elgand.

CONTROL SYSTEM-III
EE-703B

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Feedback Linearization**: Motivation, Input–Output Linearization, Full-State Linearization, State Feedback Control and Stabilization.	05
2	**Sliding Mode Control:** Overview of SMC, Motivating Examples, Stabilization of second order system; Advantages and disadvantages.	05
3	**Optimal control system:** Formulation of optimal control problem: Minimum time, minimum energy, minimum fuel problem, state regulator, output regulator & tracking problems. Calculus of variations: Constrained fixed point and variable point problems, Euler Lagrange equations. Problems with equality and inequality constraints. Engineering application, Lagrange, Mayer & Bolza problems, Pontryagin's maximum (minimum) principle. Multiple decision process in discrete and continuous time - The dynamic programming. Numerical solution of two point boundary value problems - the steepest descent method and the Fletcher - Powell Method.	20

Numerical problems to be solved in the class.

Text Books:

1. Applied Nonlinear control, J.J.E. Slotine & W. Li, Prentice Hall
2. Modern Control theory, M. Gopal, 2nd Edition, New age international publishers.
3. Introduction to control system, D.K. Anand & R.B. Zmood, Asian book Pvt. Ltd.

Reference Books:

1. Adaptive control system, K.J. Astrom and B. Wittenamark, Addision Wesley Publishing Co
2. Nonlinear control systems, Springer Verlag..

Electric Machines III
EE-703C

Credit: 3 **Contact: 3L**

(Syllabus Modified)

Module	Content	Hour
1	Generalized theory of electric machines: The Primitive machine, Voltage equations of the Primitive machine, Invariance of power, Transformation from a displaced brush axis, Transformation from three phases to two phases, Transformation from rotating axes to stationary axes, Physical concepts of Park's transformations, Transformed impedance matrix, Electrical torque, Restriction of the generalized theory of electrical machines.	10
2	Direct Current machine dynamics: Separately excited D.C. generators: steady state analysis, and transient analysis. Separately excited D.C. motor: steady state analysis, transient analysis, Transfer function & Block diagram.	4
3	Transients and dynamics of A.C Machines, Synchronous and Induction achiness: Electrical transients in Synchronous machine, Expression for reactances and time constants. Dynamics of synchronous machine, Electromechanical equation- motor operation-generator operation - small oscillations, general equation for small oscillations-representation of oscillations in state variable form. Dynamics of Induction machine, Induction machine dynamics during starting and braking, acceleration time, Induction machine dynamics during normal operation, Equation of dynamical response of Induction motor.	8
4	Space Vectors and its application to the analysis of electrical machines specially induction motors: Principle, DQ flux-linkages model, Space Phasor model derivation, Analytical solution of machine dynamics, Signal flow graph of the space modeled Induction motor, Control principle of Induction motor.	6
5	Motor behavior under asymmetrical voltage supply. Harmonic effects on Induction motor, harmonic equivalent circuit and harmonic torque.	08

Numerical problems to be solved in the class.

Text Books:

1. Generalized theory of Electrical machines, P.S.Bimbhra, Khanna publishers.
2. Electrical Machinery, S.K. Sen, Khanna Publishers.
3. Electric motor drives, modeling, analysis and control, R. Krishnan, PHI

Reference Books:

1. Modern power electronics and AC drives, B.K. Bose, Pearson education.
2. Power system stability, Vol-III, E.W.Kimbar, John Wiley & Sons.
3. Electrical Machinery, A.E. Fitzgereld, C. Kingslay and S.D. Uman, Mc Graw Hills.
4. http://alexandria.tue.nl/extral/PRF14B/9702378.pdf
5. http://www.iasj.net/iasj.net/iasj?func=fulltext&ald=24742

HIGH VOLTAGE ENGINEERING
EE-704A

Credit: 3 **Contact: 3L**

Module	Content	Hour

1	**Breakdown phenomena:** Breakdown of Gases: Mechanism of Break down of gases, Charge multiplication, Secondary emission, Townsend Theory, Streamer Theory, Paschen's Law, Determination of Minimum breakdown voltage, Breakdown in non uniform field, Effect of polarity on corona inception and break down voltage. Partial Discharge: definition and development in solid dielectric. Break Down of Solids: Intrinsic breakdown, Electromechanical break down, Thermal breakdown, Streamer Breakdown. Breakdown of Liquid: Intrinsic Break down, Cavitation Theory, Suspended particle Theory. Breakdown in Vacuum: Non metallic electron emission mechanism, Clump mechanism, Effect of pressure on breakdown voltage.	12
2	**Generation of High Voltage:** Generation of high AC voltages: Testing transformer, Cascaded transformer, Series resonant circuit, single stage and multi stage. Advantages of Series Resonant Circuit in testing of cables. Generation of DC high voltage: Cockcroft Walton doubler and multistage circuit. Electrostatic generator. Definition of Impulse Voltage as per Indian Standard Specification, Wave front and wave tail time ,Generation of Impulse Voltage, Multistage Impulse generator, triggering of Impulse Generator.	10
3	**Measurement of High Voltage:** Sphere gap voltmeter, AC , DC and impulse high voltage measurement as per Indian Standard Specifications. Resistance and Capacitance Potential dividers, Peak voltmeters for measurement of high AC voltage in conjunction with capacitance dividers. Capacitance Voltage Transformer, Rotating Voltmeter for the measurement of DC high voltage, Electrostatic Voltmeter	06
4	**Transient in power systems:** Lightning Phenomena, Electrification of cloud, Development of Lightning Stroke, lightning induced over voltage, direct stroke, indirect stroke. Protection of Electrical Apparatus against over voltage, Lightning Arrestors, Valve Type, Metal Oxide arresters, Expulsion type. Effect of location of lightning arresters on protection of transformer. Protection of substation, Ground wires. Insulation Co ordination, Basic Insulation level. Basic Impulse level, Switching Impulse level. Volt time characteristics of protective devices, Determination of Basic Impulse level of substation equipment.	08
5	**High Voltage Testing:** High Voltage testing, Testing as per Indian Standard Specifications, Power frequency withstand, induced over voltage and impulse test on transformers, Power frequency wet withstand test and impulse test on insulators	04

Numerical problems to be solved in the class.

Text Books:

1. High Voltage Engineering, C.L. Wadhawa, New Age International Publishers.
2. High Voltage Engineering, M.S. Naidu & V. Kamraju, Tata MC Graw Hill publication.
3. Book of Bgamude.

Reference Books:

1. High Voltage Engineering, M.A. Salem, H. Anis, A. E. Morahedy, R. Radwan, Marcel Dekker, Inc.

POWER PLANT ENGINEERING

EE-704B

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Power and energy, sources of energy, review of thermodynamic cycles related to power plants, fuels and combustion calculations. Load estimation, load curves, various terms and factors involved in power plant calculations. Effect of variable load on power plant operation, Selection of power plant.	08

	Power plant economics and selection: Effect of plant type on costs, rates, fixed elements, energy elements, customer elements and investor's profit; depreciation and replacement, theory of rates. Economics of plant selection, other considerations in plant selection.	
2	**Steam power plant:** General layout of steam power plant, Power plant boilers including critical and super critical boilers. Fluidized bed boilers, boilers mountings and accessories, Different systems such as coal handling system, pulverizers and coal burners, combustion system, draft, ash handling system, Dust collection system, Feed water treatment and condenser and cooling towers and cooling ponds, Turbine auxiliary systems such as governing, feed heating, reheating, flange heating and gland leakage. Operation and maintenance of steam power plant, heat balance and efficiency, Site selection of a steam power plant.	08
3	**Diesel power plant:** General layout, Components of Diesel power plant, Performance of diesel power plant, fuel system, lubrication system, air intake and admission system, supercharging system, exhaust system, diesel plant operation and efficiency, heat balance, Site selection of diesel power plant, Comparative study of diesel power plant with steam power plant. **Gas turbine power plant:** Layout of gas turbine power plant, Elements of gas turbine power plants, Gas turbine fuels, cogeneration, auxiliary systems such as fuel, controls and lubrication, operation and maintenance, Combined cycle power plants, Site selection of gas turbine power plant .	08
4	**Nuclear power plant:** Principles of nuclear energy, Lay out of nuclear power plant, Basic components of nuclear reactions, nuclear power station, Nuclear waste disposal, Site selection of nuclear power plants. Hydro electric station Hydrology, Principles of working, applications, site selection, classification and arrangements, hydro-electric plants, run off size of plant and choice of units, operation and maintenance, hydro systems, interconnected systems. Non Conventional Power Plants Introduction to non-conventional power plants (Solar, wind, geothermal, tidal)etc.	09
5	**Electrical system:** Generators and their cooling, transformers and their cooling. Instrumentation Purpose, classification, selection and application, recorders and their use, listing of various control rooms. Pollution due to power generation.	07

Numerical problems to be solved in the class.

Text Books:

1. Power Plant Engineering, P.K. Nag, Tata McGraw Hill.
2. Power Plant Engineering, F.T. Morse, Affiliated East-West Press Pvt. Ltd, New Delhi/Madras
3. Power Plant Technology El-Vakil, McGraw Hill.

Reference Books:

1. Steam & Gas Turbines & Power Plant Engineering by R.Yadav, Central Pub.House.

Power plant Engineering, K.K. Ramalingam, Scitech

POWER GENERATION ECONOMICS

EE-704C

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Economics of Generation :** Cost of power generation- Thermal, Hydro and Nuclear. Types of Consumers in a distribution system-Domestic, Commercial, Industrial etc. Concept of load factor, plant capacity factor, plant use factor, diversity factor, demand factor. Choice of size and number of generation units.	07
2	**Tariff-**: Block rate, flat rate, two part, maximum demand, Power factor and three part tariffs. Subsidization and Cross subsidization. Availability tariff of generation companies. Pool tariff of transmission companies. Availability based tariff (ABT).	08
3	**Unit Commitment:** Constraints in Unit Commitment, Spinning reserve, Thermal unit constraints, Hydro constraints, Must run, Fuel constraints. Unit commitment solution methods,	07
4	**Economic Dispatch**: Transmission loss formulae and its application in economic load scheduling. Computational methods in economic load scheduling. Active and reactive power optimization.	10
5	**State Estimation and load forecasting in power system:** Introduction, state estimation methods, concept of load forecasting, load forecasting technique and application in power system.	08

Numerical problems to be solved in the class.

Text Books:

1. Economic operation of Power System, L.K. Kirchmayar John Wiely, Newyork.
2. Power system Analysis, operation & control, Chakrabarty & Haldar, 2nd edition, PHI.
3. Modern power system analysis, D.P. Kothari & I.J. Nagtrath, Tata McGraw Hill.

References:

1. Power generation operation & control, A.J. Wood & B.F. Wollenberg, Wiley India.
2. Operation and control in power system, P.S.R. Murthy, BSP Publication.

RENEWABLE & NON CONVENTIONAL ENERGY
EE-704 D

Credit: 3 **Contact: 3L**

Module	Content	Ho
1	**Introduction to Energy sources:** Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on environment, Kyoto Protocol.	03

2	**Solar Energy:** Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaics - solar cells, different types of PV Cells, Mono-poly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & its applications. PV hybrid systems.	0
3	**Wind Energy:** Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations	0
4	**Energy from Biomass:** Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas	0
5	**Geothermal Energy:** Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.	0
6	**Energy from Ocean:** Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.	0
7	**Magneto Hydrodynamic power generation:** Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects.	0
8	**Hydrogen Energy:** Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles.	03
9	**Fuel cell:** Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells	0

Numerical problems to be solved in the class.

Text Books:

4. Non conventional Energy sources, G.D. Rai, Khanna Publishers.
5. Renewable energy sources and conversion technology, Bansal Keemann, Meliss, Tata Mc Graw Hill.
6. Non conventional Energy, Ashok V. Desai, New Age International Publishers Ltd.

Reference Books:

1. Renewable energy resources and emerging technologies, D.P. Kothari, Prentice Hall of India Pvt. Ltd.

COMPUTER NETWORKS
EE-705A

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Overview of Data Communication and Networking:** Introduction, Data communications: components, data representation (ASCII, ISO etc.), direction of data flow (simplex, half duplex, full duplex); network criteria, physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study. **Physical Level:**	10

	Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit Switching: time division & space division switch, TDM bus; Telephone Network.	
2	**Data link Layer:** Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N ARQ, Selective repeat ARQ, HDLC;] **Medium Access sub layer:** Point to Point Protocol, LCP, NCP, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Traditional Ethernet, fast Ethernet (in brief).	10
3	**Network layer:** Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing : IP addressing, sub netting; Routing : techniques, static vs. dynamic routing , Unicast Routing Protocols: RIP, OSPF, BGP; Other Procols: ARP, IP, ICMP, IPV6. **Transport layer:** Process to Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm,	12
4	**Application Layer:** Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key based), Digital Signature, Firewalls. **Modern topics:** ISDN services & ATM, DSL technology, Cable Modem: Architecture and operation in brief. Wireless LAN: IEEE 802.11, Introduction to blue-tooth.	08

Numerical problems to be solved in the class.

Text Books:

1. Data Communications and Networking (3rd Ed.), A. Forouzan , TMH
2. Computer Networks (4th Ed.), A. S. Tanenbaum, Pearson Education/PHI
3. Data and Computer Communications (5th Ed.), W. Stallings, PHI/ Pearson Education

Reference Books:

1. Computer Networking -A top down approach featuring the internet, Kurose and Rose
Pearson Education
2. Communication Networks, Leon, Garica, Widjaja, TMH
3. Communication Networks, Walrand, TMH.
4. Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.), Comer, Pearson Education/PHI

ARTIFICIAL INTELLIGENCE

EE-705B

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Intelligent Agents – Agents and environments - Good behavior – The nature of environments – structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.	06

2	**Searching techniques:** Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments - Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems - Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.	09
3	**Knowledge representation:** First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation - Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects.	09
4	**Learning:** Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods - Learning with complete data - Learning with hidden variable - EM algorithm - Instance based learning - Neural networks - Reinforcement learning – Passive reinforcement learning - Active reinforcement learning - Generalization in reinforcement learning.	09
5	**Applications:** Communication – Communication as action – Formal grammar for a fragment of English – Syntactic analysis – Augmented grammars – Semantic interpretation – Ambiguity and disambiguation – Discourse understanding – Grammar induction - Probabilistic language processing - Probabilistic language models – Information retrieval – Information Extraction – Machine translation.	07

Text Books:

1. Artificial Intelligence – A Modern Approach", Stuart Russell, Peter Norvig, 2nd Edition, Pearson Education / Prentice Hall of India, 2004.

Reference Books:

1. Artificial Intelligence: A new Synthesis, Nilsson. J. Nils , Harcourt Asia Pvt. Ltd., 2000.
2. Artificial Intelligence, Rich Elaine & Knight Kevin, 2nd Edition, Tata McGraw-Hill, 2003.
3. Artificial Intelligence-Structures and Strategies for Complex Problem Solving, Geogre **F. Luger, Pearson Education / PHI, 2002.**

DIGITAL COMMUNICATION
EE-705C

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Probability Theory and Random Processes**: Conditional probability, communication example, joint probability, statistical independence, random variable-continuous and discrete, cumulative distribution function, probability density function – Gaussian, Rayleigh and Rician, mean, variance, random process, stationary and ergodic processes, correlation coefficient, covariance, auto correlation function and its properties, random binary wave, power spectral density.	06

2	**Signal Vector Representation:** Analogy between signal and vector, distinguishibility of signal, orthogonality and orthonormality, basis function, orthogonal signal space, message point, signal constellation, geometric interpretation of signals, likelihood functions, Schwartz inequality, Gram-Schmidt orthogonalization procedure, response of the noisy signal at the receiver, maximum likelihood decision rule, decision boundary, optimum correlation receiver; probability of error , error function, complementary error function, Type-I and Type-II errors	10
3	**Digital Data Transmission:** Concept of sampling, Pulse Amplitude Modulation (PAM), interlacing and multiplexing of samples, Pulse Code Modulation (PCM), quantization, uniform and non-uniform quantization, quantization noise, binary encoding, A-Law and b -law companding, differential PCM, delta modulation and adaptive delta modulation. Digital transmission components, source, multiplexer, line coder, regenerative repeater, concept of line coding –polar/unipolar/bipolar NRZ and RZ, Manchester, differential encoding and their PSDs, pulse shaping, Inter Symbol Interference. (ISI), Eye pattern, Nyquist criterion for zero ISI, equalizer, zero forcing equalizer, timing extraction.	10
4	**Digital Modulation Techniques:** Types of Digital Modulation, coherent and non-coherent Binary Modulation Techniques, basic digital carrier modulation techniques: ASK, FSK and PSK, Coherent Binary Phase Shift Keying (BPSK), geometrical representation of BPSK signal; error probability of BPSK, generation and detection of BPSK Signal, power spectrum of BPSK. Concept of M-ary Communication, M-ary phase shift keying, the average probability of symbol error for coherent M-ary PSK, power spectra of MPSK, Quadrature Phase Shift Keying (QPSK), error probability of QPSK signal, generation and detection of QPSK signals, power spectra of QPSK signals, Offset Quadrature Phase shift Queuing (OQPSK), Coherent Frequency Shift Keying (FSK), Binary FSK, error probability of BFSK signals, generation and detection of Coherent Binary FSK signals, power spectra of BFSK signal, Minimum Shift Keying (MSK), signal constellation of MSK waveforms, error probability of MSK signal, Gaussian Minimum Shift Keying: GMSK, basic concept of OFDM, constellation diagram, Some performance issues for different digital modulation techniques - Error Vector Magnitude (EVM), Eye Pattern and Relative Constellation Error (RCE), Conceptual idea for Vector Signal Analyzer (VSA).	14

Numerical problems to be solved in the class.

Text Books:

1. Digital Communications, S. Haykin, Wiley India.
2. Principles of Communication Systems, H. Taub and D.L.Schilling, TMH Publishing Co.
3. Wireless Communication and Networks: 3G and Beyond, I. Saha Misra, TMH Education.
4. Digital Communications, J.G.Proakis, TMH Publishing Co.

REFERENCE BOOKS:

1. Digital Communications Fundamentals and Applications, B. Sklar and P.K.Ray, Pearson Education.
2. Modern Digital and Analog Communication Systems, B.P.Lathi and Z.Ding, Oxford University Press.
3. Digital Communication, A. Bhattacharya, TMH Publishing Co.

DIGITAL IMAGE PROCESSING

EE-705D

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Digital Image Processing Systems**: Introduction to structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, storage, Processing, Communication, Display Image Sampling and quantization, Basic relationships between pixels.	05

2	**Image Transforms (implementation):** Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D FT, FFT, IFFT, Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen – Loeve Hotelling) transform.	07
3	**Image Enhancement in the Spatial and Frequency Domain:** Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters. Frequency domain filters: Homomorphic filtering.	07
4	**Image Data Compression:** Fundamentals, Redundancies: Coding, Inter pixel Psycho-visual, fidelity criteria, Image compression models, Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone Still Image compression standards, Video compression standards.	07
5	**Morphological Image Processing:** Introductions, Dilation, Erosion, Opening, closing, Hit -or-miss transformation, Morphological algorithm operations on binary Images, Morphological algorithm operations on gray-scale Images.	07
7	**Image Segmentation, Representation and Description:** Detection of discontinuities, Edge linking and Boundary detection, Thresholding region based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors.	07

Numerical problems to be solved in the class.

Text Books:

1. Digital Image Processing, R.C Gonzalez and R. Woods, Pearson publication.
2. Digital Image Processing, Anil K. Jain, Prentice-Hall, India.

Reference Books:

1. Digital Image Processing, W.K. Pratt 2nd Edition, John Wiley & Sons.
2. Digital Image Processing and Analysis, B. Chanda & D. Dutta Majumder Prentice-Hall, India.
3. Image Processing- Theory, Algorithms & Architecture, M. A. Sid-Ahmed, McGraw-Hill.

Practical

ELECTRICAL SYSTEMS Design-I

EE-782

Credit: 2 **Contact: 3L**

The students would INDIVIDUALLY design the equipment and systems as per specifications provided by the class teacher following established procedures. *For each student, one item from each of the three groups would be chosen.* • *For unspecified items of specification and or specifications of wires, cables etc., data should be taken by students from handbooks and Indian standard.* • *Students should spend the allotted periods for carrying out design computations. Their attendance shall be recorded.* • *Students should maintain a dedicated bound notebook for recording design activities like calculations, formulae used, sketches, flowcharts etc. The notebook should be regularly submitted to the class teacher for review and signature.* • *Evaluation would be based on (i) Class attendance (20%), (ii) Design Note Book (30%) (iii) Design Report (30%) (iv) End of semester viva (20%, preferably by an external examiner)*	
Group-A	• Designing a heating element with specified wattage, voltage and ambient temperature. • Designing an aircore grounding reactor with specified operating voltage, nominal current and fault current.
Group-B	• Designing the power distribution system for a small township.

	• Designing a double circuit transmission line for a given voltage level and power (MVA) transfer. • Wiring and installation design of a multistoried residential building (G+4,not less than 16 dwelling flats with a lift and common pump) • Designing of a substation
Group-C	• Designing an ONAN distribution transformer. • Designing a three phase squirrel cage induction motor. • Designing a three phase wound rotor induction motor. • Designing a split phase squirrel cage induction motor for a ceiling fan or a domestic pump. • Designing a permanent magnet fractional hp servo motor .

Electric Drive
Code: EE-791

Contacts: 3P

Credits: 2

1. Study of thysistor controlled DC Drive.
2. Study of Chopper fed DC Drive
3. Study of AC Single phase motor-speed control using TRIAC.
4. PWM Inverter fed 3 phase Induction Motor control using PSPICE / MATLAB / PSIM Software.
5. VSI / CSI fed Induction motor Drive analysis using MATLAB/DSPICE/PSIM Software.
6. Study of V/f control operation of 3Φ induction motor drive.
7. Study of permanent magnet synchronous motor drive fed by PWM Inverter using Software.
8. Regenerative / Dynamic braking operation for DC Motor - Study using software.
9. Regenerative / Dynamic braking operation of AC motor - study using software.

PC/PLC based AC/DC motor control operation.

Computer network laboratory
EE-792 (A)

Credit: 2 Contact: 3P

1. IPC (Message queue)
2. NIC Installation & Configuration (Windows/Linux)
3. Familiarization with
   - Networking cables (CAT5, UTP)
   - Connectors (RJ45, T-connector)
   - Hubs, Switches
4. TCP/UDP Socket Programming
5. Multicast & Broadcast Sockets
6. Implementation of a Prototype Multithreaded Server
7. Implementation of
   - Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window)
   - Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check)
   - Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)

ARTIFICIAL INTELIGENCE LABORATORY
EE-792(B)

Credit: 2 Contact: 3P

At least eight problems are to be given to students. Those are problems are to be solved with programming Languages such as PROLOG & LISP

DIGITAL COMMUNICATION LABORATORY
EE-792 (C)

Credit: 2 Contact: 3P

1. Design, implementation and study of all the properties of 7-length and 15-length pn sequences using shift register.
2. Study of PAM and demodulation.
3. Study of PCM and demodulation.
4. Study of line coders: polar/unipolar/bipolar NRZ, RZ and Manchester.
5. Study of delta modulator and demodulator.
6. Study of adaptive delta modulator and demodulator.
7. Study of BPSK modulator and demodulator.
8. Study of BFSK modulator and demodulator.
9. Study of ASK modulator and demodulator.
10. Study of QPSK modulator and demodulator.
11. Simulation study of probability of symbol error for BPSK modulation.
12. Simulation study of probability of symbol error for BFSK modulation.

DIGITAL IMAGE PROCESSING LABORATORY
EE-792(D)

Credit: 2

Contact: 3P

1. Display of Grayscale Images.
2. Histogram Equalization.
3. Non-linear Filtering.
4. Edge detection using Operators.
5. 2-D DFT and DCT.
6. Filtering in frequency domain.
7. Display of color images.
8. Conversion between color spaces.
9. DWT of images.
10. Segmentation using watershed transform.

Other Practicals as in Old Syllabus

VIII Semester
Theory

Organisational Behaviour
HU801A
Contracts: 2L
Credits- 2

1. Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. **[2]**

2. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. **[2]**
3. Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. **[2]**
4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory. **[4]**
5. Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. **[2]**
6. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. **[2]**
7. Leadership: Definition, Importance, Theories of Leadership Styles. **[2]**
8. Organizational Politics: Definition, Factors contributing to Political Behaviour. **[2]**
9. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. **[2]**
10. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture. **[4]**

References:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.

HVDC TRANSMISSION
EE-801A

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Introduction:** Introduction of DC power transmission technology, comparison of AC and DC transmission, limitation of HVDC transmission, reliability of HVDC systems, application of DC transmission, description of DC transmission system, planning for HVDC transmission, modern trends in DC transmission.	04
2	**Analysis of HDVC converters:** Choice of converter configuration, simplified analysis of Graetz circuit, converter bridge characteristics, Characteristics of a twelve pulse converter, detailed analysis of converters..	06
3	**Control of HVDC converter and systems:** Necessity of control of a DC link, rectifier control, compounding of rectifiers, power reversal of DC link, voltage dependent current order limit(VDCOL) characteristics of the converter, inverter extinction angle control, pulse phase control, starting and stopping of DC link, constant power control, control scheme of HVDC converters.	08
4	**Harmonics and filters:** Generation of harmonics by converters, characteristics of harmonics on DC side, characteristics of current harmonics, characteristic variation of harmonic currents with variation of firing angle and overlap angle, effect of control mode on harmonics, noncharacteristic harmonic. Harmonic model and equivalent circuit, use of filter, filter configuration, design of band-	10

	pass and high pass filter, protection of filters, DC filters, power line communication and RI noise, filters with voltage source converter HDVC schemes.	
5	**Fault and protection schemes in HVDC systems:** Nature and types of faults, faults on AC side of the converter stations, converter faults, fault on DC side of the systems, protection against over currents and over voltages, protection of filter units.	04
6	**Multiterminal HVDC systems:** Types of multiterminal (MTDC) systems, parallel operation aspect of MTDC. Control of power in MTDC. Multilevel DC systems. Power upgrading and conversion of AC lines into DC lines, Parallel AC/DC systems, FACTS and FACTS converters.	08

Text Books:

1. HVDC Transmission, S. Kamakshaiah & V. Kamaraju, Tata McGraw hill education.
2. HVDC Power transmission system, K.R.Padiyar, Wiley Eastern Limited.

Reference Books:

1. The Performance, Operation and Control of EHV Power Transmission Systems, A. Chakraborty, D.P. Kothary, A.K. Mukhopadhyay, Wheeler Pub.
2. High Voltage Direct Current Transmission, J. Arrillaga, Peter Pregrinu.
   Extra High Voltage AC Transmission Engineering, Rakosh Das Begamudre, New Age International (P) Ltd.
3. High Voltage Direct Current Power Transmission, Colin Adamson and N.G.Hingorani, Garraway Limited, London

ILLUMINATION ENGINEERING
EE-801B

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Light, sight & color:** Sources of light: Day light, artificial light sources, energy radiation, visible spectrum of radiation, black body radiation and full radiator. Incandescence, dependence of light o/p on temperature. Theory of gas discharge and production of light. Perception of light and color, optical system of human eye, eye as visual processor. Reflection, refraction and other behavior of light.	06
2	**Measurement of light:** Measurement of light - radiometric and photometric quantities, units of measurement, standardization. Measurement of light distribution, direct and diffused reflection, fundamental concepts of colourimentry and measurement of colour.	06
3	**Lamp, accessories & luminaries:** Light production by gas discharge, fluorescence, incandescence, daylight principle of operation, light efficacy, color, electrical characteristics, typical applications, dimming condition of GLS filament, tungsten halogen lamps, fluorescent tubes, compact fluorescent lamp (CFL), low and high pressure sodium lamps, high pressure mercury lamp, metal halide lamp. Functions of luminaries, classification, Materials Used in luminaries manufacturing, reflection, refraction, diffusion, polarization and optical design, photometric measurements, application data and its use.LED.	12
4	**Interior lighting:** Objectives quantity and quality of light, selection of lamps, luminaries section, placement. Design considerations for lighting of offices, conference rooms, hospitals, teaching places, house etc., design calculations.	08
5	**Lighting control:** Types of lighting controls, strategy for selection, benefits of lighting control. Electric distribution system for lighting, maintenance strategies, group replacement schedule. Techniques of achieving energy efficient lighting design, role of computers in lighting	08

	design, advantages and limitations of computer aided lighting design.	

Text Books:

1. Utilization of Electric Power, C.L. Wadha, New Age International Ltd.
2. Generation, Distribution and Utilization of electrical energy, C.L. Wadha, New Age International Ltd.
3. Art and Science of Utilization of Electrical Energy, H. Partab, Dhanpat Rai & Sons.
4. Standard Hand Book for Electrical Engineers, Fink & Beaty, McGraw Hill International.

ENERGY MANAGEMENT & AUDIT
EE-801C

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	Energy Management & Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments and intervals of EA regulation.	06
2	Energy Scenario: Commercial and Non-Commercial Energy, Primary Energy Resources, Commercial Energy Production, Final Energy Consumption, Energy Needs of Growing Economy, Long Term Energy Scenario, Energy Pricing, Energy Sector Reforms, Concept of smart grid, Tariff.	08
3	Energy Conservation Act-2001 and related policies: Energy Conservation Act-2001 and its features, Notification Under the act, Designated agencies, Schemes of Bureau of Energy Efficiency(BEE)-ECBC, S & L, DSM, BLY, SME's, Designated Consumers, Electricity Act 2003, Integrated Energy Policy,	06
4	Energy Efficiency and Climate changes: Energy and environment, Air pollution, Climate change, United Nations Framework Convention on climate change (UNFCCC), Kyoto Protocol, Clean Development Mechanism (CDM), CDM methodology and Procedures, Sustainable development	06
5	Non-Conventional Energy Sources: Concept of renewable Energy and importance, Different types of renewable Energy, Solar energy, Wind energy, Biomass energy, Hydro-energy, Fuel cells, Energy from wastes, Wave, Tidal and geothermal. Concept of energy storing device.	06
6	Energy Efficient Technologies in Electrical Systems: Maximum demand controllers, Automatic power factor controllers, Energy efficient motors, Soft starters with energy saver, Variable speed drives, Energy efficient transformers, Electronic ballast, Occupancy sensors, Energy efficient lighting controls, Energy saving potential of each technology	06

Text Books:

1. Energy Management Supply and Conservation, Dr. Clive Beggs, Butterworth Heinemann, 2002 .
2. Handbook of Energy Engineering, Albert Thumann & Paul Mehta, The Fairmont Press, INC.
3. Plant Engineers & Manager Guide to Energy Conservation, Albert.
4. Energy Management Handbook, Wayne C, John Willey and Sons

Reference Books:

1. NPC energy audit manual and reports
2. Guide to Energy Management, Cape Hart, Turner and Kennedy
3. Cleaner Production – Energy Efficiency Manual for GERIAP, UNEP, Bangkok prepared by National Productivity Council
4. www.bee.org

DIGITAL SPEECH SIGNAL PROCESSING
EE-801D

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	Introduction: Production and transmission of acoustic signals: articulation of human speech. Acoustic-phonetic structure of Speech ,Speaker verification and Identification, Speaker Recognition, Speech Recognition , music synthesis and speech synthesis.	04
2	Discrete time speech signal Processing ,Anatomy and Physiology of Speech production, Categorization of Speech sound: Phonemes, Vowels, nasals, fricatives, plosives and transitional sounds, Pitch and Formants Z-transform, LTI Systems in the Frequency domain ,FFT, Time-Varying Systems and Short-time Fourier Transform(STFT),Stochastic process, Review of Digital Filters , models of speech production systems	08
3	Acoustics of Speech Production. Wave Equation, Lossless case, Effects of energy loss and boundary, Tube concatenation , lattice filter	06
4	Analysis and synthesis of Pole-Zero speech Model, Autocorrelation method, Linear Predictive model, lattice filter formulation, error minimization	06
5	The stochastic parameters of human speech, Gaussian densities and statistical model training, voiced and unvoiced speech modeling, resonance. Psycho-acoustics, Physiological exploration of periodicity, audio-spectrograms and sonograms, pitch-perception models.	08
6	Physiology of the ear and hearing mechanism, the Auditory System modeled as a Filter-bank, Gamma-tone , Spectrum and Complex Cepstrum analysis of speech as perceived by detectors, Automatic Speech Recognition (ASR), Linear Prediction analysis, GMM models, Log-ratio, Speech coding, Speaker recognition and Speaker verification	08

Text Books:

5. Discrete-time Speech Signal Processing, Thomas F. Quatieri, 2000, PHI.
6. Speech Communications: Human and Machine, D. O'Shaughnessy, 2nd edition, Universities Press, 2001
7. Digital Processing of Speech Signals, L. R. Rabiner and R. W. Schafer, Prentice-Hall, Englewood Cliffs, NJ, 1978.
8. Speech & Audio Signal Processing -Processing and Perception of Speech & Music, B.Gold & N.Morgan, Wiley Student edition

Reference Books:

1. Fundamentals of Speech Recognition, L. R. Rabiner and B.H. Juang. Englewood Cliffs, NJ, Prentice Hall 1993.
2. Speech Analysis. R. W. Schafer and J. D. Markel (eds.), IEEE Press, New York, 1979.
3. Acoustic Theory of Speech Production, G. Fant Mouton, The Hague, 1970.
4. Speech Analysis, Synthesis and Perception. J. L. Flanagan 2nd ed., Springer-Verlag, New York/Berlin, 1972.

POWER PLANT INSTRUMENTATION & CONTROL
EE-802A

Credit: 3 **Contact: 3L**

Module	Content	Hour

1	Concepts of Power plants of different types: Setups, energy conversions and measurement requirements, examples of Thermal, Hydal, and Nuclear plants. Thermal power plant and system instrumentation.	08
2	Instrumentation for : (i) Turbines (ii) Condensers (iii) Generators (iv) Coal handling (v) Water treatment (vi) Feed water, combustion air and flue gases	12
3	Control: Boiler Control - Steam pressure control, combustion control, Furnace Draft control, Steam temperature control, Feed water control, Data logger and computer control, supervisory control and monitoring system. Instrumentation for safety interlocks - protective gears, emergency measures, Alarm systems and Analysis etc. Pollution measurement, monitoring and control.	12
4	Data handling-processing, logging, acquisition, accounting, display and storage. Instrumentation for Generator and Busbar coupling. Introduction to power plant modeling/simulation	08

Text Books:

1. Principles of Industrial Instrumentation, D. Patranabis, TMH New Delhi

Reference Books:

1. Electric Power Engineering Handbook – Edited by L. L. Grigsby.
2. Instrument Engineers Handbook, B. G. Liptak, Chilton Book Co., Philadelphia

SENSORS & TRANSDUCERS
EE-802B

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Mechanical and Electromechanical sensor:** Definition, principle of sensing & transduction, classification. Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity. Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes. Inductive sensor: common types- Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis. LVDT: Construction, material, output input relationship, I/O curve, discussion. Proximity sensor	12
2	**Capacitive sensors:** Variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity. Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.	08

3	**Thermal sensors:** Material expansion type: solid, liquid, gas & vapor Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermister material, shape, ranges and accuracy specification.]Thermo emf sensor: types, thermoelectric power, general consideration, Junction semiconductor type IC and PTAT type. Radiation sensors: types, characteristics and comparison. Pyroelectric type.	11
4	**Magnetic sensors:** Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics. Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive cell types, materials, construction, response. Geiger counters, Scintillation detectors, Introduction to smart sensors	09

Numerical problems to be solved in the class.

Text Books:

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI
2. Instrument transducers, H.K.P. Neubert, Oxford University press.
3. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill.

BIO-MEDICAL INSTRUMENTATION
EE-802C

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	**Fundamentals:** Introduction to Physiological Systems –Organism, Cardiovascular, Respiratory, Renal, Hepatic, Gastrointestinal, Endocrinal, Nervous, Muscular, Cellular. Biological Signals – Bioelectric events, Biomechanical Systems, Cellular & Membrane phenomenon. The Action Potential and Propagation through Nervous System. The Peripheral Nervous Systems and sensory mechanisms. Biomaterials. Fundamentals of Electrophysiology –EKG, EEG, EMG, Evoked potentials. Quantification of Biological Signals.	08
2	**Measurement & Analysis:** Biological Sensors- Bio-electrodes, Biosensors and Transducers for Cardiology, Neurology, Pulmonary, Oxygen saturation & gaseous exchange, flow measurement, goniometry, Endoscopy, Impedance Plethysmography. Biological Amplifiers –Instrumentation Amplifiers for Electrophysiology (ECG, EMG, EEG, EOG), Filters, Power Supplies. Recording and Display systems, Digital Conversion for storage, Electrical Hazards in measurements, Isolation Circuits, calibration, alarms & Multi-channel re-constitution. Hospital requirements – Multi-parameter bed-side monitors, Central Nursing Stations, Defibrillators, Ventilators, Catheters, Incubators.	10
3	**Life-Support & Treatment:** Cardiac Support: Implantable & programmable Pacemakers, External & Internal Defibrillators, Coronary Angiography. Electro-physiotherapy: Shortwave & ultrasonic diathermy, Transcutaneous. Nerve Stimulators in pain relief, Traction Systems, Ultrasound in bone fracture regeneration, hypothermia & hyperthermia systems.	10

	Lasers in treatment and surgery : Opthalmic, Ablators, Endoscopic. Assists and Artificial limbs- Orthoses , passive and powered Prostheses	
4	**Imaging:** Fundamentals of X-Rays, Radiological Imaging, Digital Radiology, DSA. Computer Tomography, Image Processing, solid state sensors, whole-body scans. Gamma camera & radio- isotope imaging. Ultrasonography- Transducers, Signal Conditioners, 2D & 3D scans, Doppler & Colour Doppler. Fundamentals of Magnetic Resonance Imaging and PET – scans.	12

Text Books:

1. Handbook of Biomedical Instrumentation , R S Khandpur, Tata –Mcgraw Hill Education [Partly Downloadable]
2. Understanding the Human Machine- A Primer for Bioengineering, M E Valentiniuzzi [Freely Downloadable in PDF], World Scientific Publishing Co.
3. Biomedical Instrumentation and Measurements, L Cornwell, F.J. Weibell & E.A. Pfeiffer, Prentice Hall.
4. Medical Instrumentation – Application & Design, J G Webster & J W. Clark , Houghton Miffin Publication.
5. Introduction to Bio-medical Equipment Technology, J J Carr & JM Brown Regents , Prentice Hall.
6. Design of Micro- controller based Medical Instrumentation, J Tompkins & J G Webster, Prentice Hall Inc

Reference Books:

1. A systems approach to Biomedicine, W.B. Blesser , McGraw Hill..
2. Biomedical Engineering, J H U Brown, J E Jacobs & L Stark, Davis Co, Philadelphia, USA.
3. Principles of Applied Biomedical Instrumentation, L A Geddes & L E Baker, John Wiley & sons.
4. Biological Control Systems, J H Milsum, Mc Graw Hill.
5. Bioelectric Phenomena, R Plonsey, McGraw-Hill.

PROCESS CONTROL
EE-802D

Credit: 3 **Contact: 3L**

Module	Content	Hour
1	General review of process, Process control & automation, Servo and regulatory control, Basic process control loop block diagram. Characteristic parameter of a process, Process quality, Process potential, Process resistance, Process capacitance, Process lag, Self regulation. Process modeling, Process equations-their limitations-general approach,. Typical processes and derivation of their functions. Characteristics and functions of different modes of control actions, Schemes and analysis of On-Off, Multistep, Floating, Time proportional, PID control. Effect of disturbances and variation in set point in process control. Offset-why it appears and how it is eliminated-analysis and mathematical treatment.	10
2	Process reaction curves, Controllability-using (i) deviation reduction factors (ii) gain bandwidth product, State controllability. Tuning controllers: both closed and open loop methods (Ziegler-Nichols, Cohen, PRC method and 3-C method of parameter adjustment) Electronic PID controller design Pneumatic controllers-brief analysis.	08
3	Different control strategies-schemes, brief analysis and uses (i) Ratio control (ii) Cascade control (iii) Feed forward control (iv) Multivariable control	06
4	Final control element: actuators (Pneumatic actuators, Electrical actuators) and control valves (Globe, Ball. Butterfly, Gate, Pinch), different parts, Fail Position, Valve Characteristics, Cv, single & Double seated valves, Valve sizing, Valve selection,	

	Cavitation, Flashing, Noise. Control valve accessories- Air filter regulator, I/P converter, Pneumatic positioner, Electro Pneumatic positioner, limit switches, Motion transmitter. Brief study of safety valves and Solenoid valves.	08
5	Introduction to Programmable Logic controllers- Basic Architecture and function, Input-output modules and interfacing, CPU and memory, Relays, Timers, Counters and their uses, PLC programming and applications, Introduction to DCS	08

Numerical problems to be solved in the tutorial classes.

Text Books:

4. Principle of Process control, D. Patranabis, TMH
5. Automatic Process Control, D.P. Eckman, John Wiley.
6. Process control, P. Harriott, Mc Graw Hill

Reference Books:

7. Chemical process control, G. Stephanpoulos, PHI
8. Process control instrumentation technology, C.D. Johnson, PHI
9. Process Control-Principles and application, S. Bhanot, Oxford University press.
10. Process Control, S.K. Singh, PHI
11. Process dynamic & Control, S. Sundaram, Cengage Learning.
12. Instrument Engineers Handbook, B.G. Liptak, Chilton Book Co. Philadelphia.

Practical

ELECTRICAL SYSTEMS LABORATORY-II
EE-882

Credit: 4 **Contact: 6L**

The students would INDIVIDUALLY design the equipment and systems as per specifications provided by the class teacher following established procedures.
For each student, one item from each of the four groups would be chosen.

- For unspecified items of specification and or specifications of wires, cables etc., data should be taken by students from handbooks and Indian standard.
- Students should spend the allotted periods for carrying out design computations. Their attendance shall be recorded.
- Students should maintain a dedicated bound notebook for recording design activities like calculations, formulae used, sketches, flowcharts etc. The notebook should be regularly submitted to the class teacher for review and signature.
- Evaluation would be based on (i) Class attendance (20%), (ii) Design Note Book (30%) (iii) Design Report (30%) (iv) End of semester viva (20%, preferably by an external examiner)
- Topics of group A, B & C covered in 7^{th} semester (EE-782)` are not to be attempted in the 8^{th} semester (EE-892)

Group-A	• Designing a heating element with specified wattage, voltage and ambient temperature. • Designing an air core grounding reactor with specified operating voltage, nominal current and fault current.
Group-B	• Designing the power distribution system for a small township. • Designing a double circuit transmission line for a given voltage level and power (MVA) transfer. • Wiring and installation design of a multistoried residential building (G+4,not less than 16 dwelling flats with a lift and common pump) • Designing of a substation

Group-C	• Designing an ONAN distribution transformer. • Designing a three phase squirrel cage induction motor. • Designing a three phase wound rotor induction motor. • Designing a split phase squirrel cage induction motor for a ceiling fan or a domestic pump. • Designing a permanent magnet fractional hp servo motor.
Group-D	• Design the control circuit of a Lift mechanism • Design a controller for speed control of DC machine. • Design a controller for speed control of AC machine.