Electrical Engineering

B.TECH. PROGRAMME

Release Month & Year : June, 2017

B.Tech in Electrical Engineering 1st Year 1st Semester Syllabus Structure

Theory							
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points
			L	T	P	Total	
1	HMTS1101	Business English	2	0	0	2	2
2	PHYS1001	Physics I	3	1	0	4	4
3	MATH1101	Mathematics I	3	1	0	4	4
4	ECEN1001	Basic Electronics Engineering	3	1	0	4	4
5	MECH1101	Engineering Mechanics	3	1	0	4	4
		Total Theory	**14**	**4**	**0**	**18**	**18**

Laboratory							
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points
			L	T	P	Total	
1	PHYS1011	Physics I Lab	0	0	3	3	2
2	ELEN1011	Basic Electronics Engineering Lab	0	0	3	3	2
3	MECH1011	Workshop Practice	1	0	3	4	3
4	HMTS1111	Language Practice Lab (Level 1)	0	0	2	2	1
		Total Laboratory	**1**	**0**	**11**	**12**	**8**

Sessional							
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points
			L	T	P	Total	
1	HMTS1121	Extra curricular activities	0	0	2	2	1
		Total Sessional	**0**	**0**	**2**	**2**	**1**
		Total of Semester	**15**	**4**	**13**	**32**	**27**

B.Tech in Electrical Engineering 1st Year 2nd Semester Syllabus Structure

Theory							
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points
			L	T	P	Total	
1	CSEN1201	Introduction to Computing	3	1	0	4	4
2	CHEM1001	Chemistry I	3	1	0	4	4
3	MATH1201	Mathematics II	3	1	0	4	4
4	ELEC1001	Basic Electrical Engineering	3	1	0	4	4
5	MECH1201	Engineering Thermodynamics and Fluid Mechanics	3	1	0	4	4
		Total Theory	**15**	**5**	**0**	**20**	**20**

Laboratory / Practical							
Sl. No	Course Code	Course Name	Contact Hrs per Week				Credit Points
			L	T	P	Total	
1	CSEN1211	Introduction to Computing Lab	0	0	3	3	2
2	CHEM1011	Chemistry I Lab.	0	0	3	3	2
3	ELEC1011	Basic Electrical Engineering Lab	0	0	3	3	2
4	MECH1012	Engineering Drawing	1	0	3	4	3
		Total Laboratory	**1**	**0**	**12**	**13**	**9**
		Total of Semester	**16**	**5**	**12**	**33**	**29**

B.Tech in Electrical Engineering 2nd Year 1st Semester Syllabus Structure

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	MATH2001	Mathematical Methods	3	1	0	4	4
2	PHYS2001	Physics-II	3	1	0	4	4
3	ELEC2101	Analog & Digital Electronic circuits	4	0	0	4	4
4	ELEC2102	Circuit Theory	3	1	0	4	4
5	ELEC2103	Field Theory	3	1	0	4	4
6	HMTS2002	Indian Culture and Heritage	2	0	0	2	1
		Total Theory	18	3	0	22	21

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	PHYS2011	Physics-II Lab.	0	0	3	3	2
2	ELEC2111	Analog & Digital Electronic circuit Lab.	0	0	3	3	2
3	ELEC2112	Circuit Theory Lab	0	0	3	3	2
4	HMTS2011	Language Practice Laboratory (Level 2)	0	0	3	3	2
		Total of Practical / Sessional	0	0	12	12	8
TOTAL OF SEMESTER:						34	29

B.Tech in Electrical Engineering 2nd Year 2nd Semester Syllabus Structure

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	MATH2002	Numerical and statistical methods	3	0	0	3	3
2	ELEC2201	Electric Machine-I	3	1	0	4	4
3	ELEC2202	Electrical & Electronic Measurement	4	0	0	4	4
4	ELEC2203	Thermal Power Engineering	4	0	0	4	4
5	CHEM2001	Basic Environmental Engineering & Ecology	3	0	0	3	3
6	HMTS2001	Human Values and Professional Ethics	2	0	0	2	2
		Total Theory	18	1	0	20	20

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	MATH2012	Numerical and statistical methods lab	0	0	2	2	1
2	ELEC2211	Electrical Machine-I Lab.	0	0	3	3	2
3	ELEC2212	Electrical & Electronic Measurement Lab.	0	0	3	3	2
4	ELEC2213	Thermal power Engineering Lab	0	0	3	3	2
		Total of Practical / Sessional	0	0	11	11	7
TOTAL OF SEMESTER:						31	27

B.Tech in Electrical Engineering 3rd Year 2nd Semester Syllabus Structure

B.Tech in Electrical Engineering 3rd Year 1st Semester Syllabus Structure

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	HMTS3101	Economics for Engineers	3	0	0	3	3
2	ELEC3101	Electrical Machine-II	3	1	0	4	4
3	ELEC3102	Power System-I	3	1	0	4	4
4	ELEC3103	Signals & Systems	3	0	0	3	3
5	ELEC3104	Data Structure and Database Concept	3	0	0	3	3
Professional Electives-I							
1	ELEC3131	Electronic Instrumentation	3	0	0	3	3
2	ELEC3132	Illumination Engineering	3	0	0	3	3
		Total Theory	18	2	0	20	20

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	ELEC3111	Electrical machine Lab.-II	0	0	3	3	2
2	ELEC3112	Power system-I Lab.	0	0	3	3	2
3	ELEC3113	Signals & Systems Lab	0	0	3	3	2
4	ELEC3114	DBMS Laboratory	0	0	3	3	2
		Total of Practical / Sessional	0	0	12	12	8
TOTAL OF SEMESTER:						32	28

Theory:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	ELEC3201	Power System-II	3	1	0	4	4
2	ELEC3202	Power Electronics	3	0	0	3	3
3	ELEC3203	Control System	3	1	0	4	4
4	ELEC3204	Microprocessor & Microcontroller	3	0	0	3	3
5	HMTS3201	Principles of Management	2	0	0	2	2
Professional Electives-II							
1	ELEC3231	Digital Signal Processing	3	0	0	3	3
2	ELEC3232	Electrical Machine Dynamics	3	0	0	3	3
		Total Theory	17	2	0	19	19

Practical / Sessional:

Sl. No.	CODE	Paper	Contacts periods Per weeks			Total Contact Hrs	Credits
			L	T	P		
1	ELEC3211	Power System-II Lab.	0	0	3	3	2
2	ELEC3212	Power Electronics Lab.	0	0	3	3	2
3	ELEC3213	Control System Lab	0	0	3	3	2
4	ELEC3214	Microprocessor &Microcontroller Lab	0	0	3	3	2
5	HMTS3221	Personality Development	1	0	0	1	1
		Total of Practical / Sessional	1	0	12	13	9
TOTAL OF SEMESTER:						32	28

B.Tech in Electrical Engineering 4th Year 1st Semester Syllabus

Theory:

Sl. No.	Code	Paper	Contact Periods per Weeks			Total Contact Hrs	Credits
			L	T	P		
1	ELEC4101	Electric Drives & Power Utilization	3	1	0	4	4
2	ELEC4102	High Voltage Engineering	3	1	0	4	4
3		**Professional Elective-III**	3	0	0	3	3
4		**Free Elective-I**	3	0	0	3	3
		Total Theory	15	0	0	14	14

Practical:

Sl. No.	Code	Paper	Contact Periods per Weeks			Total Contact Hrs	Credits
			L	T	P		
1	ELEC4111	Electric Drives Lab.	0	0	3	3	2
2	HMTS 4121	Group Discussion for Professional	0	0	3	3	2
		Total of Practical	0	0	6	6	4

Sessional:

Sl. No.	Code	Paper	Contact Periods per Weeks			Total Contact Hrs	Credits
			L	T	P		
1	ELEC4191	Project- I	0	0	0	6	4
2	ELEC4121	Electrical Machine Design	0	0	0	3	2
3	ELEC4031	Seminar-I	0	0	0	3	2
4	ELEC4131	Industrial Training Evaluation	0	0	0	0	2
		Total of Sessional	0	0	0	12	10
TOTAL OF SEMESTER:						32	28

Professional Elective-III Papers (any one)

3(a) ELEC4161 Advanced Power System
3(b) ELEC4162 Advanced Control System

Free Elective-I Papers(any one)

4(a) INFO4182 Cloud Computing
4(b) AEIE4181 Instrumentation & Telemetry

Free Elective-I Paper offered to other Department

ELEC4182 Circuit Theory Analysis

B.Tech in Electrical Engineering 4th Year 2nd Semester Syllabus

Theory:

Sl. No	Code	Paper	Contact Periods per Weeks			Total Contact Hrs	Credits
			L	T	P		
1	HMTS4201	Organizational Behavior	2	0	0	2	2
2		**Free Electives-II**	3	0	0	3	3
		Total Theory	5	0	0	5	5

Sessional:

Sl. No.	Code	Paper	Contact Periods per Weeks			Total Contact Hrs	Credits
			L	T	P		
1	ELEC4032	Seminar-II	0	0	0	3	2
2	ELEC4221	Electrical System Design	0	0	0	3	2
3	ELEC4231	Comprehensive Viva Voce	0	0	0	0	3
4	ELEC4291	Project - II	0	0	0	12	8
		Total of Sessional	0	0	0	18	15
TOTAL OF SEMESTER:						23	20

Free Elective-II Papers(any one)

2(a) INFO4282 Soft Computing Application
2(b) CHEN4282 Total Quality Management & Assurance
2(c) BIOT4282 Non-Conventional Energy

Free Elective-II Paper offered to other Department

ELEC4282 Fundamentals of Illumination Engineering

B.Tech in Electrical Engineering
1st Year, 1st Semester

Course Name : BUSINESS ENGLISH					
Course Code: HMTS1101					
Contact hrs per week:	L	T	P	Total	Credit points
	2	0	0	2	2

Module I – [5L]

Communication Skill
Definition, nature & attributes of Communication
Process of Communication
Models or Theories of Communication
Types of Communication
Levels or Channels of Communication
Barriers to Communication

Module II-[12L]

Business Communication- Scope & Importance
Writing Formal Business Letters
Writing Reports
Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular
Project Proposal
Technical Report Writing
Organizing e-mail messages
E-mail etiquette
Tips for e-mail effectiveness

Module III-[10L]

Language through Literature
Modes of literary & non-literary expression
Introduction to Fiction, (An Astrologer's Day by R.K. Narayan and Monkey's Paw by W.W. Jacobs), Drama (The Two Executioners by Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of the Scorpion by Nissim Ezekiel and Palanquin Bearers by Sarojini Naidu)

Module IV-[3L]

Grammar in usage (nouns, verbs, adjectives, adverbs, tense, prepositions, voice change) -to be dealt with the help of the given texts.

References

1. Armand Matterlart and Michele Matterlart, Theories of Communication: A Short Introduction, Sage Publications Ltd., 1998.

2. Chan, Janis Fisher, and Diane Lutovich. Professional Writing Skills. San Anselmo, CA:
   Advanced Communication Designs, 1997.

3. Geffner, Andrew P. Business English. Hauppauge, New York: Barron's Educational Series, 1998.

4. Good, Edward C. Mightier Than the Sword. Charlottesville: Word Stone Publications, 1989.

5. Edward P.Bailey, Writing and Speaking at Work: A Practical Guide for Business Communication, Prentice-Hall, 7th edn, 2004.

6. Kitty O. Locker, Business and Administrative Communication, McGraw-Hill/ Irwin, 7th edn, 2004.

7. Lillian Chaney and Jeanette Martin, Intercultural Business Communication, Prentice Hall, 4th edn, 2005.

8. Yudkin, Marcia. Persuading on Course Name. Lansing, IL: Infinity Publishing, 2001.

Course Name : PHYSICS 1					
Course Code: PHYS 1001					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module I: [22 L]

Optics

1.Interference :

The principle of superposition of waves, Superposition of waves: Two beam superposition, Multiple-beam superposition, coherent and incoherent superposition. Two source interference pattern (Young's double slit), Intensity distribution. Interference in thin films, wedge shaped films and Newton's rings, applications of interference. Newton's rings: Determination of wavelength of light, refractive index of liquid.

2 Diffraction:

Diffraction of light waves at some simple obstacles. Fraunhoffer diffraction through double slit and diffraction grating, grating spectra, resolving power of grating.

3. Polarisation & Fibre Optics:

Elementary features of polarization of light waves.Production and analysis of linearly, elliptic and Circularly polarized light, polaroids and application of polarizations. fibre optics - principle of operation, numerical aperture, acceptance angle

4 Laser

Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

Module II : [8L]

Waves & Oscillation

Superposition of two linear SHMs (with same frequency), Lissajous' figures. Damped vibration – differential equation and its solution, Critical damping, Logarithmic decrement, Analogy with electric circuits. Forced vibration – differential equation and solution, Amplitude and Velocity resonance, Sharpness of resonance and Quality factor. Progressive wave- Wave equation and its differential form, Difference between elastic (mechanical) and electromagnetic waves.

Module III : [9L]

Quantum Mechanics

Need for Quantum physics-Historical overviews, Particle aspects of radiation-Black body radiation, Compton scattering, pair production., Origin of X-ray spectrum. Wave aspect of particles- matter wave, de Broglie Hypothesis, Heisenberg Uncertainty principles- Statement, Interpretation and application.

Module IV: [6L]

Introduction of Crystallography

Space Lattice, Unit Cell, Lattice Parameters, Crystal Systems, Bravais Lattices, Miller Indices and its applications, Crystal Planes and Directions, Inter Planar Spacing of Orthogonal Crystal Systems, Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC. Bragg's law and its applications.

Text Books

1. Atomic Physics Vol 1 – S.N. Ghoshal
2. Optics – Ajoy Ghak
3. Waves & Oscillation – N.K. Bajaj
4. Quantum Physics of Atoms , Molecules, Solids, Nuclei and particles – Eisberg and Resnick

Reference Books

1. Introduction to Special Relativity – Robert Resnick
2. Prespective on Modern Physics - Arthur Beiser
3. Optics – Jenkins and White
4. University Press – Sears & Zemansky
5. Introduction to modern Physics – Mani and Meheta
6. Optics – Brijlal and Subrahmanyam

Course Name : MATHEMATICS I					
Course Code: MATH1101					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module I [10L]

Matrix:

Matrices and their basic attributes, Determinant of a square matrix, Minors and Cofactors, Laplace's method of expansion of a determinant, Product of two determinants, Adjoint of a determinant, Jacobi's theorem on adjoint determinant. Singular and non-singular matrices, Adjoint of a matrix, Inverse of a non-singular matrix and its properties, Orthogonal matrix and its properties, Special Complex Matrices: Hermitian, Unitary, Normal(definition only), Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by :Cramer's Rule and Matrix inversion method, Consistency and inconsistency of a system of homogeneous and inhomogeneous linear simultaneous equations, Characteristic Equation and computation of eigenvalues and eigenvectors of a square matrix (of order 2 or 3), Cayley-Hamilton theorem and its applications(with special reference to higher power of matrices, e.g. Idempotent and Nilpotent matrices)

Module II [10 L]

Mean Value Theorems & Expansion of Functions:

Rolle's theorem: its geometrical interpretation and its application, Concavity and Convexity of curves, Mean Value theorems – Lagrange & Cauchy and their application, Taylor's theorem with Lagrange's and Cauchy's form of remainders and its application, Expansions of functions by Taylor's and Maclaurin's theorem, Maclaurin's infinite series expansion of the functions: $\sin x, \cos x, e^x, \log(1+x), (a+x)^n, n$ being an integer or a fraction (assuming that the remainder $R_n \to 0$ as $n \to \infty$ in each case).

Infinite Series:

Preliminary ideas of sequence, Infinite series and their convergence/divergence, Infinite series of positive terms, Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test(statements and related problems on these tests), Raabe's test, Proof of e being irrational, Alternating series, Leibnitz's Test (statement, definition) illustrated by simple examples, Absolute convergence and Conditional convergence,

Module III [10 L]

Successive differentiation:

Higher order derivatives of a function of single variable, Leibnitz's theorem (statement only and its application, problems of the type of recurrence relations in derivatives of different orders and also to find $(y_n)_0$).

Calculus of Functions of Several Variables:

Recapitulation of some basic ideas of limit and continuity of functions of single variable, Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their related problems, Jacobians up to three variables and related problems, Maxima, minima and saddle points of functions and related problems.

Module-IV [10 L]

Multiple Integration and Vector Calculus:

Concept of line integrals, Double and triple integrals. Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics, Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Statements and applications).

Reduction formula:

Reduction formulae both for indefinite and definite integrals of types:

$\int \sin^n x, \int \cos^n x, \int \sin^m x \cos^n x, \int \cos^m x \sin nx, \int \frac{dx}{(x^2+a^2)^n}, m, n$ are positive integers.

References

1. Advanced Engineering Mathematics: Erwin Kreyszig by Wiley India
2. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
3. Higher Engineering Mathematics: John Bird (Elsevier)
4. Advanced Engineering Mathematics: Wiley and Barrett (Tata McGraw-Hill)
5. Calculus: M. J. Strauss, G. L. Bradley and K. L. Smith (Pearson Education)
6. Engineering Mathematics: S. S. Sastry (PHI)
7. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP),Indian Edition.
8. Linear Algebra(Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)
9. Vector Analysis(Schaum's outline series): M.R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)
10. Introduction to Real Analysis: S.K.Mapa (Sarat Book Distributors)

Course Name : Basic Electronics Engineering					
Course Code: ECEN1001					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module I [10 L]

Semiconductors:

Crystalline material, Energy band theory, Fermi levels; Conductors, Semiconductors and Insulators: electrical properties, band diagrams. Semiconductors: intrinsic and extrinsic, energy band diagram, electrical conduction phenomenon, P-type and N-type semiconductors, drift and diffusion carriers.

Diodes and Diode Circuits:

Formation of P-N junction, energy band diagram, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener Diode and its Application, Zener and Avalanche breakdown.
Simple diode circuits, load line, piecewise linear model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

Module II [10 L]

Bipolar Junction Transistors:

Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off, active and saturation modes of operation, transistor action, input & output characteristics, load line & amplifier operation and current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor.

Module III [9 L]

Field Effect Transistors:

Junction field effect transistor (JEET): Principle of operation, JFET parameters, eqv. Circuit, JFET biasing, self bias, design of bias circuits, load line, amplifier characteristics.

MOSFETs:

Construction & principle of operation of p- & n-channel enhancement & depletion mode MOSFETs, drain & transfer characteristics, threshold voltage & its control.

Cathode Ray Osilloscope:

Construction and working principle of CRO, Lissajous pattern.

Module IV [9 L]

Feed Back Amplifier:

Concept-block diagram, properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, condition of oscillation, Barkhausen criteria.

Operational Amplifier:

Introduction to integrated circuits, operational amplifier and its terminal properties; Application of operational amplifier; Concept of op-amp saturation, inverting and non-inverting mode of operation, Adders, Subtractors, Voltage follower, Integrator, Differentiator, Basic Comparator Circuit.

References:

1. Boylestad & Nashelsky:Electronic Devices & Circuit Theory
2. R.A Gayakwad:Op Amps and Linear IC's, PHI
3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications
4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering
5. Millman & Halkias: Integrated Electronics.
6. Salivahanan: Electronics Devices & Circuits.
7. Albert Paul Malvino: Electronic Principle.

Course Name : ENGINEERING MECHANICS					
Course Code: MECH 1101					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module-I [10L]

Importance of Mechanics in Engineering ; Definition of Mechanics; Concepts of particles & rigid bodies;

Vector and scalar quantities; Vector algebra –definition and notation; Types of vectors – equal , equivalent , free , bound , sliding ; Addition , subtraction of vectors ; Parallelogram law , triangle law , vector polygon ; Scalar multiplication of vectors ; Resolution of vectors in Cartesian co–ordinate system ; Unit vector, unit co–ordinate vectors ($\hat{\imath}$, $\hat{\jmath}$, $\hat{k}$) ; Direction cosines ; Addition/ subtraction of vectors in components form.

Definition of force vector ; Dot product , cross product and the application ; Important vector quantities (position vector , displacement vector) ; Moment of a force about a point and about an axis , moment of a couple ; Representation of force and moments in items of $\hat{\imath}$, $\hat{\jmath}$, $\hat{k}$. Principle of transmissibility of force (sliding vector); Varignon's theorem for a system of concurrent forces with proof; Resolution of a force by its equivalent force-couple system; Resultant of forces.

Module-II [10L]

Type of forces – collinear, concurrent, parallel, concentrated, distributed; Active and reactive forces, different types of reaction forces; Free body concept and diagram; Concept and equilibrium of forces in two dimensions; Equations of equilibrium; Equilibrium of three concurrent forces -- Lami's theorem.

Concept of friction: Laws of Coulomb's friction; Angle of friction, angle of repose, coefficient of friction -- static and kinematic.

Module-III [12L]

Distributed force system; Centre of gravity; Centre of mass & centroid; Centroid of an arc; Centroid of plane areas – triangle, circular sector, quadrilateral and composite area consisting of above figures.

Area moment of inertia: Moment of inertia of a plane figure; Polar moment of inertia of a plane figure; Parallel axes theorem.

Concept of simple stress and strain ; Normal stress , shear stress , normal strain, shear strain; Hooke's law; Poisson's ratio; stress- strain diagram of ductile and brittle material; Proportional limit, elastic limit, yield point , ultimate stress, breaking point; Modulus of elasticity.

Module-IV[16L]

Introduction to dynamics: Kinematics & kinetics; Newton's laws of motion; Law of gravitation and acceleration due to gravity; Rectilinear motion of particles with uniform & non – uniform acceleration.
Plane curvilinear motion of particles: Rectangular components (projectile motion), normal and tangential components.
Kinetics of particles: D'Alembert's principle and free body diagram; Principle of work & energy; Principle of conservation of energy.
Impulse momentum theory: Conservation of linear momentum

References:

1. Engineering Mechanics:- Statics and Dynamics by Meriam & Kreige , Wiley india
2. Engineering Mechanics:- Statics and Dynamics by I.H. Shames, P H I
3. Engineering Mechanics by Timoshenko , Young and Rao , TMH
4. Element of strength of materials by Timoshenko & Young, E W P
5. Fundamentals of Engineering Mechanics by Nag & Chanda – Chhaya Prakashani.

Course Name : PHYSICS I Lab					
Course Code: PHYS 1011					
Contact hrs per week:	L	T	P	Total	Credit points
	0	0	3	3	2

1. Determination of Young's modulus by Flexure Method and calculation of bending moment and shear force at a point on the beam.
2. Determination of modulus of rigidity by Static/Dynamic Method.
3. Determination of thermal conductivity of a good conductor by Searle's Method.
4. Determination of thermal conductivity of a bad conductor by Lee's and Chorlton's Method.
5. Determination of dielectric constant of a given dielectric material.
6. Use of Carey Foster's bridge to determine unknown resistance.
7. Determination of wavelength of light by Newton's ring method.
8. Determination of wavelength of light by Fresnel's biprism method.
9. Determination of wavelength of light by Laser diffraction method.
10. Determination of dispersive power of the material of a given prism.
11. Determination of co-efficient of viscosity of a liquid by Poiseulle's capillary flow method.

Course Name : Basic Electronics Engineering Lab					
Course Code: ECEN1011					
Contact hrs per week:	L	T	P	Total	Credit points
	0	0	3	3	2

List of Experiments

1. Familiarisation with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multimeters etc.
2. Familiarisation with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and

Course Name : Workshop Practice					
Course Code: MECH1011					
Contact hrs per week:	L	T	P	Total	Credit points
	1	0	3	4	3

Job 1: General awareness of a typical workshop.

Theory requirements: Workshop definition, various shops in a typical workshop, Carpentry, Fitting, Foundry; Sheet Metal Shop, Welding and Brazing Shop, Machine Shop , Forging & Blacksmithy, Safety precautions to be followed in a workshop, Familiarization of Various safety devices and their uses.

Job 2: Making of a wooden pattern.

Theory requirements: Market forms of converted Timber ,eg, log, balk, plank,batten, beam ,Types of Wood, Hard Wood, Soft Wood, particle board; Seasoning of wood, Natural seasoning, Artificial seasoning, Carpentry Tools-Marking Tools, Cutting Tools, Planing Tools, Boring Tools, Striking Tools , Holding & Misc. Tools, Carpentry Processes (marking, sawing, planning, chiselling, boring, grooving, joining etc.), Safety precautions in Carpentry Shop.

Job 3: Making of a matched profile form MS plate.

Theory requirements: Work Bench, Fitting Tools (Bench Vice,Chisel,Hammer,Different types of Files, (Rough,Bastard, Second Cut, Half Round, Triangular File),Saw(Hack saw etc.), Scriber, Punch, Try Square, Angle Plate, caliper (outside & inside), Universal Surface Gauge, Centre Punch, Prick Punch, Drill (Flat,straight fluted, taper shank twist drill).
Fitting Operations,Filing, Marking, Drilling, Tapping (Rougher,Intermediate, Finisher taps), Tap Drill size (D=T-2d), Sawing, Dieing . Safety precautions in Fitting Shop.

Job 4: Making of an internal and external thread.

Theory requirements : Thread standards and thread classifications, Internal Thread,External Thread, Thread Nomenclature (Major dia, Minor dia, Pitch dia, pitch, Lead, TPI, Metric, BSP , Nominal size), Specifications of threaded fasteners (in Metric System). Safety precautions in Dieing and Tapping.

Job 5: Making of a green sand mould using the pattern made under Job no. 2.

Theory requirements: Mould making, Preparation of sand, (silica, clay, moisture, and misc items and their functions), Properties of a good sand mould, General procedure for making a good sand mould, Different tools used for preparation of a mould, Explanation of various terms , Cope and Drag Box, Runner, Riser, Gating and its utility, Parting sand, Vent holes.

Job 6: Demonstration of metal melting and casting

Theory requirements: Metal melting furnaces: Ladles, Using of Tongs, Molten metal pouring procedure, Safety precautions in pouring molten metal in a mould.

Job 7. Making of a stepped pin in a centre lathe. *(2 Classes)*

Theory requirements: Machining and common machining operations , Lathe M/c and its specifications, Head stock, Tailstock, Chuck-Self centering chuck , 4 jaw chuck, Bed, Carriage, Feed mechanism, Screw cutting mechanism, various lathe operations like turning, facing, grooving, chamfering, taper turning ,Thread cutting, Knurling, Parting, Cutting speed, Feed, Depth of cut , Different types of cutting tools-Safety precautions in a machine shop.

Job 8: Making of square prism from a round shaft by Shaping Machine

Theory requirements: Description of a Shaping machine, Base , Column, Saddle, Clapper box, Quick return mechanism, Feed Mechanism, Table, Rotation of table, Adjustment of stroke length, Adjustment of starting point of cut. Safety Precautions while working in Shaping Machine.

Job 9: Making of square prism from a round shaft by Milling Machine

Theory requirements: Description of a milling machine, Specification of a Milling machine, Types of Milling-Up Milling, Down Milling, Vertical Milling Machine, Horizontal Milling Machine , Safety precautions while working in Milling Machine.

Job 10 : Arc Welding practice and making of a welded joint

Theory requirements: Welding, Weldability, Types of Welding, MMAW, Gas Welding, Electrode , Functions of Flux, Equipment for MMAW, Different types of Flames in Gas Welding and Gas Cutting (Neutral-Oxidising-Reducing Flames), Different types of welding joints, AC Welding , DC Welding; Safety precautions in Welding Shop.

Job 11 : Sheet Metal forming & Brazing

Theory requirement: Specification of sheet metal, SWG vs. mm, HR sheet, CR sheet, GI Sheet, Stainless Steel Sheet, Aluminum sheets, Tin Plates, Sheet metal working Tools, Micrometer, Chisels, Punches, Hammers, Mallets, Hand Shear or Snippets, Various sheet metal forming operations, Shearing, Marking, Punching, Drilling, Bending, Drawing, Brazing, Safety precautions in Sheet Metal Working Shop.

References:

1. Elements of Workshop Technology (Vol- I and II)- Hajra Choudhury, Media Promoter &Publishers Privet Limited.

2. Workshop Technology (Vol- I and II) – Chapman , Viva Books Privet Limited.

Course Name : Language Practice Lab (level 1)					
Course Code: HMTS 1111					
Contact hrs per week:	L	T	P	Total	Credit points
	0	0	2	2	1

Module I [3P]

Introduction to Linguistics (Phonology)
Phonetics-Vowel and Consonant Sounds (Identification &articulation)
Word- stress
Intonation (Falling and rising tone)
Voice Modulation
Accent training

Module II [3P]

Listening Skills
Principles of Listening
Approaches to listening
Guidelines for Effective Listening
Listening Comprehension
Audio Visual (Reviews)

Listening Skills
Principles of Listening
Approaches to listening
Guidelines for Effective Listening
Listening Comprehension
Audio Visual (Reviews)

Module III [2P]

Discourse Analysis-
Spoken Discourse
Conversational Skills/Spoken Skills
Analysing Speech dynamics
(Political Speeches
Formal Business Speeches)

Module IV [9P]

Writing Skill-
Descriptive, narrative and expository writing
Writing with a purpose---Convincing skill, argumentative skill/negotiating Skill (These skills will be repeated in oral skills).
Writing reports/essays/articles—logical organization of thoughts
Book review

References

1. Munter, Mary. Guide to Managerial Communication. 5th ed. Upper Saddle River, NJ: Prentice Hall, 1999.
2. Cypres, Linda. Let's Speak Business English. Hauppauge, NY: Barron's Educational Series, 1999. Crystal, David. 1971. *Linguistics*. Baltimore: Penguin Books.
3. Larsen-Freeman, D. (1986). "Techniques and principles in language teaching." Oxford: Oxford University Press.
4. Littlewood, W. (1981). "Language teaching. An introduction." Cambridge: Cambridge University Press.
5. Savignon, S. J., & Berns, M. S. (Eds.). (1983). "Communicative language teaching: Where are we going? Studies in Language Learning," 4(2). (EDRS No. ED 278 226, 210 pages)

Course Name : Co Curricular Activities					
Course Code: HMTS 1121					
Contact hrs per week:	L	T	P	Total	Credit points
	0	0	2	2	1

Objective: This course aims at instilling a sense of social responsibility. This objective can be achieved by bringing in awareness about the contemporary issues relevant to the GenX and Gen Y through enlightened discussions and active participation. Since the course has 1 credit detailed planning regarding the area of activities and method of evaluation should be charted at the start of the semester.

Module I:

Project Work
Development of projects based on integral and holistic developmental models to be implemented in rural areas or underdeveloped areas in the peripheral areas of cities. This could include a wide area of activity –
from taking up a research projects to analyse the need of a particular under-developed area to trying to implement a project already formulated. This could also relate to mobilizing funds for a specific project.

Module II:

Action-oriented schemes

e.g.Organising Blood –donation camps
Conducting child –healthcare services
Helping the old and sick
(in coordination with NGOs and other institutes)

Module III:

Society and Youth

Developing Awareness among the youth about social issues both local and global for e.g. Eradication of social evils like drug abuse, violence against women and others.

Module IV:

Youth and Culture

Generating new ideas and help the participants to be creative and innovative for e.g.Enacting street plays, encouraging creative writing by organizing workshops and competitions. Active participation of the students in the nation building process by making positive changes in the social and individual space.

B.Tech in Electrical Engineering
1st Year, 2nd Semester

Course Name : Introduction to Computing					
Course Code: CSEN 1201					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Learning Objective: Introduction to the concept of computer and computation and solving of problems using C as a programming language. Coverage of C will include basic concepts, arithmetic and logic, flow control, and data handling using arrays, structures, pointers and files.

Module I: [13L]

Fundamentals of Computer

History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Assembly language, high level language, compiler and assembler (basic concepts).

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit). Binary Arithmetic & logic gates. Boolean algebra – expression, simplification, Karnaugh Maps.

Module II: [5L]

Basic Concepts of C

C Fundamentals:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements.

Operators & Expressions:

Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Module III: [8L]

Program Structures in C

Flow of Control:

Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes - auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables.

C preprocessor (macro, header files), command line arguments.

Module IV: [14L]

Data Handling in C

Arrays and Pointers:

One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality.

String and character arrays; C library string functions and their use.

User defined data types and files:

Basic of structures; structures and functions; arrays of structures.

Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs();

Text Books

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Reference Books

1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D.M.Ritchie, B.W. Kernighan

Course Name : Chemistry 1					
Course Code: CHEM 1001					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module I [10 L]

Thermodynamics & Spectroscopy

Chemical Thermodynamics & Thermochemistry

Concept of Thermodynamic system, Introduction to first law of thermodynamics, Enthalpy Heat Capacity, Reversible and Irreversible processes, Adiabatic changes, Application of first law of thermodynamics to chemical processes, 2nd law of thermodynamics, Evaluation of entropy, Work function and free energy, Phase Changes, Clausius Clapeyron Equation, Chemical Potential, Gibbs Duhem Relation, Activity and Activity coefficient.

Spectroscopy

Electromagnetic Radiation, Basic idea of UV-visible & IR spectroscopy.

Module II [10 L]

Structure & Bonding

Chemical Bonding

Covalent bond, VSEPR Theory, Molecular Orbital Theory, Hydrogen bond, Intermolecular forces-vander Waals forces, Ionization energy, Electronegativity, Electron affinity, Hybridisation, Dipole moment

Solid State Chemistry

Introduction to stoichiometric defects (Schottky & Frenkel) and non – stoichiometric defects (Metal excess and metal deficiency). Role of silicon and germanium in the field of semiconductor.

Ionic Equilibria and Redox Equlibria

Acid Base Equilibria in water, Strength of acids and bases, Hydrogen ion exponent, Ionic product of water, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation, Redox Equilibria,

Structure and reactivity of Organic molecule

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals.
Brief study of some addition, eliminations and substitution reactions.

Module III [10 L]

Electrochemistry & Reaction Dynamics

Conductance

Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance, ion conductance, effect of temperature and concentration (Strong and Weak electrolyte). Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Conductometric titrations: SA vs SB & SA vs WB; precipitation titration KCl vs $AgNO_3$.

Electrochemical Cell

Cell EMF and thermodynamic derivation of the EMF of a Galvanic cell (Nernst equation), single electrode potentials, hydrogen half-cell and calomel half cell (construction, representation, cell reaction, expression of potential, discussion, application) Storage cell, fuel cell (construction, representation, cell reaction, expression of potential, discussion, application). Application of EMF measurement on a) the change in thermodynamic function (ΔG, ΔH, ΔS) b) the equilibrium constant of a reversible chemical reaction c) the valency of an ion.

Kinetics

Reaction laws: rate expression, order and molecularity, zero, first and second order kinetics. Pseudounimolecular reaction, Arrhenius equation.
Mechanism and theories of reaction rates (Collision theory and Transition state theory,).
Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics).

Module IV [10 L]

INDUSTRIAL CHEMISTRY & POLYMERIZATION

Industrial Chemistry

Solid Fuel: Coal, Classification of coal, constituents of coal, carbonization of coal (HTC and LTC), Coal analysis: Proximate and ultimate analysis.
Liquid fuel: Petroleum, classification of petroleum, Refining, Petroleum distillation, Thermal cracking, Octane number, Cetane number, Aviation Fuel (Aviation Gasoline, Jet Gasoline), Bio-diesel.
Gaseous fuels: Natural gas, water gas, coal gas, bio gas.

Polymerization

Concepts, classifications and industrial applications. Polymer molecular weight (number avg. weight avg. viscosity avg.: Theory and mathematical expression only), Poly dispersity index (PDI). Polymerization processes (addition and condensation polymerization), degree of polymerization, Copolymerization, stereo-regularity of polymer, crystallinity (concept of T_m) and amorphicity (Concept of T_g) of polymer.

Preparation, structure and use of some common polymers: plastic (PE: HDPE, LDPE, PVC, Bakelite, PP), rubber (natural rubber, SBR, NBR) and Vulcanization., fibre(nylon 6.6, Nylon 6, Polyester).
Conducting and semi-conducting polymers.

Text Books

1. Engineering Chemistry, Gourkrishna Dasmohapatra, Vikas Publishing House
2. A Text book of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co Pvt Ltd
3. Engineering Chemistry, K. L. Chugh, Kalyani Publishers.

Reference Books

1. General & Inorganic Chemistry, R. P. Sarkar, Fuels and Combustion, New Central Book Agency P Ltd
2. L. Finar, Organic Chemistry, Addison Wesley Longman, Inc
3. Organic Chemistry, Morrison & Boyd, Prentice Hall of India
4. Physical Chemistry, K. L. Kapoor, McMillan
5. P. C. Rakshit, Physical Chemistry, Sarat Book House (7th Edition).

Course Name : Mathematics II					
Course Code: MATH1201					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module I [10 L]

Ordinary differential equations (ODE)-

First order and first degree: Exact equations, Necessary and sufficient condition of exactness of a first order and first degree ODE (statement only), Rules for finding Integrating factors, Linear and non-linear differential equation, Bernoulli's equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation).

Second order and first degree:

General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods for finding P.I., Method of variation of parameters, Cauchy-Euler equations.

Module II:[10L]

Basics of Graph Theory

Graphs, Digraphs, Weighted graph, Connected and disconnected graphs,Complement of a graph, Regular graph, Complete graph, Subgraph,; Walks, Paths, Circuits, Euler Graph,Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph,Graph isomorphism, Bipartite graph.

Tree:

Definition and properties, Binary tree, Spanning tree of a graph, Minimal spanning tree, properties of trees, Algorithms: Dijkstra's Algorithm for shortest path problem, Determination of minimal spanning tree using DFS, BFS, Kruskal's and Prim's algorithms.

Module III [10L]

Improper Integral:

Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations.

Laplace Transform:

Introduction to integral transformation, functions of exponential order, Definition and existence of LT (statement of initial and final value theorem only), LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine , cosine and exponential integrals using LT, LT of periodic and step functions Definition and properties of inverse LT Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT.

Module IV [10L]

Three Dimensional Geometry

Equation of a plane. General form. Transformation to the normal form. Intercepts. Equation of the plane through three given points. Equation of a plane passing through the intersection of two planes. Angle between two intersecting planes. Bisectors of angles between two intersecting planes. Parallelism and perpendicularity of two planes.

Canonical equation of the line of intersection of two intersecting planes. Angle between two lines. Shortest distance between two lines. Condition of coplanarity of two lines. Length of the perpendicular from a point to a given line.

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig, (Wiley Eastern)
2. Graph Theory: V. K. Balakrishnan, (Schaum's Outline, TMH)
3. A first course at Graph Theory: J. Clark and D. A. Holton (Allied Publishers LTD)
4. Introduction to Graph Theory: D. B. West (Prentice-Hall of India)
5. Graph Theory: N. Deo (Prentice-Hall of India)
6. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)
7. Higher Engineering Mathematics: John Bird (4th Edition, 1st Indian Reprint 2006, Elsevier)
8. Calculus: Strauss, Bradley and Smith (3PrdP edition, Pearson Education)
9. Engineering Mathematics (Volume 2): S. S. Sastry (Prentice-Hall of India)
10. Introductory Course in Differential Equations: Daniel A. Murray (Longmans & Green).
11. Co-ordinate Geometry – S. L. Loney.
12. Analytical Geometry And Vector Algebra- R M Khan

Course Name : BASIC ELECTRICAL ENGINEERING					
Course Code: ELEC1001					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module-I: [12 L]

DC Network Theorem: Kirchhoff's law, nodal analysis, mesh analysis, Superposition theorem, Thevenin's theorem, Norton theorem, Maximum power transfer theorem, star-delta conversion.

DC Machines: Construction, EMF equation, Principle of operation of DC generator, open circuit characteristics, external characteristics, Principle of operation of DC motor, Speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of dc motor.

Module-II [8L]

Electrostatics: Gauss's law and its applications to electric field and potential calculation. Capacitor, capacitance of parallel plate capacitor, spherical capacitor and cylindrical capacitor.

Electromagnetism: Amperes law, Biot-savart's law, Ampere's circuital law and their applications, Magnetic circuits, analogy between magnetic and electric circuits, Faraday's law, self and mutual inductance. Energy stored in a magnetic field, Hysteresis and Eddy current losses.

Module-III [10L]

AC single phase system: concept of alternating signal, average and RMS values of alternating signal, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, AC series , parallel and series parallel circuits, Active power, Reactive power, power factor, Resonance in RLC series and parallel circuit, Q factor, bandwidth.

Three phase system: balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams. Power measurement by two wattmeter method.

Module-IV [10L]

Single phase transformer: Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, open and short circuit tests, efficiency.

3-phase induction motor: Concept of rotating magnetic field, principle of operation, Construction, equivalent circuit and phasor diagram, torque-speed/slip characteristics, Starting of Induction Motor.

Text Books:

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition
2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition
3. Basic Electrical Engineering, Hughes
4. Electrical Technology, Vol-I,Vol-II,Surinder Pal Bali, Pearson Publication
5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall
2. Advance Electrical Technology, H.Cotton, Reem Publication
3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers
4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai
5. Basic Electrical Engineering, Nath & Chakraborti
6. Fundamental of Electrical Engineering, Rajendra Prasad, PHI, Edition 2005.

Course Name : Engineering Thermodynamics & Fluid Mechanics					
Course Code: MECH1201					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Module I [10 L]

Basic concepts of Thermodynamics:

Introduction; Macroscopic and microscopic concept; Definition of Thermodynamic systems; Surrounding, universe; Open, closed and isolated systems; Concept of control volume; Thermodynamic properties: intensive, extensive & specific properties; state.

Thermodynamic equilibrium; Change of state; Thermodynamic processes and cycles; Quasi-static processes; Reversible processes; Zeroth law of Thermodynamics -concept of temperature.

Heat & Work:

Definition of Thermodynamic work; Work transfer-displacement work for a simple compressible system, path function, PdV work in various quasi-static processes(isothermal, isobaric, adiabatic, polytropic, isochoric); Free expansion; Indicated diagram (P-V diagram) .
Definition of heat; Heat transfer-a path function; Similarities and dissimilarities between heat and work.

Module II [8 L]

First law of Thermodynamics: Statement; 1st law for a closed system executing a cycle; Concept of stored energy; Energy as a property, different forms of stored energy, internal energy, first law for a non-flow process; Flow work; Definition of enthalpy, C_p, C_v; Energy of an isolated system; Flow energy; First law for an open system - steady flow energy equation; Examples of steady flow devices(nozzle and diffuser, turbine, pump, compressor, boiler, condenser and throttling device); PMM-I

Module III [10 L]

Second law of Thermodynamics:

Qualitative difference between heat and work; Definition of source & sink: cyclic heat engine, heat pump and refrigerator, thermal efficiency of heat engine, C.O.P of heat pump and refrigerator; Kelvin-Plank and Clausius statements of second law; Equivalence of the two statements.

Reversible process; Irreversible process; Factors for irreversibility; Carnot cycle and Carnot efficiency; Reversible heat engine and heat pump; PMM-II

Entropy: Mathematical statement of Clausius Inequality: Entropy as a property; Entropy principle; T-s plot for reversible isothermal, adiabatic, isochoric & isobaric processes.

Air standard Cycles:

Otto cycle & Diesel cycle, P-V & T-s plots, Net work done and thermal efficiency.

Module IV [10 L]

Properties & Classification of Fluid:

Definition of fluid; Concept of Continuum; Fluid properties- density, specific weight, specific volume, specific gravity; Viscosity : definition , causes of viscosity , Newton's law of viscosity, dimensional formula and units of viscosity, kinematic viscosity; Variation of viscosity with temperature. Ideal and Real fluids; Newtonian and Non-Newtonian fluids; No-slip condition.
Compressibility and Bulk modulus of elasticity.
Difference between compressible and incompressible fluids.

Fluid Statics:

Introduction; Pascal's Law--statement and proof; Basic Hydrostatic Law and its proof; Variation of pressure with depth in incompressible fluid, piezometric head, pressure head; Unit and scales of pressure measurement.
Measurement of fluid pressure: Piezometer, Manometers -Simple and Differential U-tube manometer, Inverted tube manometer, Inclined tube manometer.
Characteristics and choice of manometric fluid.

Module V [10 L]

Fluid Kinematics:

Definition; Flow field and description of fluid motion(Eulerian & Lagrangian method), steady and unsteady flow, uniform and non-uniform flow-examples.
Acceleration of a fluid particle-local acceleration, convective acceleration. Stream line, Stream tube, Path line and Streak line; Laminar and Turbulent flow, Reynolds Number. Equations of streamlines and path lines.
Continuity equation for unidirectional flow and for differential form in 3-D Cartesian coordinate system.

Dynamics of Ideal fluids:

Introduction, Euler's equation of motion along a streamline; Bernoulli's equation-assumptions and significance of each term of Bernoulli's equation.
Application of Bernoulli's equation-problem on pipe line. Measurement of flow rate: Venturimeter and orificemeter .
Static pressure, Dynamic pressure, Stagnation pressure-measurement of velocity by Pitot tube.

References:

1. Engineering Thermodynamics- Nag, P.K. - T. M.H
2. Fundamentals of Thermodynamics- Sonntag, Borgnakke & Van Wylen, Wiley India
3. Thermodynamics- an Engineering approach - 6e, Cengel & Boles, TM
4. Fluid Mechanics & Hydraulic Machines – R.K. Bansal, Laxmi Publications Ltd, India
5. Introduction to Fluid Mechanics and Fluid Machines- S.K. Som, G. Biswas, & S. Chakraborty , T.M.H
6. Fluid Mechanics – A.K. Jain, Khanna Publishers.

Course Name : Introduction to Computing Lab					
Course Code: CSEN1211					
Contact hrs per week:	L	T	P	Total	Credit points
	0	0	3	3	2

Basic Computation & Principles of Computer Programming Lab

Softwares to be used: Cygwin and notepad++, Tiny C

Day 1: LINUX commands and LINUX based editor
Day 2: Basic Problem Solving
Day 3: Control Statements (if, if-else, if-elseif-else, switch-case)
Day 4: Loops - Part I (for, while, do-while)
Day 5: Loops - Part II
Day 6: One Dimensional Array
Day 7: Array of Arrays
Day 8: Character Arrays/ Strings
Day 9: Basics of C Functions
Day 10: Recursive Functions
Day 11: Pointers
Day 12: Structures and Unions
Day 13: File Handling

Course Name : CHEMISTRY I LAB					
Course Code: CHEM 1011					
Contact hrs per week:	L	T	P	Total	Credit points
	0	0	3	3	2

List of Experiments:

1. To determine the alkalinity in a given water sample.
2. Estimation of iron using $KMnO_4$: self indicator.
3. Estimation of iron using $K_2Cr_2O_7$: redox sensitive indicator.
4. To determine total hardness and amount of calcium and magnesium separately in a given water sample.
5. To determine the value of the rate constant for the hydrolysis of ethyl acetate catalyzed by hydrochloric acid.
6. Heterogeneous equilibrium (determination of partition coefficient of acetic acid between n-butanol and water).
7. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
8. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
9. Iodometric estimation of Cu^{2+}.
10. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)

Course Name : BASIC ELECTRICAL ENGINEERING LAB.					
Course Code: ELEC1011					
Contact hrs per week:	L	T	P	Total	Credit points
	0	0	3	3	2

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin's & Norton's theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three phase circuit by two wattmeter method.

Course Name : Engineering Drawing					
Course Code: MECH 1012					
Contact hrs per week:	L	T	P	Total	Credit points
	1	0	3	4	3

1. Importance of engineering drawing; Acquaintance with different drafting equipment & accessories;
2. Introduction to lines : Practising different types of lines; Basic concepts in Lettering : Practising vertical & inclined letters (Practice Sheet 1)
3. Different systems of dimensioning with practice.Introduction to the concept of scale of drawing. (Practice Sheet 2)
4. Introduction to concept of orthographic projection: 1st angle and 3rd angle projection method; Symbols; projection of points. (Practice Sheet 3)
5. Projection of straight lines for different orientation including inclined to both the planes. (Practice Sheet 4)
6. Projection of plane surfaces inclined to HP and parallel to VP; Inclined to VP and Parallel to HP (Practice Sheet 5)
7. Projection of solids: Cube, rectangular prism, Hexagonal prism, Cylinder, Pyramid, Cone. (Practice Sheet 6)
8. Section of solids and their projections on principal and auxiliary planes for true shape: Cylinder, hexagonal pyramid. (Practice Sheet 7)
9. Isometric projections: Basic concepts, isometric scale; Isometric projection and view.
10. Practice with simple laminar and solid objects. (Practice Sheet 8)

References:

1. "Elementary Engineering Drawing" by Bhatt, N.D; Charotan Book Stall, Anand
2. "Engineering Graphics" by Narayana, K.L. and Kannaaiah P; TMH
3. "Engineering Graphics" by Lakshminarayanan, V. and Vaish Wanar, R.S, JainBrothers.

B.Tech in Electrical Engineering
2nd Year, 1st Semester

Subject Code: MATH 2001

Subject : MATHEMATICAL METHODS

Course Outcome:- After completing the course the student will be able to:

1. **Synthesize components of a physical phenomenon and consequently construct a mathematical model of the system.**
2. **Classify engineering problems like forced oscillations, RLC Circuits etc.**
3. **Apply suitable analytic methods to solve wave equations , heat conduction equation.**
4. **Evaluate the efficiency of a method to solve ordinary and partial differential equations.**

Module I : Functions of Complex Variables (12L)

Complex numbers and its geometrical representation .

Functions of a complex variable – Limits, Continuity , Differentiability .

Analytic Functions , Cauchy- Riemann equations , Necessary and sufficient conditions for analyticity of complex functions(Statement only) , Harmonic functions.

Line Integral on complex plane , Cauchy-Goursat theorem , Cauchy's Integral Formula. Taylor's and Laurent's series expansion .

Zeros, Different types of Singularities. Definitions of poles and residues , Residue Theorem , Evaluation of real integrals using residue theorem.

Module II: Fourier Series , Integrals and Transforms (12L)

Definite Integral , Orthogonality of Trigonometric Functions , Power Series and its convergence .

Periodic Functions , Even and Odd Functions , Dirichlet's Conditions , Euler Formulas for Fourier coefficients , Fourier series representation of a function, e.g. Periodic square wave, Half wave rectifier, Unit step function.

Half Range series , Parseval's Identity.

Fourier Integral theorem , Fourier transform , Fourier sine and cosine transform, Linearity, Scaling , Frequency Shifting and Time shifting properties, Convolution Theorem.

Discussion of some physical problems : e.g Forced oscillations.

Module III : Series solutions to Ordinary Differential equations and Special Functions (12L)

Series solution of ODE: Ordinary point , Singular point and Regular Singular point, series solution when $x = a$ is an ordinary point, Frobenius method.

Legendre's Equation , Legendre's polynomials and its graphical representation.

Bessel's equation , Bessel's function of first kind and its graphical representation.

Finite Difference Method and its application to Boundary Value Problem.

Module IV: Partial Differential Equations (12L)

Introduction to partial differential equations, Formation of partial differential equations, Linear and Nonlinear pde of first order, Lagrange's and Charpit's method of solution .

Second order partial differential equations with constant coefficients , Illustration of wave equation, one dimensional heat equation, Laplace's equation, Boundary value problems and their solution by the method of separation of variables.

Solution of Boundary value problems by Laplace and Fourier transforms.

Suggested Books:

1. Complex Variables and Applications
   Brown Churchill
   MC Graw Hill

2. Complex Variable
   Murrey R. Spiegel
   Schaum's Outline Series

3. Theory of Functions of a Complex Variable
   Shanti Narayan, P. K. Mittal
   S. Chand

4. Larry C. Andrew, B. K. Shivamoggi
   Integral Transforms for Engineers and Applied Mathematicians
   Macmillan

5. Fourier Analysis with Boundary Value Problem
   Murrey R. Spiegel
   Schaum's Outline Series

6. Mathematical Methods
Potter, Merle C., Goldberg, Jack.
PHI Learning

7. Ordinary and Partial Differential Equations
M. D. Raisinghania
S. Chand

8. Elements of Partial Differential Equation
Ian Naismith Sneddon
Dover Publications

9. Advanced Engineering Mathematics
Kreyszig
Willey

10. Higher Engineering Mathematics
B. V. Ramana
Tata McGraw-Hill

Paper : PHYSICS II
Code : PHYS2001

Contact: 3L+1T
Credit: 4
Outcome of the Subject:

- Students undertaking this course will develop a basic understanding of quantum mechanics with thorough knowledge of operator functions and solution and applications of Schrodinger equation;
- They will acquire the concepts of basic solid state physics and classification of solids; the students will develop the different types of statistical distributions and be able to understand semiconductor behavior by application of statistical methods.
- They will also get a thorough understanding of different dielectric materials, physical interpretation of magnetic properties of matter, and basic understanding of superconductivity.
- In all cases they must build an ability of addressing related problems and explore the applications of the different theories.

Module 1 :

Classical Mechanics :

Constraints. Generalised coordinates. Lagrange's equation of motion. Hamiltonian formulation, Hamilton's equation of motion.
Course should be discussed along with simple physical problems.

4 lectures

Quantum Mechanics:

Physical interpretation of wave function Ψ(normalization and probability interpretation). 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. Expectation values. Application of Schrödinger equation-Particle in an infinite square well potential (1-D and 3-D potential well), discussion on degenerate energy levels.

6 lectures

Module 2 :

Statistical Mechanics:

Concept of energy levels and energy states. Macrostates. Microstates and thermodynamic probability. Equilibrium macrostate. MB, FD and BE statistics (no deduction necessary). Fermions, Bosons (definitions in terms of spin, examples). Physical significance and application. Classical limit of quantum statistics. Fermi distribution at zero and non –zero temperature. Fermi Level.

6 lectures

Applications of Statistical Mechanics

Planck's Black body radiation. Fermi level in intrinsic and extrinsic semiconductors. Intrinsic semiconductors and carrier concentration. Extrinsic semiconductors and carrier concentration. Equation of continuity. Direct & indirect band gap semiconductors.

4 lectures

Module 3 :

Dielectric Properties:

Electric dipole moment. Dielectric constant. Polarizability. Electric susceptibility. Displacement vector. Electronic, ionic and orientation polarizations. Calculation of polarizabilities - Internal fields in solids. Piezo-electricity, pyro-electricity and ferro- electricity.

5 lectures

Magnetic Properties:
Permeability, field intensity, magnetic field induction, magnetization, magnetic susceptibility. Origin of magnetic moment, Bohr magneton. Classification of dia, para and ferro magnetic materials on the basis of magnetic moment. Domain theory of ferro magnetism. Explanation of hysteresis curve. Soft and hard magnetic materials. Properties of anti-ferro and ferri magnetic materials. Ferrites and their applications. Concept of perfect diamagnetism.

5 lectures

Module 4 :

Band Theory of Solids:
Electron in a periodic potential. Bloch theorem. Kronig-Penny model (qualitative treatment). Origin of energy band formation in solids. Classification of materials into conductors, semi conductors & insulators. Concept of effective mass of an electron and hole.

6 lectures

Super Conductivity:
Introduction (experimental survey). General properties of super conductivity. Effect of magnetic field. Meissner effect . Explanation in view of wave mechanical property. Hard and soft superconductors. Thermal properties of superconductor. London equations and penetration depth.

4 lectures

Recommended Text Book:

Quantum Physics

- Atomic Physics – S.N. Ghoshal – S Chand
- Quantum Physics– Eisberg and Resnick – Wiley
- Quantum Mechanics – A.K. Ghatak and S. Lokenathan –Springer

Classical Mechanics

- Introduction to Classical Mechanics – R.G Takwale & P S Puranik –Tata MaGraw Hill
- Classical Mechanics – N C Rana & P S Joag – Tata MaGraw Hill

Solid State Physics

- Atomic Physics – S.N Ghoshal
- Elementary Solid State Physics – M.Ali Omar – Pearson Education
- Solid State Physics – A.J Dekkar – Macmillan
- Introduction to Solid state Physics – C.Kittel

Statistical Mechanics

- Thermodynamics, Kinetic Theory, and Statistical Mechanics–Sears and Salinger–Narosa

ANALOG & DIGITAL ELECTRONIC CIRCUITS
CODE: ELEC2101

CONTACT: 4L
Credit : 4

COURSE OUTCOME

- Able to design amplifiers, integrators, differentiator, adder, subtractor, zero crossing detector, Schmitt trigger using Operational amplifiers
- Able to design Astable, Bistable and Monostable multivibrator using Op Amp and 555
- Able to design oscillators and regulated power supply
- To learn different number systems and representation of negative numbers
- Design of digital system to solve logical problem
- Design of decoder, encoder, MUX, DEMUX, counters and shift registers and their applications
- To be familiar with different semiconductor memories
- To be familiar with A/D, D/A converters , S/H
- To be familiar with different logic families

Module-I

Operational Amplifiers: Differential amplifiers using BJT & FET, OPAMP as high gain diff. amplifier- its internal structure. Specification of an OPAMP, OPAMP as voltage amplifiers (inverting and non-inverting), its advantages with respect to feedback amplifiers. Realization of integrator, differentiator, adder (inverting & non-inverting), subtractor (using single OPAMP and more than one OPAMP). Effect of input offset current and input offset voltage on integrator using OPAMP and the required compensation. Use of OPAMP to realize linear differential equations. [10L]

Module-II

Oscillators : Barkhausen criteria, Colpitts, Hartley, Phase shift oscillator, Wien Bridge oscillator, crystal oscillators

Comparators: Design of comparators, ZCD, comparator with hysteresis and its application.

Multivibrators: Design of Astable, Monostable and Bistable multivibrator. Functional diagram of 555, design of Astable, Monostable and Bistable multivibrator using 555.

Voltage regulators: Design of regulated power supply. Use of voltage regulator ICs like 78XX and 79XX. [10L]

Module-III

Number systems & Codes: Decimal, Binary, Octal and Hexadecimal representation and their conversion

Negative Number Representation: Signed magnitude, 9's complement, 10's complement, 1's complement & 2's complement.

Introduction to floating point number representation

Codes: Weighted and non-weighted codes.

Boolean Algebra : Introduction, representation of logical statement into Boolean expression and its realization using Boolean functions(AND, OR, NOT gates) , Boolean Laws and its applications to minimize the Boolean expressions. Universal gates and realization of logical expression (POS & SOP), K-map and minimization of logical expression up to four variables.

Combinational circuits: Design of Adder, Subtractor, Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer, parity Generator and its application. [10L]

Module-IV

Sequential circuits: Latch and Flip-Flop, SR, JK, D and T Flip-Flop, realization of asynchronous and synchronous counters using Flip-Flop, non-sequential counters, shift registers.

Converters: DAC (weighted resistor and R-2R ladder type), S/H, ADC (dual slope and Successive Approximation type)

Memory systems: RAM, ROM, EPROM, EEROM and Flash ROM

Logic families: TTL, ECL, CMOS, their operation and specification, interfacing of different families. Introduction to PLD. [10L]

Total=40L

Text books

1. Op-amps and Linear IC's, R.A. Gayakwad, PHI.
2. D. Roy Choudhury, S. Jain, "Linear Integrated Circuits", New Age International (P) Ltd.
3. H. Taub, D. Schilling, "Digital Integrated Electronics", McGraw-Hill Kogakusha Ltd.
4. Fundamental of Digital Circuits, A. Anand Kumar, PHI.
5. A. Mottershead, "Electronic Devices and Circuits", Prentice-Hall of India Pvt. Ltd.
6. A.P. Malvino, D.P. Leach, "Digital Principles and Applications", Tata McGraw-Hill Publishing Co.Ltd.
7. Digital Electronics - Floyd

Reference Books

8. Millman & Halkias, "Integrated Electronics Analog and Digital Circuits and Systems " , Tata McGraw-Hill

CIRCUIT THEORY

CODE: ELEC2102 **Contact: 3L+1T**

Credit : 4

COURSE OUTCOMES OF CIRCUIT THEORY

The students will be

- To solve electric circuits containing AC and DC sources applying network theorems
- To analyze magnetically coupled circuits
- Able to solve the transient analysis of electrical circuits applying Laplace transform for
- Able to Solve electric circuits applying the concept of graph theory.
- Able to calculate open circuit impedance parameter, short circuit admittance parameter, transmission parameter and hybrid parameter applying the analysis of two port network
- Able to analyze and synthesize filters
- Able to simulate the circuits using SPICE software

Module-I

Network equations: Formulation of Node & Mesh equations. Loop and node variable analysis of transformed circuits. Network Theorems: Thevenin, Norton, Superposition and Reciprocity theorem applied to circuits containing dependent sources. [8L]

Coupled Circuits: Coefficient of coupling, Dot convention, Analysis of coupled circuits. [3L]

Module-II

Laplace Transform: Concept of complex frequency. Properties of Laplace transform linearity, differentiation, integration, initial value theorem and final value theorem. Transform of standard periodic and non periodic waveforms. Circuit elements and their transformed equivalents, Independent and dependent sources and equivalence of sources, treatment of mutual couplings in t & s domain. Transient and steady state response of RL, RC, LC and RLC with or without stored energy. Concept of natural frequency and damping. Sketching transient response, determination of time domain specifications. Concept of Convolution theorem and its application. [10L]

Module-III

Graph theory: Graph of network: Concept of path, tree, tree branch, tree link, loop, tie set and cut set. Incidence Matrix, tie-set Matrix and f-cut set matrix and their properties. Loop currents and node-pair potentials, formulation of loop and node equilibrium equations in view of graph theory. [5L]

Two port networks: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and inverse hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point & transfer impedance & admittance. [5L]

Module-IV

Filter Circuits: Concept of filters, Classification of filters. Analysis and synthesis of Low pass, High pass, Band pass and Band reject filters using operational amplifier. Filter approximations: Butterworth, Chebyshev filters. [6L]

SPICE: Structure of a SPICE program, active and passive device/element statements, different study like DC analysis, transient analysis and ac analysis statement in SPICE. Plotting and printing statement, input and output Impedance calculation using SPICE, voltage and current controlled components in SPICE. [3L]

Total: 40L

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Network Analysis, M.E. Valkenburg, Pearson Education
3. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.
4. Fundamental of Electric circuit theory, D. Chattopadhay & P.C. Rakshit, S. Chand.

Reference Books:

1. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin,The Mc Graw Hill Company.
2. Modern Network Analysis, F.M.Reza & S.Seely, McGraw Hill.

FIELD THEORY
CODE: ELEC-2103

CONTACT: 3L+1T

Credit : 4

Outcome of the Course

After completion of the course students will be able to

1. Apply knowledge of different co-ordinate systems for field analysis problems.
2. Apply different techniques of vector calculus to analyze electromagnetic fields to reach substantiated conclusions.
3. Compute electric potential, field intensity and electrical energy in electrostatic fields problems.
4. Compute magnetic fields and potentials to solve the electromagnetic problems
5. Analyze the problems of time-varying magnetic fields to compute field quantities for electromagnetic devices.
6. Design and develop solutions to complex problems related to transmission lines for benefits to society in terms of more efficient transmission of power and signals (in case of RF transmission lines).

Module 1:

Introduction: Curvilinear coordinate system, Cartesian coordinates, Cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. **5L**

Introduction to Vector calculus: DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Stoke's theorem, Laplacian operator on scalar and vector, Classification of vector fields, Statement of Helmholtz's theorem, Uniqueness theorem. **4L**

Module 2:

Electrostatic field: Coulomb's law, Electric field intensity E & Potential Φ, Gauss's law, Polarization and Dipole moment, Energy density in electrostatic field. Electric boundary conditions between dielectrics, Conductor–dielectric. Application of Poisson's and Laplace's equation for solving Electrostatic problems. Ohm's law and law of conservation of charge and continuity equation. General procedure for solving Poisson's and Laplace's equation. **6L**

Magneto static fields: Biot-Savart's law, Ampere's circuital law both differential and Integral form, Magnetic flux density, Magnetic scalar and Vector potential, Derivation of vector potential from Biot-Savart's law, Derivation of Poisson's equation in a magnetic field, Application of magnetic vector potential concept for solving field problem. Force on a current carrying conductor due to magnetic field and torque developed in current carrying coil in a magnetic field, magnetic moments, Magnetization in material, boundary conditions between two magnetic media, Inductor and Inductance of solenoid, Magnetic energy, Methods of Images. **6L**

Module 3:

Electromagnetic fields: Faraday's law, Transformer and motional emf, Displacement current, Loss tangent, Maxwell's equations for time varying fields, Time varying Potential, Lorentz condition for potentials, Time harmonic fields. **4L**

Electromagnetic wave propagation: Wave equation, Electromagnetic wave equation in loss-less dielectric medium and conducting medium, Plane and polarized waves and their propagation, Intrinsic Impedance, solution of wave equation, Skin effect, Skin depth, Polarization, Reflection of a plane wave at normal incidence, Poynting Theorem and Poynting vector, application of its for power flows through a cable. **6L**

Module 4:

Transmission line: Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions: lossy and lossless, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation, Distortion of Transmission line, Reflection and Transmission Coefficients, Input impedance, Standing waves, Standing wave ratio. **8L**

Total Classes=40

Text Books:

1. Engineering Electromagnetics by W.H.Hayt
2. Electromagnetics by Kraus & Carver
3. Electromagnetic Theory and application by P.Mukhopadhyay
4. Electromagnetics by A.Pramanik
5. Electromagnetics by Joseph Edminister
6. Electromagnetic fields by Griffiths.

Indian Culture and Heritage (HMTS-2002)

2L/1credit M.M. 100

ModuleI
Indian Religion &Philosophy

1. Orthodox Indian Philosophy:

2. Unorthodox Indian philosophy:

3. Essentials of Hinduism

4. An overview of Jainism, Buddhism, Sikhism, Islam, Christianity religions

Module II
Values and Personality

1. Aspects of Indian Values
2. Essentials of Personality Building
3. Ethics at work place
4. Aspects of Leadership qualities

Module III
Indian Scriptures

1. Selections from the Vedas

2. Select verses from Upanishad

3. An overview of Gita

4. XVIth chapter of Gita

Module IV

Indian Psychology

1. Aspects of Yoga Philosophy
2. Mind and its workings according to Yoga
3. Law of Karma
4. Selections from Manusmriti

References:

1. Indian Philosophy by S.C. Chatter and D. M. Dutta, Calcutta University Press
2. Spiritual Heritage of India, Swami Prabhavananda, Sri Ramakrishna Math, Chennai
3. Raja Yoga by Swami Vivekananda, Advaita Ashrama, Mayavati
4. Vedic Selection, Calcutta University Press
5. Gita by Swami Swarupananda, Advaita Ashrama, Kolkata
6. Upanishads by any press
7. Carving a Sky (MSS) by Samarpan
8. Essentials of Hinduism (MSS) by Samarpan
9. The Call of the Vedas — Bharatiya Vidya Bhavan

Paper : Physics-II Laboratory

Code : PHYS2011

Contact: 3P

Credit:2

Group 1: Experiments on Electricity and Magnetism

1. Determination of dielectric constant of a given dielectric material.
2. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
3. Determination of the thermo-electric power at a certain temperature of the given thermocouple.
4. Determination of specific charge (e/m) of electron.

Group 2: Quantum Physics

5. Determination of Planck's constant.
6. Determination of Stefan'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

Group 3: Modern Physics

9. Determination of Hall co-efficient of semiconductors.
10. Determination of band gap of semiconductors.
11. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Note: A candidate is required to perform at least 5 experiments taking one from each group.

Emphasis should be given on the estimation of error in the data taken.

PH2011

Outcome of the course

After taking this course, which is a laboratory paper students will be able to apply theoretical knowledge of electricity and magnetism, quantum physics and semiconductor physics to perform various experiments that will help them determine some very important material constants viz. dielectric constant, Hall coefficient, band gap of semiconductors etc., as well as some universal constants of great importance like Stefan's constant, Planck's constant etc. They will develop skills of result analysis and graph plotting along with operational skills of the different experimental apparatus.

ANALOG & DIGITAL ELECTRONIC CIRCUIT LABORATORY
CODE: ELEC2111

Contact: 3P
Credit : 2

Experiments on Analog Electronic Circuit

1. Transfer characteristics of an inverting and non-inverting amplifier using op-amp
2. Realization of Adder and Subtractor using operational amplifier.
3. Realization of integrator and differentiator using operational amplifier.
4. Transfer characteristics of Zero Crossing Detector, comparator with hysteresis using op-amp.
5. Realization of astable and monostable multivibrator using op-amp.
6. Design of astable with 50% duty cycle and monostable multivibrator using 555.
7. Design of bistable and VCO using 555.

Experiments on Digital Electronic Circuit

8. Realization of logic statement using universal logic gates.
9. Construction of decoder and encoder using logic gates.
10. Realization of MUX and DMUX using logic gates
11. Realization of SR, D, JK and T Flip-Flop
12. Realization of binary, BCD counters (synchronous and asynchronous).
13. Construction of shift registers using Flip-Flops
14. Familiarization experiments on DAC0808 & ADC0808

CIRCUIT THEORY LABORATORY
CODE: ELEC2112
Contact: 3P
Credit: 2

List of Experiments:

1. Determination of Laplace transform and Inverse Laplace transform using MATLAB.
2. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form.
3. Representation of Poles and Zeros in s-plane, determination of partial fraction expansion in s-domain and cascade connection of second-order systems using MATLAB.
4. Find the transfer function and pole-zeros of an electrical network containing RL, RC & RLC.
5. Transient response of R-L and R-C network using SPICE and hardware verification
6. Transient response of R-L-C series and parallel circuit using SPICE and hardware verification
7. Verification of Network theorems (Reciprocity, Compensation theorem) using SPICE software
8. Determination of Impedance (Z) and Admittance (Y) parameter of a two port network using SPICE/circuit maker.
9. Design of Butterworth Low Pass and High Pass filters: Simulation and Hardware implementation
10. Design of Band Pass and Band Reject filters using Butterworth Low Pass and High Pass filters: Simulation and Hardware implementation

Language Practice Lab Level II

Paper Code: HMTS 2011

Contact: 3P

Credit: 2

Marks: 100

Modules

Module 1

Formal verbal communication:

- Introduction to formal verbal communication, Interpersonal Skills & Public Speaking: Building Positive Relationships, Focusing on Solving Problems, Time Management, Dealing with Criticism: Offering Constructive Criticism, Responding to Criticism – Managing Conflict: Approaches to Conflict, Resolving Conflict
- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

Module II

Presentation skills

- Speech Purposes - General: Informative Speeches, Persuasive Speeches, Entertaining Speeches, Methods of Speaking: Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation

- Organising the Presentation: the Message Statement, Organising the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium, Post-presentation Discussion

Module III

Group Discussion

- Introduction to Group Communication
  Factors in Group Communication, Status – Group Decision Making: Reflective Thinking, Brainstorming, Body Language, Logical Argument, The Planning Process, Strategies for Successful GDs, Role of Social Awareness (Newspapers, Magazines, Journals, TV News, Social Media), Practice GDs

Module IV

Job Application and Personal Interview

- **Job Application** Letter: Responding to Advertisements and Forced Applications, Qualities of Well-Written Application Letters: The You-Attitude, Length, Knowledge of Job

Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section

- **Resume and CV:** Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination Chronological and Functional Resume – Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honours and Achievements, Personal Profile, Special Interests, References

- **Interviewing**

  Types of Interviews, Format for Interviews: One-to-one and Panel Interviews, Employment Interviews, Frequently Asked Questions, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews

Marks: 100

Module I- 20 marks

Module II- 30 marks

Module III- 20 marks

Module IV- 30 marks

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001

2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004

3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999

4. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011

B.Tech in Electrical Engineering
2nd Year, 2nd Semester

SUBJECT: NUMERICAL AND STATISTICAL METHODS
SUBJECT CODE: MATH 2002

Credit: 3
Contact: 3L
Total Contact Hour: 36

Course Outcome: After completing the course students will be able to

(i) Apply numerical methods to obtain approximate solutions to mathematical problems where analytic solutions are not possible.

(ii) Develop algorithmic solutions for problems like system of linear equations, integration, ordinary differential equations which are pertinent to many physical and engineering problems.

(iii) Apply probabilistic methods to engineering problems where deterministic solutions are not possible.

(iv) Analyze probability distributions required to quantify phenomenon whose true value is uncertain.

(v) Find numerical solutions to algebraic and transcendental equations appearing in a vast range of engineering problems e.g in the study of Ideal and non ideal gas laws, pipe friction , design of electric circuits.

(vi) Apply numerical methods to find solutions to linear system of equations appearing in spring-mass systems , resistor circuits, steady state analysis of a system of reactors.

(vii) Solve problems in data analysis , least-cast treatment of wastewater where the knowledge of interpolation will be required.

(viii) Compute numerical solution to integrals to find root mean square current.

MODULE-I – NUMERICAL SOLUTION TO LINEAR AND NON-LINEAR EQUATIONS (8L)

SOLUTION OF NON-LINEAR ALGEBRAIC EQUATIONS AND TRANSCENDENTAL EQUATIONS:
Bisection Method, Newton-Raphson Method, Regula-Falsi Method.

SOLUTION OF LINEAR SYSTEM OF EQUATIONS:
Gauss elimination method, Gauss-Seidel Method, LU Factorization Method.

MODULE-II – NUMERICAL SOLUTION TO INTEGRATION AND ORDINARY DIFFERENTIAL EQUATIONS (8L)

INTERPOLATION AND INTEGRATION:
Newton's Forward and Backward Interpolation Method, Lagrange's Interpolation, Trapezoidal and Simpson's $1/3^{rd}$ Rule.

SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:
Euler's and Modified Euler's Method , Runge-Kutta Method of 4^{th} order.

MODULE-III – FUNDAMENTALS OF PROBABILITY (5L)

Prerequisites- Set Theory.
Random experiment, Sample space , Events .
Definition of Probability ,
Addition law of probability, Multiplication law and Conditional Probability.
Bayes' Theorem (Statement only)

MODULE-IV – PROBABILITY DISTRIBUTIONS AND STATISTICS (15L)

Random Variables – Discrete and Continuous, Probability Mass Function, Probability Density and Cumulative Distribution Functions, Mathematical Expectation and Variance.

Special Distributions: Binomial, Poisson, Uniform, Exponential and Normal.

Measures of Central Tendency and Dispersion – Mean, Median, Mode and Standard Deviation for grouped and ungrouped frequency distribution.

Simple Correlation and Regression.

Suggested Books:

1. Miller & Freund's Probability and Statistics for Engineers
   R.A.Johnson
   Prentice Hall of India

2. Numerical Mathematical Analysis
   J.B.Scarborough
   Oxford and IBH Publishing Co. Pvt. Ltd.

3. Numerical Methods (Problems and Solution)
   Jain, Iyengar , & Jain
   New Age International Publishers

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

5. A First course in Probability
   Sheldon Ross
   Pearson

ELECTRICAL MACHINE I
CODE: ELEC2201

CONTACT: 3L+1T
Credit : 4
COURSE OUTCOME
At the end of this course students will be able to

1. Apply the knowledge of energy conversion principle to solve complex electrical engineering problem related to fundamental processes involved in electric machinery.
2. Identify and analyze the problems of two major ways of estimating electromagnetic forces reaching substantiated conclusions.
3. Apply the knowledge of behavior of DC machines to solve complex electrical engineering problems related to different types of DC generator and motor
4. Identify and analyze the problems related to performance analysis of DC machines reaching substantiated conclusions.
5. Identify and analyze the problems related to performance analysis of single phase transformer reaching substantiated conclusion.
6. Apply the knowledge of operating principle of 3-phase transformer in the practical field of installation, testing and commissioning of transformers.
7. To identify and analyze complex electrical engineering problems in presence of harmonics in three phase transformer reaching substantiated conclusions.

MODULE I
Generalized theory: Electromechanical Energy Conversion Principle, Singly Excited Magnetic System and Doubly Excited Magnetic system. Electromagnetic torque and Reluctance torque. 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. Voltage developed in a conductor rotating in a pulsating field. Rotating magnetic field. [10L]

MODULE II
D.C machine: Construction, operating principle & classification. Armature & field winding. EMF equation from fundamental principle. Voltage buildup of dc generator. Armature reaction & its improvement. Commutation process, its classification & improvement. External & internal Characteristics of DC generators. Parallel operation of DC generator. Operating principle of DC motor, its classification. Torque equation of dc motor. Load characteristics of dc motors. Starting & Speed control of DC motor. Losses and efficiency of DC machines. Hopkinson's and Swinburne's test. Application of DC generators and motors. Different methods of breaking of DC Motors [12L]

MODULE III
Single Phase Transformer : Construction, Type, Basic principle of operation. EMF equation. Resistance and leakage reactance drop in transformer. Electrical equivalent circuit of transformer. Phasor diagram. Determination of equivalent circuit parameters, open circuit & short circuit test. Voltage regulation & Efficiency of transformer. Polarity test & Parallel operation. Cooling of transformer. Auto transformer & its application. [12L]

MODULE IV
Polyphase Transformer : Construction, type & rating of 3-ph Transformer. Different connections, vector groups, Parallel operation of Transformers, Effect of unbalanced loading, Production of Harmonics in Transformer and its suppression, tertiary winding, Open Delta connection, Scott connection, 3 phase to 6 phase connections, neutral shifting, Double star and Double delta, 3 winding transformer: Parameter estimation,Tap changing: On load & Off load. Grounding transformer[10L]

Text Books :	**Reference Books :**
1. Electrical Machinery by Dr. P.S. Bimbra. 2. Generalized Theory of Electrical Machines by Dr. P.S. Bimbra 3. Electrical Machines by P. K. Mukherjee & S. Chakravorty 4. Electrical Machinery by S.K.Sen 5. Theory of Alternating Current Machinery by Alexander S Langsdorf	1. The Performance And Design Of Direct Current Machines by Clayton & Hancock. **2.** The Performance And Design Of Alternating Current Machines by M.G.Say.

ELECTRICAL & ELECTRONIC MEASUREMENT
CODE: ELEC2202
CONTACT: 4L

The students will be able

- To learn the mechanism of torque production in various deflecting type of measuring instruments, their construction and the method of extension of the range of instruments
- To calculate the error of measurement using the statistical method
- To know the principle of measurement of power and energy and use of CT and PT
- To measure different types of resistance; to measure inductance and capacitance using different bridges; to locate the fault in a cable
- To know the principles of analogue electronic and digital voltmeters;
- To know the principle and operation of cathode ray oscilloscope

Module-I

Electrical Instruments:

Introduction, Classification of electrical measuring instruments. Construction, Principle of operation, torque equation, advantage and disadvantage of Moving coil, rectifier type instrument, Moving iron, Electrodynamometer type and induction type instruments. Extension of instrument ranges and multipliers, Principle of operation of the Electrostatic Instruments. [7L]

Errors in Measurement:

Definition of accuracy, precision, speed of response, non-linearity, techniques of linearization, classification of errors. Statistical error analysis, mean, median, mode, average, estimates, distribution, probable error, standard deviation, test of normal distribution, curve fitting using least squares methods. [5L]

Module-II

Measurement of Power:

Power measurement by Electrodynamometer Wattmeter, construction, principle of operation, shape of scale, wattmeter connections and errors. [3L]

Measurement of Energy:

Induction type energy meter: Principle of operation, errors and their compensation. [3L]

Instrument transformer:

Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Construction, Principle of operation, Equivalent circuit and Vector diagram of Current & Potential transformer, Errors in Current Transformer and Potential Transformer. [4L]

Module-III

Measurement of Resistance:

Wheatstone bridge, Low resistance measurement by Kelvin double bridge, High resistance measurement, Megger. [2L]

Measurement of Inductances, Capacitances and Frequency:

Maxwell's Bridge, Anderson Bridge, Hay's Bridge, De Sauty's Bridge, Schering Bridge and Wien bridge. [2L]

Potentiometer:

Principle of operation and application of Crompton's DC potentiometer, Polar and Co-ordinate type AC potentiometer & Application. [4L]

Location of cable fault: Murray loop test, Varley loop test. [2L]

Module-IV

Electronic Instruments:

Direct coupled DC volt meter, chopper type DC voltmeter, average reading AC voltmeters, peak reading AC voltmeters, true RMS voltmeter, Electronic multi-meter, [6L]

Digital Voltmeter: Integrating type and Successive approximation type. [2L]

Cathode ray oscilloscope (CRO):

Concept of digital storage oscilloscope. [1L]

TOTAL-41L

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.
4. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication.
5. Electrical and Electronic Measurement, N.K.Dutta

Thermal Power Engineering
(B.Tech.-Electrical-2nd year)
Subject Code: ELEC 2203

Credit: 4 **Lectures/Week: 4**

Course Objectives: After attending the course, the students will be able to:

1. **Understand the various methods of generating shaft power.**
2. **Identify and learn the basic components of a simple thermal power plant and their working.**
3. **Identify and learn the basic components of IC engine and their working.**
4. **Explain engine test procedure and finding various engine efficiencies.**

Module No	Syllabus	No. of Lectures
1	**1.1** Basic components of Power Plant, Analysis of Steam Power Cycles: Vapour Power Cycles, Rankine Cycle, Rankine versus Carnot Cycle, limitations of Carnot cycle, Reheat Cycle, Regenerative Cycle.	5
	1.2 Steam Generators and Water Treatment: Essentials, Classifications, Basic boiler mountings, Accessories and Mountings, Sub-critical and Super-critical steam generation, Rating of boilers and boiler efficiency	4
	1.3 Superheaters, Economisers and Feedwater Heaters: Description and working principle	3
2	**2.1** Condensers: Functions, Types, Vacuum Efficiency, Effects of Vacuum and Air leakage, Condenser efficiency	3
	2.2 Cooling ponds and Cooling Towers: Cooling ponds and Towers, Types, Dry Cooling systems	3
	2.3 Fuels, Fuel Handling, Combustion: Fuel classification, Methods of Coal handling, Fuel combustion, Fluidized Bed Combustion System	3
	2.4 Ash handling and Dust Collection: Principal requirements, Systems of ash handling, Uses of ash, Dust collection (Cyclone Separator, ESP, Fabric Filters)	3
3	3.1 Types of nozzles, Flow through Nozzles under dry saturated and superheated condition ,condition for maximum mass flow rate , Nozzle Efficiency, Relationship between Area, Velocity and Pressure in nozzle.	4
	3.2 Steam Turbines, Classification , Impulse and Reaction Steam Turbine Velocity diagram, Power Developed, Blade Efficiency, Stage Efficiency, Overall efficiency, Axial Thrust ,Condition for maximum efficiency , Degree of Reaction in Reaction Turbine, Velocity and Pressure compounding ,Losses in Turbines	6
	3.3 Governing of Steam Turbines	2
4	4.1 Basics of I C Engines	1
	4.2 Analysis of Otto Cycle, Diesel Cycle and Dual Cycle and their comparison under different conditions	4
	4.3 Fuel characteristics of SI engine & CI engine , Detonation in SI/CI engines, Octane Number, Cetane Number	2
	4.4 Engine Performance & Testing- Measurement of IP, Measurement of BP , Indicated thermal efficiency, Brake thermal efficiency, Mechanical efficiency , Volumetric efficiency , Brake specific fuel consumption , Heat balance sheet .	4
	4.5 Exhaust gas emission and control	1

Recommended Books: **1. Domkundwar- Thermal Engineering-Dhanpat Rai &co.**

2. Ballaney-Thermal Engineering- Khanna Publishers

3. R.K.Rajput- Thermal Engineering – Laxmi Publications

Basic Environmental Engineering & Ecology
Code: CHEM 2001

Contacts: 3L
Credits: 3

Module 1

Environment & Ecology (General discussion) **9L**

Basic ideas of environment and its component 1L

Mathematics of population growth: exponential and logistic and associated problems, definition of resource, types of resource, renewable, non-renewable, potentially renewable, Population pyramid and Sustainable Development. 2L

General idea of ecology, 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 Sundarban); 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, Phosphorus, Sulphur]. 2L

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity. 1L

Module 2 **9L**

Air pollution and control

Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. 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. Acid rain: causes, effects and control. Earth's heat budget, carbon capture, carbon footprint 2L

Lapse rate: Ambient lapse rate, adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion, Maximum mixing depth 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. 1L

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). 2L

Module 3 **9L**

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, 2L

River/Lake/ground water pollution: River: DO, 5 day BOD test, Unseeded and Seeded BOD test, BOD reaction rate constants, COD. 1L

Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 1L

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] 2L

Water pollution due to the toxic chemicals effects: Lead, Mercury, Cadmium, Arsenic 1L

Noise Pollution

Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise]. Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18hr Index), effective perceived noise level.

Noise pollution control. 2L

Module 4 **9L**

Land Pollution

Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes, electronic waste 2L

Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. 2L

Social Issues, Health and Environment

Environmental disasters: Bhopal gas tragedy, Chernobyl disaster, Three Mile Island disaster, cancer and environment: carcinogens, teratogens and mutagens (general aspect) 2L

Environmental impact assessment, Environmental audit, Environmental laws and protection act of India. 1L

Energy audit, Green building, Green sources of energy, Concept of Green Chemistry, Green catalyst, Green solvents (replacement of VOC) 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.
3. Asim K. Das, Environmental Chemistry with Green Chemistry, Books and Allied P. Ltd
4. S. C. Santra, Environmental Science, New Central Book Agency P. Ltd
5. GourKrishna Das Mahapatra, Basic Environmental Engineering and Elementary Biology, Vikas Publishing House P. Ltd.

Human Values and Professional Ethics(HMTS-2001)

2l/2credit Max Marks: 100

Module I

Human society and the Value System

Values: Definition, Importance and application.
Formation of Values: The process of Socialization
Self and the integrated personality
Morality, courage, integrity

Types of Values:

Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism
Aesthetic Values: Perception and appreciation of beauty
Organizational Values: Employee: Employer--- rights, relationships, obligations
Psychological Values: Integrated personality and mental health
Spiritual Values &their role in our everyday life
Value Spectrum for a Good Life, meaning of Good Life

Value Crisis in Contemporary Society

Value crisis at----
Individual Level
Societal Level
Cultural Level
Value Crisis management --- Strategies and Case Studies

Module II

Ethics and Ethical Values
Principles and theories of ethics
Consequential and non-consequential ethics
Egotism,Utilatirianism, Kant's theory and other non-consequential perspectives
Ethics of care, justice and fairness, rights and duties

Ethics-- Standardization
Codification
Acceptance
Application

Types of Ethics--- Ethics of rights and Duties
Ethics of Responsibility
Ethics and Moral judgment
Ethics of care

Ethics of justice and fairness
Work ethics and quality of life at work

Professional Ethics

Ethics in Engineering Profession;
moral issues and dilemmas, moral autonomy(types of inquiry)
Kohlberg's theory, Giligan's theory(consensus and controversy)
Code of Professional Ethics Sample Code of ethics like ASME, ASCE. IEEE,Institute of Engineers,Indian Institute of materials management, Institute of Electronics and telecommunication engineers
Violation of Code of Ethics---conflict, causes and consequences
Engineering as social experimentation, engineers as responsible experimenters (computer ethics, weapons development)
Engineers as managers, consulting engineers, engineers as experts, witnesses and advisors, moral leadership
Conflict between business demands and professional ideals
social and ethical responsibilities of technologies.
Whistle Blowing: Facts, contexts, justifications and case studies

Ethics and Industrial Law

Institutionalizing Ethics: Relevance, Application, Digression and Consequences

Module III

Science, Technology and Engineering

Science, Technology and Engineering as knowledge and profession
----Definition, Nature, Social Function and Practical application of science
Rapid Industrial Growth and its Consequences
Renewable and Non- renewable Resources: Definition and varieties
Energy Crisis
Industry and Industrialization
Man and Machine interaction
Impact of assembly line and automation
Technology assessment and Impact analysis
Industrial hazards and safety
Safety regulations and safety engineering
Safety responsibilities and rights
Safety and risk, risk benefit analysis and reducing risk
Technology Transfer: Definition and Types
The Indian Context

Module IV

Environment and Eco- friendly Technology

Human Development and Environment
Ecological Ethics/Environment ethics
Depletion of Natural Resources: Environmental degradation

Pollution and Pollution Control
Eco-friendly Technology: Implementation, impact and assessment

Sustainable Development: Definition and Concept
Strategies for sustainable development
Sustainable Development--- The Modern Trends

Appropriate technology movement by Schumacher and later development
Reports of Club of Rome.

Suggested Readings:

1)Tripathi,A.N., Human Values, New Age International, New Delhi,2006
2)Ritzer, G., Classical Sociological Theory, The McGraw Hill Companies, New York,1996.
3)Doshi,S.L., Postmodern Perspectives on Indian Society, Rawat Publications, New Delhi,2008.
4)Bhatnagar, D.K., Sustainable Development, Cyber Tech Publications, New Delhi, 2008.
5)Kurzwell,R., The age of Spiritual Machines, Penguin Books, New Delhi,1999.
6)Weinberg, S.K., Social Problems in Modern Urban Society, Prentice Hall,Inc.,USA, 1970.
7) Giddens, Anthony 2009. Sociology. London: Polity Press (reprint 13th Edition).

SUBJECT : NUMERICAL AND STATISTICAL METHODS LAB
SUBJECT CODE: MATH 2012

Credit: 1
Contact: 2P

Course outcome: After completing the course the student will be able to :

1. Reproduce customized programs to solve problems based on Numerical Methods.
2. Develop algorithms to handle large systems of equations appearing in physical and engineering problems.

Development of computer programs in C for the following problems:

1. Regula-Falsi Method
2. Newton-Raphson Method
3. Gauss-elimination Method
4. Gauss-Seidel Method
5. Newton's Forward Interpolation
6. Lagrange's Interpolation
7. Trapezoidal and Simpson's $1/3^{rd}$ rule
8. Euler's and Modified Euler's Method
9. Runge-Kutta method of 4^{th} order
10. Computation of Mean , Median , Mode and Standard Deviation for grouped and ungrouped frequency distribution
11. Computation of Correlation coefficient and Regression equation for Bivariate data.

Electrical Machine Laboratory-I

[ELEC 2211]

Contact Hour-3P

Credit-2

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.
5. Measurement of speed of DC series motor as a function of load torque.
6. Swinburne's test of a D.C. Machine .
7. Hopkinson's test
8. Study of equivalent circuit of a single phase transformer.
9. Polarity test on a single phase transformer & study of different connections of 3-phase transformer
10. Parallel operation of single phase transformer

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS LABORATORY
CODE: ELEC2212
CONTACT: 3P
Credit : 2

List of Experiments:

1. Familiarization of instruments: - Identification of the different parts of PMMC, Dynamometer, Electro-thermal and Rectifier type of instruments, Oscilloscope and Digital multi-meter.
2. Calibration of moving iron and electrodynamometer type ammeter/voltmeter/ wattmeter by potentiometer.
3. Calibration of dynamometer type wattmeter by potentiometer.
4. Calibration of AC energy meter.
5. Measurement of resistance using Kelvin double bridge.
6. Measurement of power and use of Instrument transformer to extending range of power measuring instruments.
7. Measurement of power in Three-phase 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.

Thermal Power Engineering Lab

Sub Code: ELEC 2213

B.Tech.-Electrical-2nd year.

Credit:2 **Periods/Week: 3**

Expt.No.	Title of the Experiment	Periods
1.	Study of Two-stroke petrol ,Four-stroke Petrol and Diesel Engine with the help of cut models.	3
2.	Study of various water tube and fire tube boilers with the help of cut models.	3
3.	To Find out the Calorific Value of Petrol and Coal with the help of Bomb Calorimeter.	3
4.	To Find Out the Flash Point and Fire Point of Petrol and Diesel Fuel with the help of Pensky Martins Test Apparatus.	3
4.	To find out the quality of steam by measuring enthalpy and Dryness fraction.	3
5.	To Find Out the cloud Point and Pour Point of Petrol and Diesel Fuel.	3
6.	To study valve timing diagram of 4-stroke diesel engine .	3
7.	Load Test of 4-stroke Diesel Engine by Electrical Load –Box.	3
8.	Load Test of 4-stroke multicylinder petrol engine by Rope Brake dynamometer (Morse Test)	3
9.	Exhaust Gas Emission Test.	3

B.Tech in Electrical Engineering
3rd Year, 1st Semester

Economics for Engineers (HMTS-3101)

3L/week **Credit-3**

Module 1:

Market: Meaning of Market, Types of Market, Perfect Competition, Monopoly, Monopolistic and Oligopoly market.
The basic concept of economics – needs, wants, utility.
National Income-GDP, GNP. Demand & Supply, Law of demand, Role of demand and supply in price determination, Price Elasticity.
Inflation: meaning, reasons, etc. **(6L)**

Module 2:

Business: Types of business, Proprietorship, Partnership, Joint-stock company, and cooperative society – their characteristics.
Banking: role of commercial banks; credit and its importance in industrial functioning. Role of central bank: Reserve Bank of India.
International Business or Trade Environment. **(4L)**

Module 3:

Financial Accounting-Journals. Ledgers, Trial Balance, Profit & Loss Account, Balance Sheet.
Financial Statement Analysis (Ratio and Cash Flow analysis). **(8L)**

Cost Accounting- Terminology, Fixed, Variable and Semi-variable costs.
Break Even Analysis. Cost Sheet. Budgeting and Variance Analysis.
Marginal Cost based decisions. **(6L)**

Module 4:

Time Value of Money: Present and Future Value, Annuity, Perpetuity.
Equity and Debt, Cost of Capital. **(4L)**

Capital Budgeting: Methods of project appraisal - average rate of return - payback period - discounted cash flow method: net present value, benefit cost ratio, internal rate of return.
Depreciation and its types, Replacement Analysis, Sensitivity Analysis. **(8L)**

Evaluation: Max marks-100
Internal Test-30
Semester Test-70

Suggested Readings:

1. R**.** Narayanswami, *Financial Accounting- A Managerial Perspective.* Prentice-Hall of India Private Limited. New Delhi
2. Horne, James C Van, *Fundamentals of Financial Management*. Prentice-Hall of India Private Limited, New Delhi
3. H. L. Ahuja., *Modern Economic Theory*. S. Chand. New Delhi.
4. Newman, Donald G., Eschenbach, Ted G., and Lavelle, Jerome P. *Engineering Economic Analysis.* New York: Oxford University Press. 2012.

ELECTRICAL MACHINE II

CODE: ELEC3101 **CONTACT: 3L+1T**

At the end of this course students will be able to

1. Able to solve complex electrical engineering problem related to operating principle of three phase IM and analyze the performance of three phase IM
2. Able to analyze the performance and starting of single phase Induction Motor with their uses depending on the torque speed characteristics.
3. Apply the knowledge of special motors for solving complex engineering problems related to various application of special electromechanical devices.
4. Identify and analyze the complex problems related to operation, installation and commissioning of Synchronous machines reaching substantiated conclusion using fundamental concept of Synchronous Machines.

MODULE I

Three Phase Induction Motor(IM) : Construction. Type and operating principle. Flux and MMF phasor in Induction motors. e.m.f equation. Determination of equivalent circuit parameters by No load & Block rotor test. Efficiency of 3-ph IM. Torque-slip characteristics. Conditions for maximum torque at start and run. Deep bar and double cage rotor. Methods of starting and speed control. Crawling & Cogging phenomena. Application of Polyphase Induction motor. Induction generator. [10L]

MODULE II

Single Phase Induction Motor : Construction. Double revolving field theory. Cross field theory. Starting methods. Speed-Torque characteristics. Phasor diagram. Determination of equivalent circuit parameters by No load and Block rotor test. Condition of Maximum torque. Applications. [6L]

Special Electromechanical Devices: Switched Reluctance motor. Stepper motor. Brush less DC machines. Application of A.C series motor. [4L]

MODULE III

Synchronous Generator: Construction and operating principle. Different excitation systems. Armature reaction. Theory for salient and non-salient pole machine. Two reaction theory. Transient and subtransient reactances during short circuit condition. Determination of synchronous machines parameters under steady state and transient condition. Phasor diagram of alternator under different types of loads. Operating characteristic of alternator. Determination of voltage regulation by Synchronous impedance method, M.M.F. method. Potier triangle method. Synchronous machine connected to infinite bus. Effect of change of excitation and speed of prime mover. synchronization of alternator. Power flow and power angle characteristic. Synchronizing power [14]

MODULE IV

Synchronous Motor: Construction and operating principle of synchronous motor. Damper winding. Method of starting. Phasor diagram. V curve under lagging and leading p.f, Under excitation and over excitation. Synchronous Condenser. Power factor control , Hunting. Applications. [6]

Text Books	Reference Books :
1. Electrical Machinery by Dr. P.S. Bimbhra. 2. Generalized Theory of Electrical Machines by Dr. P.S. Bimbhra 3. Electrical Machines by P. K. Mukherjee & S. Chakravorty 4. Electrical Machinery by S.K.Sen 5. Theory of Alternating Current Machinery by Alexander S Langsdorf	1. The Performance And Design Of Direct Current Machines by Clayton & Hancock. 2. The Performance And Design Of Alternating Current Machines by M.G.Say.

POWER SYSTEM - I
Code: ELEC3102
Contact: 3L+1T

COURSE OUTCOME

Students will be able

1. To learn about the basic structure of Power System.
2. To learn about the methods and components used in conventional power generation plants.
3. To learn about various means of power transmission.
4. To learn about the mechanical design of power transmission system.
5. To learn about the electrical parameters involved in power transmission system.
6. To learn the representation of the transmission lines and analyze their performance.
7. To learn about the components of distribution system and improve their performances.

MODULE – I

Introduction: Structure of a power system-Generation, transmission and distribution configurations. Choice of voltage and frequency.

Generation of Electric of Power: General layout of a typical coal fired power station, Hydro electric power station, Nuclear power station, Gas –turbine power station, their components and working principles, comparison of different methods of power generation. (9L)

MODULE – II

Overhead transmission line: Types of conductors, Skin effect and Proximity effect. Inductance and Capacitance of single phase and three phase (symmetrical and unsymmetrical) line, Charging current, Transposition, Bundle and composite conductors, GMD and GMR. Influence of earth on conductor capacitance.

Power Cables : Types of cables, insulation Resistance, stress and capacitance of single and multicore cables, grading of cables, sheath effects, dielectric loss. Comparison of cables and overhead lines.

(12L)

MODULE – III

Mechanical design of transmission line: Calculation of sag of Transmission lines, Variation of sag with wind and ice load, stringing chart.

Insulators: Types of Insulators, Potential distribution over a string of Suspension Insulators, String efficiency, Methods of Equalizing the Potential.

Corona: Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential , Corona loss, advantages & disadvantages of Corona, methods of reduction of Corona. (8L)

MODULE – IV

Transmission System: Short, Medium and Long transmission lines and their representation. ABCD constants, Ferranti effect, Surge Impedance Loading, Active and reactive power flow through transmission lines, Power Circle diagram.

Distribution Systems: Feeders, distributors, and service mains; Types of distribution systems- Radial, Ring Main; Interconnector ; Kelvin's law for design of feeders.
Power factor correction and Tariff. (11L)

Text Books:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Elements of power system analysis, C.L. Wadhwa, New Age International.
3. Electrical Power System, Ashfaq Hussain, CBS Publishers & Distributors

Reference Books:

1. Power System Analysis by Grainger & Stevenson, Tata McGraw Hill
2. Power System analysis by H.Cotton

SIGNALS AND SYSTEMS
CODE: ELEC3103
CONTACT: 3L

COURSE OUTCOMES OF SIGNALS AND SYSTEMS

Students will be able to

- understand the concept of signals
- analyze the spectral content of different signals
- find Z and inverse Z transforms
- determine the mathematical model of physical systems
- model different systems by state variable approach

Module-I

Signals: Concept of Signals, Continuous and discrete time signals, Classification of Signals: Periodic and aperiodic, even and odd, energy and power signals, Deterministic and random signals, Exponential, sinusoidal signals. Decomposition of signals into odd and even components. Singularity functions- step, ramp ,impulse and doublet signals. Properties of Impulse Function. Decomposition of simple aperiodic waveforms in terms of singularity functions,. Transformation of signals: time scaling; time shifting. Convolution Theorem. **[6L]**

Fourier Series & Transform: Dirichlet's conditions, Fourier series-trigonometric and exponential. Fourier transform of aperiodic functions. Generalized Fourier transform. Properties of Fourier transform. **[6L]**

Module-II

Sampling: Representation of continuous time signals by its samples –Types of sampling, Sampling theorem. Reconstruction of a signal from its samples, aliasing. **[3L]**

Z-Transforms: z-transform definition, mapping between s-plane and z-plane, unit circle in z plane, region of convergence (ROC), properties of ROC. Properties of z-transform, Poles and Zeros, inverse z-transform using Residue Theorem, Power Series expansion and Partial fraction expansion. **[5L]**

Module-III

Systems: Concept of Systems, Classification, Differential equation representation of systems, Definition of Linear Time invariant (LTI) systems. Concept of transfer function, Poles and zeros. Time and frequency response of first and second order systems. **[6L]**

Modeling of Dynamic Systems: Mechanical systems (translational systems and rotary systems) electromechanical systems (DC Servo motor and PMMC). Electrical analogous systems. **[5L]**

Module-IV

State space analysis: State variable representation of systems, Normalization of linear equations. Converting higher order linear differential equations into State Variable (SV) form. Obtaining SV model from Transfer Function. Obtaining characteristic equations and transfer functions from SV model. State variable representations of electrical and mechanical systems. Solutions of state equations. State transition matrix. Properties of state transition matrix. **[9L]**

Total: 40L

Text Books:

1. Signal Processing & Linear Systems, B.P.Lathi, Oxford
2. Signals and Systems, A.Nagoor Kani, McGraw Hill
3. Signals and Systems, S.Haykin & B.V.Veen, John Wiley
4. Signals and Systems, T.K.Rawat, Oxford

Reference books

1. Kuo, B. C; "Automatic Control System" Prentice Hall of India
2. Lindner D. K; "Introduction to signals and systems", McGraw Hill
3. C-T Chen- Signals and Systems- Oxford
4. Network Analysis & Synthesis, F.F Kuo., John Wiley & Sons

Data Structure and Database Concept
Paper Code : ELEC3104
Contact: 3 L/week,
Credit: 3
Total: 45L

Data Structures

Module I: **(13L)**

Array, Structure, and Pointers in C: creation of customized data type, Array of Structure, Pointers and its application in handling array and structure.
Linear Data structures:
Singly Linked List- Insertion at beginning, at end and any position of the List. Deletion by value, by position: beginning, end and any position of the List
Stack and Queue: Both array and Linked Representation, Circular queue using array only.
Application of stack: Infix to postfix conversion, Evaluation of postfix expression.

Module II: **(10L)**

Recursion: Design of Recursive algorithm.
Non-Linear Data Structures:
Trees: Binary Trees: Array and Linked representation, Binary tree Traversal Techniques, reconstruction of binary tree using traversal sequence.
Binary Search Trees - Insertion and Deletion algorithms.
Sorting Algorithms: Bubble sort, Insertion sort, Quick sort and their comparison.
Searching Algorithms: Linear search, Binary search and their comparison.

Database Concept

Module III: (10L)

Introduction to Database Concepts, File Processing System and Database Management System, DBMS Architecture and Data Independence.
Data Model: Basic Concepts, Entity-Relationship Diagram, Keys, Cardinality, Weak Entity Set.
Introduction to relational algebra & SQL: Operators like select, project, rename, Cartesian product, join, union, intersect, minus, DDL, DML.

Module IV: (12L)

Relational Database Design: Functional Dependencies, Normalization: Different anomalies in database designing
1NF, 2NF, 3NF and BCNF, Lossless-Join Decomposition and Dependency Preservation,
Introduction to Transaction Processing Concepts: ACID properties, Serializability and Recoverability

Text Books:

Data Structures:

I) Title: Data Structures.
Author: Seymour Lipschutz.
Publication: Tata McGraw-Hill (India)

II) Title: Data Structures and Program Design in C.
Author: Kruse Robert L., Robert Kruse, Cl Tondo.
Publication: Pearson Education India.

Database Concept:
I) Title: Fundamentals of Database Systems
Author: Elmasri Ramez and Navathe Shamkant
Publication: Pearson.

II) Title: Database System Concepts
Author: A. Silberschatz, H.F Korth, S.Sudarshan
Publication: McGraw Hill Education (India) Private Limited

Reference Books:
Data Sturucture:
I) Title: Data Structures using C.
Author: Tanenbaum A. S, Langsam Y., Augenstein M.J.
Publication: Pearson.

II) Title: The Art of Computer Programming
Author: Donald E. Knuth
Publication: Addison-Wesley Professional

Database Concept:
I) Title: Introduction to Database Management Vol. I, II, III,
Author: Date C. J.
Publication: Addison Wesley.

II) Title: Principles of Database Systems
Author: Ullman JD.
Publication: Galgottia Publication

ELECTRONIC INSTRUMENTATION
CODE: ELEC3131
CONTACT: 3L

COURSE OUTCOMES OF ELECTRONIC INSTRUMENTATION

Students will be able to

- Understand the principle of operation of electrical transducers
- grasp the techniques to measure non-electrical quantities
- know the working principles of wave analyser and spectrum analyser
- understand signal conditioning circuits
- Acquire the concepts of data acquisition and virtual instrumentation.

Module -I

Sensors and Transducers: Introduction, Classification of Transducers, Characteristics and choices of Transducers. [1]

Temperature transducers: Resistance Temperature Detectors (RTD), Thermistors, Thermocouples and Radiation Pyrometers-construction, principle of operation, advantages and disadvantages. [6]

Resistive Strain Gauge: construction, principle of operation, application. [2]

Linear Variable Differential Transformer (LVDT): construction, principle of operation, phase-sensitive demodulation, advantages and disadvantages of LVDT, use of LVDT. [3]

Module-II

Capacitive Transducer: variable air gap, variable plate overlap, variable dielectric, differential arrangement, measurement of Displacement and Liquid level, advantages and disadvantages, use of capacitive Transducer. [3]

Piezoelectric Transducers: Fundamental concepts, materials, charge sensitivity, voltage sensitivity. Force/displacement transducers, Buffer amplifiers, charge amplifiers, Static and dynamic responses. Accelerometers. [3]

Pressure transducers: Primary sensing elements: Bourdon tube, diaphragm, bellows, Electronic pressure gauges, Capacitive pressure transducers. [2]

Measurement of Flow: Electromagnetic Flow meter, Hot wire anemometers, Ultrasonic Flow transducer. [3]

Module-III

Frequency Domain Instruments: Wave analyser, Frequency Selective wave analysers, Heterodyne Wave analyser, application of Wave analyser, Basic Spectrum analyser [4]

Special Instruments: Q meter, function generators. [3]

Module-IV

Data Acquisition Systems: General Block diagram of Data Acquisition Systems (DAS), Objectives of DAS, classification of DAS, Applications of DAS [2]

Signal Conditioner: Review of digital to analog and analog to digital converters, Sample and hold circuit, Multiplexing, Analog to Digital Multiplexing, Digital to Analog Multiplexing, Analog Multiplier. [5]

Virtual Instrumentation: Virtual Instruments versus Traditional Instruments, Software in Virtual Instrumentation, Virtual Instrumentation in the Engineering Process [1]

Total: 38L

TEXT BOOKS:

1. Modern Electronic Instrumentation & Measurement Techniques : by Helfrick & Cooper
2. Transducer & Instrumentation, D.V.S Murty,PHI
3. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
4. Sensors & Transducers : by D. Patranabis
5. Electronic Instrumentation : by Oliver & Cage

REFERENCE BOOKS:

1. Measurement Systems: by Ernest Doebelin
2. Instrument Measurement & Analysis : By Nakra & Chaudhry
3. Principles of Measurement Systems : by John P. Bentley

ILLUMINATION ENGINEERING
CODE : ELEC 3132
CONTACT: 3L
Credit : 3

COURSE OUTCOME

- To get acquainted with the laws of photometry for calculation of illuminance levels for different lighting applications
- To understand the principles of operation of different photometers
- To understand the principles of operation of different lamps and their accessories
- To analyse indoor lighting schemes and design energy efficient installations complying with lighting codes
- To design energy efficient road lighting installations in conformity with lighting codes
- To understand the parameters of sports lighting installations

Module – I **[9L]**

Illumination Engineering Basics and Photometers

Light and Electromagnetic Radiation, Visible spectrum of radiation.

Radiometric and photometric quantities, visual response curve of standard observer, relation between Lumen and Watt.

Laws of Illumination, perfect diffuser, Lambert's law.

Bench photometer, luxmeter, distribution photometer, integrating sphere.

Module – II **[9L]**

Lamps and its Accessories: Incandescent lamps, tungsten halogen lamps, fluorescent tubes, compact fluorescent lamps (CFL), low and high pressure sodium vapour lamps, high pressure mercury vapour lamps, metal halide lamps, Light Emitting Diode (LED) lamps.

Ballast- function, electromagnetic and electronic types, principles of operation.

Module – III **[9L]**

Interior Lighting Design

Objectives, quantity and quality of light, selection of lamps and luminaires. Design considerations for lighting of offices, conference rooms, hospitals. Design calculations by lumen method in accordance with lighting code.

Module – IV **[9L]**

Outdoor Lighting : Road, Playground and Landscape Lighting Design

Basic concepts of outdoor lighting design- objectives, design parameters, qualitative & quantitative evaluation of outdoor lighting systems.

References / Books

1. Lighting Engineering Applied Calculations – R. H. Simons & A.R. Bean, Architectural Press
2. Applied Illumination Engineering, Second Edition, Jack L Lindsey, Prentice Hall.
3. Lamps and Lighting – Edited by J.R.Coaton and A.M.Marsden, 4th Edition Arnold
4. IES Lighting Handbook – IES North America.
5. National Lighting Code- Published by Govt of India,2011

ELECTRICAL MACHINE LAB-II
CODE: ELEC 3111
CONTACT HR: 3P

List of Experiments:

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 [Xd] & quadrature reactance [Xq] 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
13. Determination of equivalent circuit parameters of 3 ph induction machine
14. Performance of 3 ph squirrel cage induction motor

POWER SYSTEM – I Lab
Code: ELEC3112
Contact: 3P

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1. Determination of the generalized ABCD Constant of a long transmission line
2. Dielectric strength test of insulating oil
3. Determination of break down strength of solid insulating material
4. Measurement of earth resistance by a Earth-Tester
5. Determination of Phase Sequence Test of a given Three Phase Supply
6. Simulation of DC distribution by network analyzer for Single-end fed system
7. Simulation of DC distribution by network analyzer for Double-end fed system
8. Study and analysis of an electrical transmission line circuit with the help of PSPICE
9. Study of different types of insulators

SIGNALS & SYSTEMS LAB.
CODE: ELEC3113
CONTACT: 3P

1. The generation of different type of continuous and discrete signals using MATLAB.
2. Spectrum analysis of different signals.
3. Study of aliasing phenomenon and convolution.
4. Time response of first and second order systems for step, ramp and impulse input.
5. Study of performance indices of second order system excited by step input.
6. Frequency response of first and second order systems.
7. Determination of z- transform and inverse z transform using MATLAB.
8. Obtain Transfer Function of a given system from State Variable model and vice versa using MATLAB.
9. Obtain the step response and initial condition response of SISO and MIMO systems in SV form by simulation.

DBMS Laboratory
Paper Code : ELEC3114
Contact : 3 hours /week
Credit : 2

Experiments on Database on RDBMS Platform (Oracle):

DDL Commands: Creating Tables along with constraints like: Primary Key, Foreign Key, unique, Not Null, Check. Altering Table Structure like adding and modifying constraints, adding and modifying column data types, etc.

DML: Inserting rows, Updating rows, Deleting rows

SQL Query: Cartesian Product, All types of Join, Union, Intersect, Minus, Single Row functions, multiple row functions using GROUP BY clause, ORDER BY Clause, Nested Sub-Queries

Introduction to PL/SQL: Programming Language Constructs in PL SQL like variable declaration, Conditional Statements, different types of loop structures, functions, etc. Programming using Cursors.

Books:

DBMS Laboratory

Title: SQL, PL/SQL: The Programming Language Of Oracle (With CD-ROM) (English) 4th Revised Edition
Author: Ivan Bayross
Publisher: BPB Publications

B.Tech in Electrical Engineering
3rd Year 2nd Semester

POWER SYSTEM-II
Code: ELEC3201
Contact: 3L+1T

COURSE OUTCOME

Student will be able

1. To learn the representation of power system components by equivalent per unit reactance diagram.
2. To learn to perform various power system analyses like fault analysis, power flow and stability analysis.
3. To learn the basic principles of Power System relaying.
4. To learn the basic principle of Circuit Breaking.
5. To learn the protection schemes for different power system components.

MODULE – I

Representation of Power system components: Single-line diagram of balanced three phase system, Impedance & Reactance diagram, Per unit system representation, Base values-phase and line quantities.

Symmetrical & Unsymmetrical Fault Analysis: 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.

Symmetrical fault analysis.

Symmetrical component analysis of unsymmetrical faults, single line-to-ground fault, line-to-line fault, double line-to-ground fault. [11L]

MODULE – II

Power system stability: Classification of power system stability – voltage stability, Rotor angle stability/ steady state stability, transient stability, equal area criteria, swing equation, multi machine stability concept.

Load flow Analysis: Load flow problem, Y-bus Formulation of problem, Solution technique using Gauss-Seidal method, Newton-Raphson method [10L]

MODULE – III

Basic principles of power system protection, block diagrams of protective schemes and fundamental principles of Induction relay. Single input relays, Principle and application of non-directional & directional over current and earth fault relays. Distance relays, Differential relays. Basic aspects of static relay.

Protection schemes for transformer, generators and motors. [10L]

MODULE – IV

Circuit Breaker : General requirements of circuit breakers. Formation of electric arc, quenching theories, recovery voltage and RRRV, Arc re-striking phenomena. Problems in capacitive and low inductive current interruptions. Rating of circuit breakers.

Different types of circuit breakers - their operating mechanisms & applications. Testing of circuit breakers. D.C circuit breaking.

Substation grounding [9L]

Text Books:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. Power System Analysis by Grainger & Stevenson, Tata McGraw Hill
3. Switchgear protection and power systems, Sunil S Rao, Khanna Publications.
4. Elements of power system analysis, C.L. Wadhwa, New Age International
5. Power System Protection and Switchgear, B. Ravindranath, M. Chander

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. Power System Stability & Control - Prabha Kundur
4. Power Systems Stability, Vol. I,II& II, E.W. Kimbark, Wiley.
5. Power Systems Analysis, A. R. Bergen & V. Vittal, Pearson Education.
6. Power System Operation by James Malinowski , Robert Miller
7. The Art and Science of Protective Relaying by C. R. Mason, John wiley & Sons

Power Electronics
Paper Code: (ELEC3202)
Contact: 3L

Course Outcomes:

Students will be able to

- Understand the basic theory and characteristics of power semiconductor devices.
- Analyze basic converter (AC-DC, DC-DC, DC-AC, AC-AC) topologies.
- Understand and design single-phase and three-phase thyristorized converters.
- Learn the application of power electronics in electric drives.
- Understand role of Power Electronics in utility-related applications.

Module 1 [10L]

Introduction:

Need for power conversion; Power electronic converters: classifications and scope.

Power Semiconductor Devices:

Basic structure & switching characteristics of power diodes, SCR, TRIAC & GTO, V-I characteristics and applications. Two transistor model of SCR, switching characteristics of SCR, Gate Triggering methods of SCR - R, RC, and UJT firing circuits for SCR, series and parallel operation of SCR, Need for snubber circuits, di/dt & dv/dt protection, Different commutation techniques of SCR.

Introduction to Power transistor, MOSFET, IGBT - Ratings, static and dynamic characteristics.

Gate drivers and switching circuits, snubbers, cooling and heatsinks.

Module 2[12L]

Phase controlled converters:

Input and output characteristics of common rectifier topologies: Single-phase half-wave and full-wave controlled rectifiers with R, RL and RLE load. Effect of Free-wheel diode. Semiconverters with R, RL and RLE load. Three-phase half-wave and full-wave controlled and uncontrolled rectifiers with R, RL load (effects of continuous and discontinuous current on converters), Effect of Free-wheel diode, Power quality aspects in converters, Effect of source inductance in controlled rectifier and loss of voltage due to commutation, Introduction to 1-phase dual converter operation and three phase dual converter.

Selection of devices and its specifications.

DC Choppers:

Classification & operation of choppers (A, B, C, D, E), Control strategies, Buck, Boost and Buck-Boost converters: circuit configuration and analysis, Multiphase chopper.

Module 3[10L]

Inverters:

Definition and classification of inverters: VSI and CSI, SPWM, Brief idea of Resonant Pulse converter.

Principle of operation of 1-phase VSI and 3-phase VSI (120°, 180°) modes.

PWM inverters.

Series and parallel connections of inverters: Basic series inverter, Modified series Inverter, 1-phase parallel inverter operation (without feedback diode).

Multilevel inverters.

Power quality aspects of inverters, Improvement of power quality.

Module 4[8L]

AC-AC direct converter:

Principle of on-off voltage regulator and phase controlled voltage regulator, Operation of 1-phase controlled voltage regulator with R, RL loads.

Principle of operation of cycloconverters, circulating and non-circulating mode of operation single phase to single phase cycloconverters, three phase to three phase cycloconverters.

Introduction to matrix converter.

Applications:

Speed control of AC and DC motors, HVDC transmission, Static circuit breaker, SMPS, UPS, Static VAR compensators, FACTS - shunt and series compensators.

Text Books:

1. Power Electronics, Mohan, Undeland & Robbins, Wiley India.
2. Power Electronics, M.H. Rashid, PHI, 3rd Edition.
3. Power Electronics, M.D Singh and K.B. Khanchandani, Tata Mc Graw Hill, 2015.
4. Power Electronics, P.S. Bimbhra, Khanna Publishers, 2012.
5. Power Electronics, Dr. P.C Sen, Mc Graw Hill Education, 1st Edition.

Reference Text Books:

1. Modern Power Electronics and AC Drives, B.K Bose, Prentice Hall.
2. Element of Power Electronics, Phillip T Krien, Oxford, 2007.
3. Analysis of Thyristor power conditioned motor, S.K. Pillai, University Press.
4. Power Electronics: Principles and applications, J.M. Jacob, Thomson.

CONTROL SYSTEM
CODE: ELEC3203
CONTACT: 3L+1T

COURSE OUTCOMES OF CONTROL SYSTEMS

Students will be able to

- Know the fundamental concepts of Control systems and mathematical modeling of the system
- Analyze time and frequency response of the system
- Understand the concept of stability and examine it by various approaches
- Acquire knowledge about determination and improvement of system performance
- Design and realize systems using state variable modeling technique

Module -I

Introduction to control systems: Introduction of automatic control, Classification of control systems, open loop and closed loop systems. Examples of control systems. Properties of Control Systems, Elementary concepts of sensitivity and robustness, concepts of non minimum phase systems and time delay systems. [2L]

Representation of Systems: Block diagram representation of control systems. Block diagram algebra. Block diagram reduction and signal flow graph. Mason's gain formula. [4L]

Control system components: Potentiometer, Tacho-generator, Synchro and resolver, DC and AC servomotor, Actuators, Gyroscope. [4L]

Module -II

Time domain analysis: Review of transient & steady state response of first and second order systems. Concept of undamped natural frequency, damping, overshoot, rise time, peak time and settling time. Effects of Poles and Zeros on transient response. Steady-state and transient errors, concept of system types and error constants. [5L]

Stability Analysis: BIBO stability**,** stability by pole location, Routh-Hurwitz criteria and applications, Root locus techniques, construction of Root Loci. [7L]

Module -III

Frequency domain analysis: Review of frequency response of first and second order systems. Frequency Domain Specifications. Bode plot and Nichols chart. Polar plots. Nyquist criterion, Stability margins. Comparison of absolute and relative stability. [10L]

Module -IV

Design of Control System: Control actions: Proportional, integral, derivative actions and their combinations. Design of compensators. Lead, Lag ,Lead- Lag and Lag-Lead compensators. [4L]
State Variable Analysis: State variable formulation of control systems, Canonical forms of SV equations, diagonalization. Introduction to Controllability and Observability. Linear state variable feedback controllers, the pole placement problem. Linear system design by state variable feedback. [6L]

Total: 41L

Text Books:

1. Control Systems: Principles and Design, M Gopal, TMH
2. Modern Control Engineering, Ogata;Katsuhiko, PHI
3. Automatic Control Systems, B.C. Kuo & F. Golnaraghi, 8th Edition, PHI
4. Control system Engineering: I.J. Nagrath & M. Gopal, New Age International.

Reference books:

1. Digital Control & State Variable Methods: M. Gopal, 2nd Edition, TMH
2. Control system Engineering, Ananda Natarajan , P. Ramesh Babu, Scitech
3. Control System Engineering: D. Roy Chowdhuri, PHI

Microprocessor and Microcontroller (ELEC3204) (3 + 0 + 0)

Course Outcome:

After completing the course, the students will be able to

1. interface both read/write and read-only memories and Input & output devices to microprocessor.
2. write programs in assembly level language in Personal Computer environment, to convert it into .HEX file and download the .HEX file to Read/Write memory of a microprocessor based system for execution.
3. have an idea on microcontrollers / embedded systems
4. Develop the real time systems related to Electrical Engineering

Microprocessor (8085)

Module -I

1. Introduction (1L)
2. Architecture of 8085, Programming model and Instruction set (2L)
3. Timing Diagrams and execution of instruction (1L)
4. How to write simple programs (addition/subtraction, delay routine etc.) (1L)
5. Interfacing of Memory Device (ROM & R/WM) (2L)
6. Interfacing of IO devices, Keyboard, LED, 7-segment display, ADC, DAC, matrix keyboard (5L)

[12L]

Module -II

7. Generation of different waveforms (1L)
8. Programs of higher level and conversion of codes (2L)
9. Interrupts –(software and hardware) and realisation with examples (3L)
10. Interfacing of standard I/O devices – 8255A, 8253/54, concept of serial communication (3L)

[9L]

Microcontroller (8051)

Module - III

1. Introduction
2. Architecture of 8051, facility provided thru pins and concepts of I/O ports, Power-on-reset, Oscillator circuit
3. Memory organization: detailing of internal RAM, SFRs
4. Instruction set, Assembly level Programming concept and simple programs
5. Timers and counters and its different modes
6. Simple programs using timer-counter
7. Interrupts and its priority
8. Serial Communication **[11L]**

Module - IV

9. Programming of Microcontroller in C Language
10. Interfacing of Keyboard, LEDs , 7- segment display, LCD
11. Interfacing of ADC and DAC and sensors,
12. Interfacing of relays, opto-coupler, DC Motor, stepper motor
13. Interfacing of real time clock
14. Advanced serial data transfer protocols: I2C, SPI **[7L]**

PIC Microcontroller

Inrtoduction and basic features **[1L]**

Text Books:

1. Microprocessor Architecture, Programming and Applications with 8085 by R. S. Gaonkar, Penram Pub.
2. The 8051 Microcontroller Based Embedded Systems by Manish K Pate, McGrawHill Pub.
3. 8051Microcontroller and Embedded Systems by Muhammad Ali Mazidi, Janice Mazidi, Janice Gillispie Mazidi .

Principles of Management (HMTS-3201)

2L/Week Credit-2

Module 1:

Management: Definition, nature, purpose and scope of management, Skills and roles of a Manager, functions, principles; Evolution of Management Thought: Taylor Scientific Management, Behavioral Management, Administrative Management, Fayol's Principles of Management, Hawthorne Studies. **(4L)**

Module 2:

a) **Planning:** Types of plans, planning process, Characteristics of planning, Traditional objective setting, Strategic Management, premising and forecasting.
b) **Organizing:** Organizational design and structure, Coordination, differentiation and integration.
c) **Staffing:** Human Resource Management and Selection, Performance appraisal and Career strategy, Managing Change.
d) **Decision-Making:** Process, Simon's model of decision making, creative problem solving, group decision-making.
e) **Coordinating:** Concepts, issues and techniques.
f) **Controlling:** Concept, planning-control relationship, process of control, Types of Control, Control Techniques (**8L)**

Module 3:

Span of management, centralization and de-centralization Delegation, Authority & power - concept & distinction, Line and staff organizations. **(4L)**

Module 4:

Organization Behaviour: Motivation, Leadership, Communication, Teams and Team Work**. (6L)**

Management by Objectives (MBO): Management by exception; Styles of management: (American, Japanese and Indian), McKinsey's 7-S Approach, Self Management. **(2L)**

Evaluation:
Max. Marks-100
Internal Test-30
Semester End Test-70

Suggested Readings:

1. Harold Koontz & Heinz Weihrich, Essentials of Management, TMH.
2. Stoner, Freeman, Gilbert Jr., Management, PHI.
3. Bhatt & Kumar, Principles of Management, OUP.

DIGITAL SIGNAL PROCESSING
CODE: ELEC3231
CONTACT: 3L

COURSE OUTCOMES OF DIGITAL SIGNAL PROCESSING

Students will be able to

- Develop a clear conception about discrete time signals
- Understand the concept of convolution sum and its properties
- Realize the fundamentals of various transformation techniques
- Compute discrete Fourier Transform by various algorithms
- Design FIR and IIR filters
- Acquire elementary knowledge about digital signal processors

Module-I

Discrete-time signals: Review of concepts of sampling and discrete time signals. Sequences-periodic, energy, power, sample, step, ramp and complex exponentials. Arithmetic operations on sequences. Concept of convolution, graphical, analytical and overlap-add methods to compute convolution. [6]

LTI systems: Definition, difference-equation representation, impulse response. Properties of convolution with physical interpretations-interconnection of LTI systems. [3]

Module-II

z-transform: Review of z-transform and its properties, Application of z-transform. Concepts of z-transfer function. Stability and causality conditions for LTI systems. Recursive and non recursive systems, FIR and IIR systems. [5]

Transformation techniques: Continuous-time to discrete-time transformation: Mapping using impulse invariant transformation, bilinear transformation, approximation of derivative and matched z-transformation. [5]

Module-III

Discrete Fourier Transform: Introduction to discrete-time Fourier transform (DTFT)**.** Concepts of discrete Fourier transform (DFT) and inverse discrete Fourier transform (IDFT), properties of DFT. Computational burden of DFT, DFT/IDFT matrices, multiplication of DFTs. Concepts of circular convolution and its computation. [6]

Fast Fourier Transform: Importance of Fast Fourier Transform (FFT)**,** Implementation**-** Radix-2 algorithm, decimation-in-time and decimation-in-frequency algorithms, concepts of Butterflies, signal flow graphs. Comparison of computational load of DFT and FFT. [4]

Module-IV

Filter Design: Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR filters using impulse invariant and bilinear transforms, design of linear phase FIR filters, rectangular window function, circular complex convolution integral, Gibbs phenomenon. Concepts of Hamming, Hanning and Blackman window. [8]

Digital Signal Processor: Elementary ideas of the architecture and important instruction sets of TMS320C 5416/6713 processor, development of small programs in Assembly Language. [2]

Total= 39L

TEXT BOOKS:

1. Digital Signal Processing,Principles, Algorithms and Applications, J.G.Proakis & D.G.Manolakis, Pearson
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj & C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
4. Digital Signal processing – T.K. Rawat, Oxford

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.

Electrical Machine Dynamics

CODE: ELEC 3232 **CONTACT: 3L**

The subject helps the student to become familiarized with modern machines which are to be applied in practical field and to design and development for the research skill and find solution of real problems.

MODULE-I

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. [12]

MODULE-II

Direct Current machine dynamics:

Steady state analysis, and transient analysis of D.C machines. Transfer functions of D.C machines. Electrical braking of D.C motors. Parallel operation of D.C generators. [8]

MODULE-III

Synchronous Machine Dynamics:

Basic synchronous machine parameters. Behavior of the machine under certain short circuit condition, short circuit oscillogram. Transient analysis of synchronous machine. Transient torque. Sudden reactive loading and unloading. Steady state and transient Power angle Characteristic. Large angular oscillation. Synchronous machine Dynamics. Electrical braking of synchronous motor. . [12]

MODULE-IV

Induction Machine Dynamics:

Induction machine dynamics during starting and braking. Acceleration time, Induction machine dynamics during normal operation, Operation on unbalanced supply voltage. Slot harmonics. Harmonic effects on Induction motor, Harmonic equivalent circuit and harmonic torque. [8]

Text Books :	Reference Books :
1. Generalized Theory of Electrical Machines by Dr. P.S. Bimbhra 2. Electrical Machinery by S.K.Sen 3. Electric motor drives, modeling, analysis and control, R. Krishnan 4 Dynamic Simulation of Electric Machinery using MATLAB by C. Ong, 5 Analysis of Electric Machinery and Drive Systems by P.C. Krause, Oleg Wasynczuk, Scott D. Sudhoff 6. Electromechanical Motion Device by P.C. krause, O.Wasynczuk	1. Modern power electronics and AC drives, B.K. Bose 2. Electrical Machinery, A.E. Fitzgereld, C. Kingslay and S.D. Uman

POWER SYSTEM-II Lab
Code: ELEC3211
Contact: 3P

1. Polarity, ratio and magnetization characteristics test on CT and PT
2. To Study & Testing of ON-delay relay and OFF-delay relay
3. To Study the Inverse characteristics of a Under-Voltage relay
4. To Study the Inverse characteristics of Earth Fault relay
5. To Study the Inverse characteristics of Over-Current relay
6. To Study the Inverse characteristics of Directional Over-Current relay
7. To Study Transformer Protection using Electro-mechanical Type Differential relay
8. To study Short Circuit Analysis using Network Analyzer
9. To Study the Performance of Over-Current Relay using ETAP software simulation.
10. To Study the Performance of Under-Voltage Relay using ETAP software simulation.
11. To Study the Performance of Differential Relay for Transformer Protection using ETAP software simulation.
12. To Study the Load Flow analysis by Gauss-Seidel & Newton-Raphson method using ETAP or MATLAB software simulation

POWER ELECTRONICS LAB
ELEC3212
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 the operation of a single phase full controlled bridge converter with R and R-L load.
5. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converters.
6. Study of performance of step down chopper with R and R-L load.
7. Study of performance of single phase controlled converter with and without source inductance (Simulation).
8. Study of performance of step up and step down chopper with MOSFET, IGBT and GTO as switch (Simulation).
9. Study of performance of single phase half controlled symmetrical and asymmetrical bridge converter (Simulation).
10. Study of performance of three phase controlled converter with R & R-L load (Simulation).
11. Study of performance of PWM bridge inverter using MOSFET as switch with R and R-L load (Simulation).
12. Study of performance of three phase AC controller with R and R-L load (Simulation).
13. Study of performance of a Dual converter (Simulation).
14. Study of performance of a Cycloconverter (Simulation).

CONTROL SYSTEM LABORATORY
CODE: ELEC3213
CONTACT: 3P

1. Familiarization with MATLAB control system tool box, MATLAB Simulink tool box
2. Simulation of Step response and Impulse response for type-0, type-1 & Type-2 system with unity feedback using MATLAB**.**
3. Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box and different control system specifications from the plot.
4. Determination of approximate transfer functions from the Bode plot.
5. Study of P, PI, PD and PID control action for first and second order system using Z-N method.
6. Tuning of P, PI, PD and PID controllers for higher order plants with and without dead time.
7. Design of Lead and Lag compensators.
8. Evaluation of steady state error, rise time, setting time, percentage peak overshoot, gain margin, phase margin etc. with incorporation of Lead and Lag compensators.
9. Design of linear state feedback controllers for a system using MATLAB.

Department of Electrical Engineering
Microprocessor and Microcontroller Lab (ELEC 3214)
Contact Hours: (0+0+3)

LIST OF EXPERIMENTS

1. a) Familiarization with Microprocessor kit
   - i) Starting and ending address of R/W Memory
   - ii) To write a program in assembly level consulting the Hex table and address generation
   - iii) To enter a program, how to run and how to verify the result in a Microprocessor kit
   - iv) To edit a program in PC, how to assemble it, how to link it to generate a .hex file and how to download the .hex file to the kit using serial com port and execute it etc. etc.

   b) To write a program (WAP) in assembly level to add two numbers, taken in registers and store the result in a memory location.

Write a program (WAP) in assembly level

2. a) to add two numbers stored in two consecutive memory locations and store the sum in next memory location.
   b) to add ten numbers stored in consecutive memory locations and store the sum in a memory location (assuming the result will not produce any carry).
3. a) to store the incremental data in consecutive memory locations.
   b) to copy the block of data from one memory area to another memory area
   c) to copy and paste the block of data from one memory area to another memory area
4. a) to find the largest / smallest number in a block of data.
   b) to arrange the block data in ascending / descending order.
5. a) to unpack a BCD number and pack an unpacked BCD number.
   b) Addition of two BCD numbers.
6. a) to convert a BCD number to the corresponding Binary number.
   b) to convert a binary number to the corresponding BCD number.
7. a) to convert a BCD code to a common anode 7-segment code.
   b) to convert a binary code to the corresponding ASCII code.
8. a) to configure the ports of 8255 Programmable Peripheral Interface (PPI)
   b) to interface a 7 segment LED display, to blink the LEDs of a 7-segment for half second ‘on’ and half second ‘off’
9. to display 0 thru 9 on 7-segment display for half second display and half second off.
10. to generate different waveforms (square, saw-tooth, triangle and sine) using DAC0808 interfacing.
11. to interface an ADC0808/0804 with microprocessor/microcontroller and take a digital data in corresponding to an analog data and store it in a memory.
12. to interface a 16X2 LCD display with 8051 microcontroller.
13. 4X4 keyboard interfacing with 8051 microcontroller.
14. Familiarization with integrated development environment (IDE) of PIC microcontroller, programming and running a sample program to blink an LED etc.

Personality Development (HMTS 3221)

1L/week Credit 1

Module 1

Self-Growth

i. Self Growth- Maslow's Hierarchy of Needs Theory
ii. Anger, Stress & Time Management- Theories and application
iii. SWOT Analysis

Module II

Stepping Up

i. Growth & Environment
ii. Competitive Spirit
iii. Responsibility Factor

Module III

Professional Communication

i. Impression Management- theory on social psychology
ii. Employability Quotient
iii. Cross-cultural communication

Module IV

Leadership & Team Playing

i. Leadership & Team Playing: Theories, Styles, Stages
ii. Motivation, Negotiation Skills, Conflict Management
iii. Planning & Envisioning: Initiative and Innovation in the Work Environment- De Bono's Six Thinking Hats

Evaluation:
Max.Marks-100(sessional)
25 marks/ module

Methodology: Assignment and project

Suggested Reading

1. Personality Development and Soft Skills by Barun K. Mitra, Oxford University, 2011
2. Soft Skills: An Integrated Approach to Maxmise Personality by Gajendra Singh Chauhan and Sangeeta Sharma, Wiley, 2016
3. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success by Gopalaswamy Ramesh and Mahadevan Ramesh, Pearson, 2010

B.Tech in Electrical Engineering
4th Year, 1st Semester

ELECTRIC DRIVES & POWER UTILIZATION

Code: ELEC4101
Contact: 3L+1T

Course Outcomes:
Students will be able to:

- Know the stable steady state operation and transient dynamics of motor-load system.
- Learn characteristics and control of solid state DC motors drives, induction motor drives & Synchronous motor drives.
- Acquire knowledge about electric traction systems and their industrial applications.
- Understand the principles of operation of different lamps and different photometers and to analyze indoor lighting schemes.
- Learn different methods of electric heating and welding.

MODULE I
Electric Drives:
Concept, classification, parts and advantages of electrical drives. Types of Loads, Components of load torques, 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.

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. Choice of couplings and bearings.

[8L]

MODULE II
AC & DC Drives:
Types of braking, braking of DC motor, Induction motor and Synchronous motor, Single phase, three phase fully controlled DC drives, Dual converter fed drives, Armature current control with constant flux and field weakening, Drive schemes with armature voltage feedback, IR-compensation and tacho feedback for both constant flux and field weakening. Chopper controlled DC motor drives. Stator voltage variation by three phase controllers, Speed control using dynamically varying resistance in the rotor circuit, slip power recovery schemes. Pulse width modulated inverter fed and current source inverter fed induction motor drive. Volts/Hertz Control, Basics of Vector or Field oriented control. **[12L]**

MODULE – III
Electric Traction:
Introduction, Requirements of Ideal Traction System Supply system for electric traction, Train movement (speed time curve, simplified speed time curve, average speed and schedule speed), Co-efficient of adhesion.
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). The traction motors starting, Breaking of Traction motors.

Use of AC series motor and Induction motor for traction, Current collection in traction system.

[10L]

MODULE – IV

Illumination Engineering:

Light and electromagnetic radiation.

Radiometric and photometric quantities, visual response curve of standard observer, relation between lumen and watt.

Laws of illumination, perfect diffuser, Lambert's law.

Photometry - Bench photometer, Luxmeter, Integrating sphere, Distribution photometer.

Lamps-general classification, filament, discharge, fluorescent – construction, principle of operation, applications.

Elementary lighting design- design parameters, BIS recommendation, General indoor lighting design by Lumen method.

Concepts of energy efficient lighting design and payback calculation.

[5L]

Electric Heating welding:

Introduction, Different methods of heating: resistance heating, Induction heating, Dielectric heating, Arc heating, microwave heating , Electric welding, Different welding methods, current control of welding transformer, Ultrasonic and laser welding. Arc furnaces : Basic Principles.

Storage Batteries: Common types and their characteristics, Principles of charging, Modes of charging, eg., Tickle, Float, Boost, Constant current, constant voltage. Battery size estimation.

[5L]

Text Books:

1. Dubey.G.K., "Fundamentals of Electrical drives", Narora publications, 1995.

2. Vedam Subramanyan, "Thyristor control of Electrical Drives", Tata McGraw Hill, Publications, 1996.

3. Bimal K. Bose, "Modern Power Electronics and AC Drives", Prentice Hall of India, 2005.

4. J.B.Gupta,"Utilization of Electric power and Electric Traction", Kataria Publishers.

5. H. Partab, "Art and Science of Utilization of Electrical Energy", Dhanpat Rai & Sons.

References:

1. R. Krishnan, "Electric motor drives Modeling, Analysis and Control", 1st edition, Pearson Publications, 2009.

2. C.L. Wadhawa, "Generation Distribution and Utilization of Electrical Energy", New Age International Publishers.

3. E.Openahaw Taylor, "Utilisation of Electric Energy", Orient Longman.

4. W.Shepherd, L.N. Hulley, & D.T.W. Liang, "Power Electronics and Motor Control", Cambridge University Press.

High Voltage Engineering
Code: ELEC4102
CONTACT: 3L+1T

On successful completion of this course, the student is capable of:

- deriving the equations for electric stress enhancement in high voltage insulation.
- explaining the physical process of breakdown - based on the Townsend, Streamer and Leader models
- describing and explaining the standard HV tests, and design the test generator circuits for ac, dc and impulse voltages (and currents).

Module: I

Introduction

Electric Field, Dielectric Strength, Electric Field in Some Geometric Boundaries, Solid Dielectrics, Liquid Dielectrics, Gas/Vacuum Dielectrics. **(2L)**

Overvoltage Phenomenon and Insulation Coordination

Natural Causes for Overvoltage – Lightning Phenomenon, Switching Surges, System Faults and Other Abnormal Conditions, Insulation Coordination on High Voltage and Extra High Voltage Power Systems **(6L)**

Module: II

Breakdown Mechanism

Conduction and Breakdown in Gases: Townsend Mechanism, Paschen's Law, Streamer Theory of Breakdown in Gases, Breakdown in Electronegative Gases, Time Lags for Breakdown, Breakdown in Non-Uniform Fields and Corona Discharges. Vacuum Insulation **(6L)**

Conduction and Breakdown in Liquids: Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids. **(3L)**

Breakdown in solid dielectrics: Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown, Breakdown of Solid Dielectrics in Practice, Breakdown in Composite Dielectrics. **(3L)**

Module: III

Generation of High Voltages and Currents

Generation of High AC Voltage – Testing transformer and its cascade connection, single-phase series resonance circuit, **Generation of High DC Voltage** – Single-stage and multi-stage symmetric as well as asymmetric voltage multiplier circuits, **Generation of Impulse Voltage and Current** – Single-stage and multi-stage impulse generators circuits, Triggering and synchronization with CRO. **(10L)**

Module: IV

Measurement of Voltages and Currents

Measurement of High DC Voltage – Ammeter in series with high resistance, Resistance potential divider, Generating voltmeters, Sphere gaps. **Measurement of Power Frequency High AC Voltage** – Capacitive Voltage Transformer, Potential Dividers, Electrostatic Voltmeter, Sphere gaps. **Measurement of Peak value of high AC Voltage – Frequency dependent method**: Chubb & Fortescue Method, **Frequency independent methods**: Davis-Bowdler Method, Rabus Method. **Sphere-Gap Method** for measurement of High DC, AC and Impulse Voltages (Peak Values). **Measurement of High DC, AC and Impulse Currents -** Hall generator, Current transformer, Resistive shunts, Rogowski coil**, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements. Measurement of Dielectric Loss-factor** – High Voltage Schering Bridge. **Partial Discharge Measurements** **(10L)**

Text Book:

1. High Voltage Engineering Fundamentals – John Kuffel, E.Kuffel , W.S Zaengal.
2. High Voltage Engineering: Theory and Practice - Mazen Abdel-Salam.
3. High Voltage Engineering – M.S Naidu, V. Kamraju.
4. High Voltage Engineering – C. L. Wadhwa.
5. High Voltage Technology –Liviu Leonard Alston.
6. High Voltage Measurement Techniques- A.J.Schwab.
7. High Voltage Engineering -V. Razevig & M.P. Chourasia.
8. High Voltage Insulation engineering – Ravindra Arora, Wolfgang Mosch.

Professional Elective – III

ADVANCED POWER SYSTEM
CODE: ELEC4161
CONTACT: 3L

COURSE OUTCOME
Students will be able
1. To understand the Economic Operation of Power Generation Systems
2. To understand the advantages and operation of HVDC transmission system .
3. To learn about power system transients.
4. To know about the frequency Control in Power System.
5. To learn about the voltage control and reactive power compensation in power system.

MODULE-I

Economic Operation of Energy Generation Systems
Generator Cost Curves; Economic Operation of Thermal Power plants ; Transmission Loss and Penalty Factor; Necessity of Hydro-Thermal Scheduling; Unit Commitment problem- various costs and constraints, solution of Unit Commitment problem. [12]

MODULE-II

Introduction to HVDC: Introduction to DC power transmission technology, comparison of AC and DC transmission, Components of HVDC transmission , Configurations of DC transmission system [4]

Power System Transients: Types of Power System Transients; Overvoltage in Transmission Lines; Propagation of Surges and Travelling Waves; Reflection and Refraction coefficient; Bewley's Lattice Diagram, Protection against Over-Voltage Transients in Power System. [7]

MODULE-III

Automatic Generation Control
Concept of AVR and ALFC Loops, Representation of Speed Governors, Turbines, Generators and loads; Exciter and VAR Control; Single Area Load Frequency Control. [7]

MODULE-IV

Reactive Power Sensitivity and Voltage Control; Shunt and Series Compensation; Introduction to different FACTS devices, their principle of operation and their role in reactive power and voltage control. [10]

TEXT BOOKS:

1. HVDC Power Transmission Systems –Technology & System Interaction by K.R.Padiyar, Willey Eastern.
2. Modern power system analysis, D.P. Kothari & I.J. Nagtrath, Tata McGraw Hill.
3. Power generation operation & control, A.J. Wood & B.F. Wollenberg, Wiley India.
4. Power System Stability and Control by Prabha Kundur, Tata McGraw Hill.
5. Electric Energy Systems Theory by O.I. Elgard, Tata McGraw Hill.

REFERENCE BOOKS:

1. Power system analysis- S.Sivanagaraju
2. Power system Analysis, operation & control, Chakrabarty & Haldar, 2nd edition, PHI.
3. Power System Operation and Control, Umakant Rao,
4. Electrical Power System by C.L Waldha, New age International Publication

ADVANCED CONTROL SYSTEM
CODE: ELEC4162
CONTACT: 3L

COURSE OUTCOMES OF ADVANCED CONTROL SYSTEM

Students will be able to

- Know the fundamental concepts of Nonlinear Control systems
- Analyze Nonlinear systems by describing function and phase plane method
- Analyze the stability of a nonlinear system by Lyapunov theory
- Acquire knowledge about sampled data control systems
- Acquire knowledge about importance of observers in control systems
- Know the fundamental concepts of optimal control systems

Module I

Introduction to nonlinear systems:

Block diagram and characteristics of nonlinear systems. Common type of nonlinearities. 2L

Nonlinear system analysis: concepts of phase plane analysis .Phase plane analysis of linear and nonlinear systems. Methods of obtaining phase plane trajectories by graphical method, isoclines method. Qualitative analysis of simple control systems by phase plane methods. Limit cycles 5L

Describing function analysis. Stability analysis by describing function technique. Prediction of limit cycles using describing function technique. 5L

Module II

Stability analysis by Lyapunov theory:

Stability concepts for nonlinear systems. BIBO Vs state stability. Definitions of Lyapunov functions. Lyapunov analysis of LTI systems. 4L

Concept of Asymptotic stability, Global asymptotic stability. The first and second methods of Lyapunov to analyze nonlinear systems. Concepts of linearization. Design of control systems using Lyapunov's Methods. 5L

Module III

Analysis of discrete time (sampled data) systems using Z-transform:

Review of Pulse transfer function. Practical sampled data systems and computer control systems. Zero order hold. Approximation of discrete (Z-domain) controllers with ZOH by Tustin transform and other methods. State variable analysis of sampled data system. Discrete time control system design by root locus method. Digital compensator design using frequency response. Design of digital PID controllers. 10L

Module IV

Observers in control systems:

State observers. Design of full order state observers. Observer based state feedback control systems. Reduced order state observers. 4L

Introduction to Optimal Control Systems:
Introductory concepts of Optimal Control Systems and Performance Indices. Concepts of regulator problem, tracking problem. Hamilton-Jacobi equation. Optimal Control of linear systems with Quadratic Performance Index. Numerical solution of Riccati equation. 5L

Text Books:

1. Control Systems: Principles and Design, M Gopal, TMH
2. Modern Control Engineering, Ogata;Katsuhiko, PHI
3. Automatic Control Systems, B.C. Kuo & F. Golnaraghi, 8th Edition, PHI
4. Control system Engineering: I.J. Nagrath & M. Gopal, New Age International.

Reference books:

1. Digital Control & State Variable Methods: M. Gopal, 2nd Edition, TMH
2. Control System Engineering: D. Roy Chowdhuri, PHI

Free Elective – I

Course Name : CLOUD COMPUTING					
Course Code: INFO4182					
Contact hrs per week:	L	T	P	Total	Credit points
	3	0	0	3	3

After successfully completing this course the students will be able to:

Learn cloud computing models, techniques, and architectures. Cloud computing has evolved as a very important computing model, which enables information, software, and other shared resources to be provisioned over the network as services in an on-demand manner.Students will be exposed to the current practices in cloud computing. Topics may include distributed computing models and technologies, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), virtualization, security and privacy issues, performance and systems issues, capacity planning, disaster recovery, challenges in implementing clouds, data centers, cloud hosted applications, and other advanced and research topics in cloud computing.

Detailed Syllabus:

Module-I: [7L]

- **Overview of Computing Paradigm [3 L]**

o Recent trends in Computing

Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing

- **Introduction to Cloud Computing [4 L]**
  - oCloud Computing

Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers

  - oProperties, Characteristics & Disadvantages

Pros and Cons of Cloud Computing, Benefits of Cloud Computing, Cloud computing vs. Cluster computing vs. Grid computing

Module-II: [11L]

- **Cloud Computing Architecture [5 L]**
  - oCloud computing stack

Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services

  - oService Models (XaaS)
    - Infrastructure as a Service(IaaS)
    - Platform as a Service(PaaS)
    - Software as a Service(SaaS)
  - oDeployment Models
    - Public cloud
    - Private cloud
    - Hybrid cloud
    - Community cloud
- **Infrastructure as a Service(IaaS) [6 L]**
  - oIntroduction to IaaS

IaaS definition, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM)

  - oResource Virtualization
    - Server

- Storage
- Network

Virtual Machine(resource) provisioning and manageability, storage as a service, Data storage in cloud computing(storage as a service)

- Examples
  - Amazon EC2

Renting, EC2 Compute Unit, Platform and Storage, pricing, customers

Module-III: [11L]

- **Platform as a Service(PaaS) [7 L]**
  - Introduction to PaaS

What is PaaS, Service Oriented Architecture (SOA)

- Cloud Platform and Management
  - Computation
  - Storage
- Examples
  - Google App Engine
  - Microsoft Azure

- **Software as a Service(SaaS) [4L]**
  - Introduction to SaaS
  - Web services
  - Web 2.0
  - Web OS

Module-IV: [12L]

- **Service Management in Cloud Computing [7 L]**
  - Service Level Agreements(SLAs)
  - Billing & Accounting
  - Comparing Scaling Hardware: Traditional vs. Cloud
  - Economics of scaling: Benefitting enormously
  - Managing Data
    - Looking at Data, Scalability & Cloud Services
    - Database & Data Stores in Cloud
    - Large Scale Data Processing
- **Cloud Security [5 L]**
  - Infrastructure Security

Network level security, Host level security, Application level security

- Data security and Storage

Data privacy and security Issues

- Identity & Access Management
- Access Control
- Trust, Reputation, Risk
- Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations

References:

1. *Cloud Computing Bible,* Barrie Sosinsky, *Wiley-India,* 2010
2. *Cloud Computing: Principles and Paradigms,* Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, *Wile,* 2011
3. *Cloud Computing: Principles, Systems and Applications, Editors:* Nikos Antonopoulos, Lee Gillam, *Springer,* 2012
4. *Cloud Security: A Comprehensive Guide to Secure Cloud Computing,* Ronald L. Krutz, Russell Dean Vines, *Wiley-India,* 2010

Subject Name : INSTRUMENTATION AND TELEMETRY					
Paper Code : **AEIE4181**					
Contact hrs per week :	L	T	P	Total	Credit Points
	3	0	0	3	3

Module I – [9L]

Measurement of pressure and vacuum: Introduction, diaphragm, capsule, bellows, bourdon tube, DP transmitters – capacitive, Mcleod gauge.

Flow rate measurement: head type flow meters – orifice, pitot tube, venturimeter; variable area flow meters –rotameters; electromagnetic flow meters; ultrasonic flow meters.

Module II – [9L]

Level measurement: float and displacers type instruments, resistive and capacitive type level instrument; D/P type sensors; ultrasonic level instruments.

Temperature measurement: RTD – working principle, different wired configuration, characteristics, typical industrial application; thermocouples – working principle, cold junction compensation, different types of thermocouples and their application in industry and laboratory, thermopiles, thermowells, thermistor, pyrometers.

Module III – [11L]

Basic classification of telemetry systems: voltage, current, position, frequency and time components of telemetering and remote control systems, quantization theory, sampling theorem, sample and hold, data conversion, coding, and conversion.

Module IV – [9L]

Multiplexing; time division multiplexers and demultiplexer theory, scanning procedures, frequency division multiplexers with constant and proportional bandwidth, demultiplexers. Fundamentals of radio-telemetry system, RF link system design. Pipeline telemetry; Power system telemetry.

References:

1. B. G. Liptak, *Instrument Engineers Handbook, vol-I and vol-II*; Chilton Book Co. Philadelphia.
2. D. Patranabis, *Principles of industrial Instrumentation*; TMH, New Delhi, 2nd Ed.
3. Eckman, *Industrial Instrumentation*; Wiley Eastern Ltd.
4. D. Patranabis, *Telemetry Principles,* Tata McGraw-Hill Education Pvt. Ltd.
5. Telemetry and Data Transmission", R. N Baral, *S. K. Kataria & Sons.*

Course Outcomes:

After the completion of the course students will be able to

1. Gain the knowledge in the area of pressure, flow, level and temperature transducers.
2. Justify the selection criteria for measurement techniques adopted in industrial environment.
3. Gain the knowledge about different telemetry systems.

Electric Drives Lab
Code: ELEC4111
Contact: 3P

1. Study of thyristor controlled DC Drive.

2. Study of Chopper fed DC Drive.

3. Study of AC Single phase motor and speed control using TRIAC.

4. PWM Inverter fed 3 Phase Induction Motor control.

5. VSI / CSI fed Induction motor Drive analysis using Software/Hardware.

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/Hardware.

8. Regenerative / Dynamic braking operation for DC Motor - Study using Software/Hardware.

9. Regenerative / Dynamic braking operation of AC motor - Study using Software/Hardware.

10. Dual converter fed DC Motor Drive for realization of four quadrant operation.

Electrical Machine Design
ELEC4121
Contact: 3P

- 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.
- Designing of a 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.
- Designing of an electronic ballast.

Free Elective offered to other Department

Course Name : **Circuit Theory Analysis (Free Elective)**					
Course Code: ELEC4182					
Contact hrs per week :	**L**	**T**	**P**	**Total**	**Credit points**
	3	**0**	**0**	**3**	**3**

Module-I

Network equations: Formulation of Node & Mesh equations. Loop and node variable analysis. Network theorems: Thevenin's theorem, Norton's theorem and Superposition theorem applied to circuits containing dependent sources. [9L]

Module-II

Laplace Transform: Review of Laplace transform. Properties of Laplace transform. Transform of standard periodic and non periodic waveforms. Circuit elements and their transformed equivalents. Transient and steady state response of RL, RC, LC and RLC with or without stored energy. Concept of natural frequency and damping. [9L]

Module-III

Graph theory: Graph of network: Concept of path, tree, tree branch, tree link, loop, tie set and cut set. Incidence Matrix, tie-set Matrix and f-cut set matrix and their properties. Loop currents and node-pair potentials, formulation of loop and node equilibrium equations in view of graph theory. [9L]

Module-IV

Two port networks: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters and Hybrid parameters. Inter relation between parameters. Inter connection between two port networks. Driving point & transfer impedance & admittance. [9L]

Text Books:

1. Networks and Systems, D. Roy Chowdhury, New Age International Publishers
2. Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.
3. Network Analysis, Van Valkenburg, Pearson Education .
4. Fundamental of Electric circuit theory, D. Chattopadhay & P.C. Rakshit, S. Chand.

References:

1. Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin,The Mc Graw Hill Company.
2. Modern Network Analysis, F.M.Reza & S.Seely, McGraw Hill.

B.Tech in Electrical Engineering
4th Year, 2nd Semester

Course Name : Organizational Behaviour					
Course Code: HMTS-4201					
Contact hrs per week:	L	T	P	Total	Credit points
	2	0	0	2	2

Module I

Introduction to Organizational Behaviour-Concept, Importance, Challenges and Opportunities (1L)

Personality-Meaning of Personality, Personality Determinants and Traits, Psychoanalytic Theory, Argyris Immaturity to Maturity Continuum Impact on organization.(2L)

Attitude-Concept, Components, Cognitive Dissonance Theory, Attitude Surveys. (2L)

Module II

Perception- Concept, Nature and Importance, Process of Perception, Factors influencing perception, Perceptual Selectivity, Shortcuts to Judge Others: Halo Effect, Stereotyping, Projection and Contrast Effects, Impact on Organization. (2 L)

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.(4L)

Module III

Leadership-Concept, Leadership Styles, Theories-Behavioural Theory: Ohio Studies, Michigan Studies, Blake & Mouton Managerial Grid; Contingency Theory: Fielder Theory. (4L)

Group Behaviour: Definition, Characteristics of Group, Types of Groups: Formal & Informal; Stages of Group Development, Group Decision making, Group Decision Making Vs Individual Decision Making. (4L)

Module IV

Organizational Design-Various organizational structures and their pros and cons.

Concepts of organizational climate and culture, Organizational Politics-Concept, Factors influencing degree of Politics (2L)

Conflict management- Concept, Sources of conflict, Stages of conflict process, Conflict resolution techniques, Tools-Johari Window to analyse and reduce interpersonal conflict, Impact on organization. (3L)

Evaluation:

Max. Marks-100

Internal Test-30

Semester End Test-70

Suggested Readings:

1) Organization Behaviour by Stephen Robbins

2) Organization Behaviour by Luthans

3) Organization Behaviour by L.M. Prasad

4) Organization Behaviour: Text, Cases &Games by Aswathappa K.

Electrical System Design
Code : ELEC4221
Contact: 3P

- 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
- 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.
- Design an energy efficient lighting scheme for residential, commercial, hospital and other indoor areas.
- Design a road lighting scheme for various types of roads according to BIS specifications.

Free Elective offered to other Department

Course Name : Fundamentals of Illumination Engineering(Free Elective)					
Course Code: **ELEC4282**					
Contact hrs per week :	L	T	P	Total	Credit points
	3	0	0	3	3

COURSE OUTCOME

- To get acquainted with the laws of photometry for calculation of illuminance levels for different lighting applications
- To understand the principles of operation of different photometers
- To understand the principles of operation of different lamps and their accessories
- To analyse indoor lighting schemes and design energy efficient installations complying with lighting codes
- To design energy efficient road lighting installations in conformity with lighting codes
- To understand the parameters of sports lighting installations

Module – I **[9L]**

Illumination Engineering Basics and Photometers

Light and Electromagnetic Radiation, Visible spectrum of radiation.

Radiometric and photometric quantities, visual response curve of standard observer, relation between Lumen and Watt.

Laws of Illumination, perfect diffuser, Lambert's law.

Module – II **[9L]**

Lamps and its Accessories: Fluorescent tubes, compact fluorescent lamps (CFL), low and high pressure sodium vapour lamps, high pressure mercury vapour lamps, Light Emitting Diode (LED) lamps.

Ballast- function, electromagnetic and electronic types, principles of operation.

Module – II **[9L]**

Lamps and its Accessories: Fluorescent tubes, compact fluorescent lamps (CFL), low and high pressure sodium vapour lamps, high pressure mercury vapour lamps, Light Emitting Diode (LED) lamps.

Ballast- function, electromagnetic and electronic types, principles of operation.

Module – III **[9L]**

Interior Lighting Design

Objectives, quantity and quality of light, selection of lamps and luminaires. Design considerations for lighting of offices, conference rooms, hospitals. Design calculations by lumen method in accordance with lighting code.

Module – IV **[9L]**

Outdoor Lighting : Road, Playground and Landscape Lighting Design

Basic concepts of outdoor lighting design- objectives, design parameters, qualitative & quantitative evaluation of outdoor lighting systems.

References / Books

1. Lighting Engineering Applied Calculations – R. H. Simons & A.R. Bean, Architectural Press
2. Applied Illumination Engineering, Second Edition, Jack L Lindsey, Prentice Hall.
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