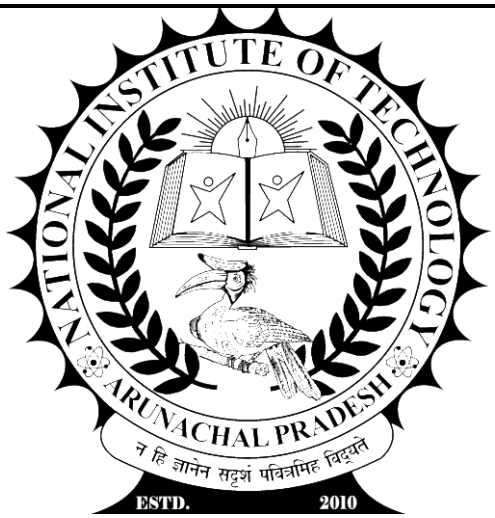
Education

NATIONAL INSTITUTE OF TECHNOLOGY ARUNACHAL PRADESH

(ESTABLISHED BY MINISTRY OF HUMAN RESOURCE DEVELOPMENT, GOVT. OF INDIA)

Ethics

In GOD's own land, a fusion of scholastic students, innovative & motivated researchers & teachers and fast



Course Structure & Syllabus For EE

Steeping Stone and Sky reaching ladder to success.

Research

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Service to Society

NATIONAL INSTITUTE OF TECHNOLOGY

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Syllabus for B.Tech in Electrical Engineering

Professor Chandan Tilak Bhunia, Ph.D [Engg.], FIETE, FIE (I), SMIEEE

DIRECTOR

FORWARD

To **achieve the target of being a global leader in the field of Technical Education**, there is some sort of time bound urgency **to work quickly, massively and strongly**, in respect of National Institute of Technology, Arunachal Pradesh being an **" Institute of National Importance"** (by an Act of Parliament) and being **established only in three years back in 2010**. I have therefore adopted a **'B' formula** as stated below to achieve the primary goal of producing world class visionary Engineers and Exceptionally brilliant Researchers and Innovators:

B- FORMULA

- **Best for Teaching**
- **Best for Research**
- **Best for Entrepreneurship & Innovation**
- **Best for Services to Society**

In implementing the **'B' formula** in letter and spirit, the framing of syllabi has been taken **as important legitimate parameter**. Therefore, extraordinary **efforts and dedications were directed for the last one year to frame** a syllabi **in a framework perhaps not available in the country as of today**.

Besides attention on **'B' formula** institute has given considerable importance to the major **faults of current Technical Education while framing the syllabus**. The major stumbling blocks in Technical Education today are:

I. The **present system is producing "Academic Engineers" rather than "Practical Engineers".**
II. The present system of education makes the **students to run after jobs rather than making them competent to create jobs.**
III. There is lack of **initiative to implement the reality of "Imagination is more important than knowledge".**

Taking due consideration of the findings made above, to my mind a credible syllabi has been framed in the institute in which the major innovations are introduction of:

I. **I-Course (Industrial Course) one in each semester at least one, which is targeted to be taught by the Industrial Expert at least up to 50% of its component.**
II. **Man making and service to society oriented compulsory credit courses of NCC/NSS, values & ethics.**
III. **Compulsory audit course on Entrepreneurship for all branches.**
IV. **Many add-on courses those are (non-credit courses) to be offered in vacation to enhance the employability of the students.**
V. **Many audit courses like French, German, and Chinese to enhance the communication skill in global scale for the students.**
VI. **Research and imagination building courses such as Research Paper Communication.**
VII. **Design Course as "Creative Design".**

Further, the syllabi has been framed **not to fit in a given structure as we believe structure is for syllabus and syllabus is not for structure. Therefore, as per requirement of the courses, the structure, the credit and the contact hours has been made available** in case to case.

The syllabus is also innovative as it includes:

I. **In addition to the list of text and reference books, a list of journals and magazines for giving students a flexible of open learning.**
II. **System of examination in each course as conventional examination, open book examination and online examination.**

Each course has been framed with definite objectives and learning outcomes. Syllabus has also identified the courses to be taught either of two models of teaching:

I. **J.C.Bose model of teaching where practice is the first theory.**
II. **S.N.Bose model of teaching where theory is the first practice.**

Besides the National Institute of Technology, Arunachal Pradesh has initiated a scheme of **simple and best teaching** in which for example:

I. **Instead of teaching RL, RC and RLC circuit separately, only RLC circuit will be taught and with given conditions on RLC circuits, RL and RC circuits will be derived and left to the students as interest building exercise.**
II. **Instead of teaching separately High Pass Filter, Band Pass Filter and Low Pass Filter etc.; one circuit will be taught to derive out other circuits, on conditions by the students.**

I am firmly confident that the framed syllabus will result in **incredible achievements, accelerated growth and pretty emphatic win over any other systems** and therefore **my students will not run after jobs rather jobs will run after my students.**

For the framing of this excellent piece of syllabus, **I like to congratulate all members of faculty, Deans and HODs in no other terms but "Sabash!".**

Prof. Dr. C.T. Bhunia
Director, NIT, (A.P.)

Teaching Methodology:

Semester	J C Bose Model	S N Bose Model
1st	Engineering Drawing I Workshop Practice I Basic Electrical & Electronics Engineering. NSS/ NCC.	Engineering Mathematics- I. Chemistry. Physics-I. Life Science. Communication Skill. Engineering Mechanics.
2nd	Programming in C Environmental Science Digital Electronics & Logic Design History of Science & Technology Workshop Practice II Engineering Drawing II	Engineering Mathematics- II. Engineering Mechanics. Physics-II Basic Elements of Mechanical Engineering
3rd	Circuit Theory & Network Discrete Mathematics Electrical Machine - I Signals & Systems	Electro-Magnetic Field Theory Behavioural Science Electrical & Electronics Measurement Systems
4th	Electrical Machine – II Power Electronics – I Power System – I Control System Engineering Introduction to Microprocessors and Microcontrollers Numerical Methods	Smart Materials and Devices Entrepreneurship and Innovation
5th	Embedded Systems Power Electronics – II Power System Reliability Power System – II Probability and Stochastic processes	Industrial Management. Machine Desgin - I
6th	Engineering Ethics & IPR. Disaster Management. Electric Drives	Power System Operation & Control Computer Aided Electrical System Design Machine Design Using Numerical Methods
7th	High Voltage Engineering Switchgear & Protection Computer Aided Power System	Mass Communication for Technology Research Paper Communication Power Plant Engineering
8th	Industrial Training Project Works Seminar Grand Viva	

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Syllabus for B.Tech in Electrical Engineering

Summary Table

Semester	Credit Course	I- Course	Audit Course	Add-on course
1st	Engineering Mathematics- I. Chemistry. Physics-I. Life Science. Engineering Drawing. Workshop Practices. Communication Skill. Engineering Mechanics Engineering Drawing I Workshop Practice I	**NIL**	NSS/ NCC Foreign Language (French/ Korean)	**NIL**
2nd	Engineering Mathematics- II. Engineering Mechanics. Programming in C Environmental Science Physics-II Digital Electronics & Logic Design History of Science & Technology Basic Elements of Mechanical Engineering Engineering Drawing II Workshop Practice II	**NIL**	Foreign Language (German/ Chinese)	**NIL**
3rd	Discrete Mathematics Electrical Machine - I Signals & Systems Electro-Magnetic Field Theory Behavioural Science Electrical & Electronics Measurements Systems	Circuit Theory and Networks		PHP
4th	Electrical Machine – II Numerical Methods Power Electronics – I Power System – I Control System Engineering Introduction to microprocessors & microcontrollers Smart Materials and Devices Entrepreneurship and Innovation	**NIL**		
5th	Embedded Systems Power Electronics – II Power System Reliability	Machine Desgin - I		**High Performance Compting**

	Power System – II Probability and Stochastic processes Industrial Management.			
6th	Engineering Ethics & IPR. Disaster Management. Electric Drives Computer Aided Electrical System Design Machine Design Using Numerical Methods	Power System Operation and Control		
7th	Mass Communication for Technology. Research Paper Communication. Power Plant Engineering High Voltage Engineering Switchgear & Protection Computer Aided Power System	**NIL**		**MATLAB Programming**
8th	Industrial Training Project Works Seminar Grand Viva	**NIL**		

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Syllabus for B.Tech in Electrical Engineering

Examination System:

Semester	Conventional	Open Book	Online
1st	Chemistry-I. Life Science. Communication Skill. NSS/ NCC Foreign Language (French/ Korean) Engineering Mechanics Engineering Drawing I Workshop Practice I	Engineering Mathematics- I. Physics-I. Basic Electrical & Electronics Engineering.	
2nd	Engineering Mathematics- II. Environmental Science Physics-II Digital Electronics & Logic Design History of Science & Technology Foreign Language (German/ Chinese) Basic Elements of Mechanical Engineering Engineering Drawing II Workshop Practice II	Engineering Mechanics. Programming in C	
3rd	Discrete Mathematics Electrical Machine - I Signals & Systems Electro-Magnetic Field Theory Behavioural Science Electrical & Electronics Measurement Systems Circuit Theory and Networks	Electro-Magnetic Field Theory	
4th	Electrical Machine – II Numerical Methods Power Electronics – I Power System – I Control System Engineering Introduction to microprocessors & microcontrollers Entrepreneurship and Innovation	Smart Materials and Devices	
5th	Embedded Systems Power Electronics – II Power System Reliability Power System – II Probability and Stochastic processes Industrial Management.	Machine Desgin - I	
6th	Engineering Ethics & IPR. Disaster Management. Electric Drives Computer Aided Electrical System Design Machine Design Using Numerical Methods		Computer Networking.
7th	Mass Communication for Technology. Research Paper Communication. High Voltage Engineering Switchgear & Protection Computer Aided Power System	Power Plant Engineering	

8th	Industrial Training Project Works Seminar Grand Viva		

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INDEX

1st Semester

Subject Code	Subject	P	T	L	Credit	Page No.
MAS 101	Engineering Mathematics I	0	1	3	4	1
CHY 101	Engineering Chemistry	2	0	2	4	3
PHY 101	Engineering Physics I	2	0	3	4	6
BIO 101	Life Science	2	0	3	4	8
ME 101	Engineering Mechanics	0	0	3	3	10
CE 101	Engineering Drawing I	3	0	0	2	12
ME 102	Workshop Practice I	3	0	0	2	14
EE 101	Basic Electrical and Electronics Engineering	3	0	3	4	16
HSS 101	Communication Skills	2	0	0	1	18
HSS 102	NSS/NCC (**Audit Course)**	2	0	0	0	-
HSS 103	Foreign Language (French/Korean) (**Audit Course)**	2	0	0	0	20
		17	1	17	28	

2nd Semester

Subject Code	Subject	P	T	L	Credit	Page No.
MAS 201	Engineering Mathematics II	0	1	3	4	21
ME 201	Basic Elements of Mechanical Engineering	0	0	3	3	23
CSE 201	Programming in C	8	0	0	4	25
CHY 201	Environmental Science	0	0	3	3	28
PHY 201	Engineering Physics II	2	0	3	4	30
ECE 201	Digital Electronics & Logic Design	2	0	3	4	33
HSS 201	Historiography of Science & Technology	0	0	3	3	36
CE 201	Basic Civil Engineering	3	0	0	2	38
ME 202	Workshop Practice II	3	0	0	2	40
HSS 202	Foreign Language (German/ Chinese) (**Audit Course)**	2	0	0	0	42
		18	1	18	29	

3rd Semester

Subject Code	Subject	P	T	L	Credit
EE – 301	Circuit Theory & Networks	2	0	3	4
*ECE – 301/ CSE - 302	Electronic Circuit & Devices Data Structure & Algorithm	2	0	3	4
PHY-301	Electromagnetic Field Theory	0	0	3	3
HSS – 301	Behavioural Science	0	0	2	2
EE - 302	Signals & Systems	0	0	3	3
EE - 303	Electrical & Electronic Measurement System	2	0	3	4
EE - 304	Electrical Machine - I	2	0	3	4
MAS - 301	Discrete Mathematics	0	1	3	4
		12	1	23	28

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4th Semester

Subject Code	Subject	P	T	L	Credit
HSS – 401	Entrepreneurship & Innovation	0	0	3	3
MAS 402	Numerical Methods	2	0	3	4
EE – 401	Electrical Machine – II	2	0	3	4
EE – 402	Power Electronics - I	2	0	3	4
EE - 403	Power System – I	2	0	3	4
EE - 404	Introduction to Microprocessors and Microcontrollers	0	0	3	3
EE – 405	Control System Engineering	2	0	3	4
*EE – 406/ ECE - 401	Smart Materials and Devices Principal of Communication Engineering	0	0	3	3
		10	0	24	29

5th Semester

Subject Code	Subject	P	T	L	Credit
HSS - 501	Industrial Management	0	0	3	3
EE – 501	Power System – II	2	0	3	4
EE – 502	Machine Design - I	2	0	3	4
EE – 503	Innovative and Creative Designing of Systems	2	0	0	1
*EE– 504/ ECE - 503	Embedded Systems Digital Signal Processing	0	0	3	3
MAS - 501	Probability and Stochastic Processes	0	0	3	3
EE – 505	Power Electronics - II	2	0	3	4
EE – 506	Power System Reliability	0	1	3	4
		8	1	21	26

6th Semester

Subject Code	Subject	P	T	L	Credit
EE - 601	Computer Aided Electrical System Design	2	0	3	4
HSS - 601	Engineering Ethics & IPR	0	0	3	3
HSS - 602	Disaster Management	0	0	2	2
EE - 602	Electrical Drives	2	0	3	4
EE - 603	Power System Operation & Control	2	0	3	4
*EE – 604/ CSE - 601	Machine Design Using Numerical methods Computer Networking	2	0	3	4
		6	0	17	21

7th Semester

Subject Code	Subject	P	T	L	Credit
HSS–701	Mass Communication for Technology	0	0	3	3
EE – 701	Computer Aided Power System Analysis	2	0	2	3
EE – 702	High Voltage Engineering	2	0	3	4
EE – 703	Power Plant Engineering	0	0	2	2
EE – 704	Switchgear & Protection	2	0	3	4
EE – 705	Utilization of Electrical power	0	0	3	3
HSS 702	Research Paper Communication	2	0	0	2
		8	0	16	21

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* N.B.: The subjects marked with * are offered as CBCS (Credit based choice system). Students have the option to choose any one of the subjects offered.

8th Semester

Subject Code	Subject	P	T	L	Credit
XXX–801	Industrial Training	2	0	0	1
XXX–802	Project Works	16	0	0	8
XXX–803	Seminar - 2	2	0	0	1
XXX- 804	Grand Viva	12	0	0	6
		32	0	0	16

List of Electives:

EE 701A: Energy Audit
EE 702A: Special Electrical Machines
EE 703A: Biomedical Instrumentation
EE 704A: Flexible AC Transmission Systems (FACTS)
EE 705A: Electrophysiology
EE 706A: Photovoltaic Device & System
EE 701B: Microprocessor Based Instrumentation
EE 702B: Power Quality Issues & Remedial Measures
EE 703B: Power Semiconductor Devices and ICs
EE 704B: Sustainable Energy Systems
EE 705B: Theory of forecasting
EE 707B: Re-engineering

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Name of the Module: Engineering Mathematics-I
Module Code: MAS 101
Semester: 1st
Credit Value: 4 [P=0, T=1, L=3]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. providing high quality education in pure and applied mathematics in order to prepare students for graduate studies or professional careers in mathematical sciences and related fields,
2. imparting theoretical knowledge and to develop computing skill to the students in the area of Science and Technology,
3. providing teaching and learning to make the students competent to their calculating ability, logical ability and decision making ability,
4. giving students theoretical knowledge of Calculus, Algebra and their practical applications in the various fields of Science and Engineering,
5. apply their knowledge in modern industry or teaching, or secure acceptance in high-quality graduate programs in Mathematics and other fields such as the field of quantitative/Mathematical finance, Mathematical computing, statistics and actuarial science.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will become more confident about their computing skill, logical skill and decision making skill,
2. students will find various applications of calculus and algebra in the practical fields science and engineering,
3. students will become more competent to analyze mathematical and statistical problems, precisely define the key terms, and draw clear and reasonable conclusions,
4. student will be able to use mathematical and statistical techniques to solve well defined problems and present their mathematical work, both in oral and written format, to various audiences (students, mathematicians, and non-mathematicians),
5. student will be able to understand, and construct correct mathematical and statistical proofs and use the library and electronic data-bases to locate information on mathematical problems,
6. student will be able to explain the importance of mathematics and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results,
7. student will be able to propose new mathematical and statistical questions and suggest possible software packages and/or computer programming to find solutions to these questions.

C. Subject Matter:

Unit I:

Matrices: Introduction to Matrices and their basic properties, Transpose of a matrix, verification of the properties oftransposes, Symmetric and Skew symmetric matrices and their properties. Determinant of a square matrix, Minors andCofactors, Laplace's method of expansion of a determinant, Product of 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, Trace of a matrix, Rank of a matrix and its determination using elementary row and column operations, Solution of simultaneous linear equations by matrix inversion method, Consistency and inconsistency of a system of homogeneous and non homogeneous linear simultaneous equations, Eigen values and Eigen vectors of a square matrix (of order 2 or 3), Eigen values, Caley-Hamilton theorem and its applications, Diagonalisation of a square matrix with real and distinct eigen values (up to 3rd order).

Unit II:

Successive Differentiation: Higher order derivatives of a function of single variable, Leibnitz's theorem (statementonly) and its application, problems of the type of recurrence relations in derivatives of different orders.

Mean Value Theorems & Expansion of Functions: Rolle's theorem(statement only) and its application, Mean Value theorems – Lagrange & Cauchy (statement only) and their application, Taylor's theorem with Lagrange's and Cauchy's form of remainders (statement only) and its application, Expansions of functions by Taylor's and Maclaurin's theorem, Maclaurin's infinite series expansion of the functions.

Unit III:

Integrals: Double and triple integrals and evaluation of area and volume. Change of order of integration.

Reduction formula: Reduction formulae both for indefinite and definite integrals.

Unit IV

Complex variables: complex numbers, De-Moivre's Theorem and its applications, Inverse circular and Hyperbolic functions, functions, continuity, Differentiability, analyticity -Cauchy Riemann equations and properties of ana1ytic functions, Cauchy's integral and Cauchy's integral formula, derivatives of analytic functions.

D. Teaching/ Learning/ Practice Pattern:

Teaching: 70%
Learning: 30%
Practice: 0%

E. Examination Pattern:

Theoretical Examination: Written

F. Books:

1. *Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern.*
2. *Babu Ram, "Engineering Mathematics", Pearson Education.*
3. *H. K. Dass "Higher Engineering Mathematics", S. Chand & Co.*
4. *B. S. Grewal , "Engineering Mathematics", S. Chand & Co.*
5. *Pulak Kundu , "A Text book on Engineering Mathematics" Vol. I, Chhaya Prakashani.*
6. *Pal &Das, "Engineering Mathematics" Vol. I, U.N. Dhar.*
7. *John Bird , "Higher Engineering Mathematics",4th Edition, 1st Indian Reprint 2006, Elsevier.*
8. *L. Rade and B. Westergren, "Mathematics Handbook: for Science and Engineering", (5th edition, Indian Edition 2009, Springer).*
9. *M. J. Strauss, G. L. Bradley and K. L. Smith , "Calculus", 3rd Edition, 1st Indian Edition 2007, Pearson Education.*
10. *S. K. Adhikari, "A text Book of Engineering Mathematics-I", Dhanpat Rai and Co. (P) Ltd.*
11. *S. S. Sastry, "Engineering Mathematics", PHI, 4th Edition, 2008.*
12. *Ravish R Singh, "Engineering Mathematics", Mc Graw Hill.*
13. *Das & Mukherjee, "Differential Calculus", U.N. Dhar & Sons Private Ltd.*
14. *Das & Mukherjee, "Integral Calculus", U.N. Dhar & Sons Private Ltd.*

G. Magazines:

1. *Current Science (Indian Academy of Science).*
2. *The Mathematics Student (Math Student) (Indian Mathematical Society).*
3. *Mathematical Spectrum (The University of Sheffield).*
4. *Mathematics Magazine (Mathematical Association of America).*
5. *+Plus magazine (University of Cambridge).*
6. *Mathematics Today, London Metropolitan University.*

H. Journals:

1. *Journal of Engineering Mathematics, Springer.*
2. *Journal of Computational and Applied Mathematics, London Metropolitan University.*
3. *The Journal of Indian academy of Sciences.*
4. *Bulletin of Pure and Applied Sciences.*

Name of the Module: Engineering Chemistry
Module Code: CHY 101
Semester: 1st
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. imparting theoretical and practical knowledge to the students in the area of chemistry.
2. providing teaching and learning to make students acquainting with advanced science and technology in chemistry.
3. injecting the future scope and the research direction in the discipline of chemistry.
4. making students competent to the research and development in advanced science and technology in chemistry.

B. Learning outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to become chemists, scientist and chemical engineers.
2. students will be skilled both theoretically and practically to do operation, control and maintenance works in chemistry and chemical engineering.
3. students will be substantially prepared to take up prospective research assignments.

C. Subject matter:

Unit I:

Chemical Thermodynamics: Concept of Thermodynamic System: diathermal wall, adiabatic wall, isolated system, closed system, open system, extensive property, intensive propertyIntroduction to first law of thermodynamics: different statements, mathematical form; internal energy: physical significance, mathematical expression (ideal and real gas), Enthalpy: physical significance, mathematical expression. Cp and CV definition and relation; adiabatic changes; reversible and irreversible processes; application of first law of thermodynamics to chemical processes: exothermic, endothermic processes, law of Lovoisier and Laplace, Hess's law of constant heat summation, Kirchoff's law. Second law thermodynamics; Joule Thomson and throttling processes; inversion temperature; evaluation of entropy: characteristics and expression, entropy change in irreversible process, entropy change for irreversible isothermal expression of an ideal gas, entropy change of a mixture of gases.

Work function and free energy: physical significance, mathematical expression for ideal and real gases obeying Vander Waals' equation, Gibbs Helmholtz equation.

Condition of spontaneity and equilibrium

UNIT II:

Electrochemistry Conductance: Conductance of electrolytic solutions, specific conductance, equivalent conductance, molar conductance and ion conductance, effect of temperature and concentration. 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 AgNO3.

Electrochemical cell: Cell EMF and its Thermodynamic significance, single electrode potentials and its applications; hydrogen half cell, quinhydrone half cell and calomel half cell. Storage cell, fuel cell. Application of EMF measurement. Reaction Dynamics: Reaction laws: rate and order; molecularity; zero, first and second order kinetics. Arrhenius equation. Mechanism and theories of reaction rates (Transition state theory, Collision theory).Catalysis: Homogeneous catalysis and heterogeneous catalysis.

UNIT III:

Structure and reactivity of Organic molecule: Electronegativity, electron affinity, hybridization, Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion and free radicals. Brief study of substitution, eliminations and addition reactions. **Instrumental Methods of Analysis:**

Introduction to instrumental methods such as IR, UV, VIS, NMR and Mass spectrometry.

UNIT IV:

Polymerization: Concepts, classifications and industrial applications. Polymerization processes(addition and condensation polymerization), degree of polymerization, Copolymerization,stereo-regularity of polymer, crystallinity and amorphicity of polymer. Preparation, structure and use of some common polymers: plastic (PE, PP, PVC, bakelite), rubber (natural rubber, SBR, NBR), fibre(nylon 6.6, polyester). Conducting and semi-conducting polymers.

Industrial Chemistry: Solid, liquid and gases fuels; constituents of coal, carbonization of coal. Coal analysis: Proximate and ultimate analysis. Classification of coal, petroleum (LPG, CNG), gasoline, octane number, aviation fuel, diesel, cetane number. Natural gas, water gas, Coal gas, bio gas. Bio-diesel.

D. List of practical's: (Minimum eight experiments should be conducted by students)

1. Acid –base titration :(Estimation of commercial caustic soda)
2. Red-ox titration: (Estimation of iron using permanganometry)
3. Complexometric titration: (Estimation of hardness of water using EDTA titration)
4. Chemical Kinetics :(Determination of relative rates of reaction of iodide with hydrogen peroxide at room temperature (clock reaction).
5. Heterogeneous equilibrium (Determination of partition coefficient of acetic acid between n-butanol and water)
6. Viscosity of solutions (determination of percentage composition of sugar solution from viscosity)
7. Conductometric titration for
   (a)Determination of the strength of a given HCl solution by titration against a standard NaOH solution.
   (b) Analysis of a mixture of strong and weak acid by strong base.
8. Preparation of a homo-polymer by free radical initiated chain polymerization and determination of its molecular weight by viscosity average molecular weight method.
9. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH.

E. Teaching/ Learning/ Practice pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

F. Examination pattern:

1. Theoretical Examination: Written.
2. Practical Examination: Conduct Practical Examination and viva-voce.

G. Books:

1. *Rakshit P. C., "Physical Chemistry" Sarat Book Distributor.*
2. *Dutta R. L. ,"Inorganic Chemistry" The New Book Stall.*
3. *Levine " Physical Chemistry" McGraw-Hill Education.*
4. *Finar I. L., "Organic Chemistry (vol. 1 & 2)." Pearson.*
5. *lasston Samuel, " Text Book of Physical Chemistry" New York, D. Van Nostrand company.*
6. *Lee J. D., "Concise Inorganic Chemistry" Wiley India.*
7. *Sykes,P., "Guidebook to Mechanism in Org.Chems", Orient Longman.*
8. *Chakraborty D. K. , "Solid State Chemistry", New Age International.*
9. *Gupta M.C. , "Atomic & Molecular Spectroscopy", New Age.*
10. *Gowarikar V.R. , "Polymer Science", New Age.*
11. *Mishra G.S. , "Introductory Polymer Chemistry", New Age.*
12. *Nasipuri D. ,"Stereochemistry of Organic Compounds", New Age.*
13. *Kalsi P.S, "Spectroscopy of Organic Compounds", New Age.*
14. *Kalsi P.S. ,"Organic Reactions & their Mechanism", New Age.*
15. *Maity and Maity ," Engingeering Chemistry", U & N Dhar Publisher.*
16. *Ray, Das, Biswas, "Engingeering Chemistry", New Central Book Agency.*

H. Magazine:

1. *Chemical science.*
2. *Chemistry Today.*

3. *Chemistry For You.*

I. Journals:

1. *Journal of Organic Chemistry, ACS*
2. *Journal of Physical Chemistry, ACS*
3. *Material Science & Engineering B, Elsevier*

Name of the Module: Engineering Physics - I
Module Code: PHY 101
Semester: 1st
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. imparting theoretical & practical knowledge to the students in the area of engineering physics,
2. providing teaching and learning to make students acquainting with modern state-of-art of engineering,
3. injecting the future scope and the research direction in the field of physics with specific specialization,
4. making students competent to design & development of engineering physics.

B. Learning outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to become engineers,
2. students will be substantially prepared to take up prospective research assignments.

C. Subject matter:

Unit I:

Scalar and vector: Scalar and vector, dot and cross product, Scalar and vector fields, concept of Gradient, Divergence and Curl.

General Properties of Matter: Elasticity, Viscosity, Surface tension.

UNIT II:

Acoustics: Simple Harmonic Motion, Damped Vibration, Forced Vibration

Thermal Physics: Kinetic Theory of Gas, conductivity & Radiation

UNIT III:

Physical Optics: Introduction to Interference, Diffraction, Polarization

Elementary Solid State Physics: Elementary ideas of crystal structure : lattice, basis, UNIT cell, fundamental types of lattices-Bravis lattice, simple cubic, f.c.c and b.c.c lattices, Miller indices and miller planes, Co-ordination number and atomic packing factor, X-rays: Origin of characteristics and continuous X-ray, Bragg's law (no derivation), determination of lattice constant

UNIT IV:

Fundamental of Quantum Physics: Wave particle duality, Compton effect, Photo electric effect, Heisenberg's uncertainty relation, concept of wave packet.

D. List of practical's: (Minimum five experiments should be conducted by students)

1. Determination of thermal conductivity of a good conductor by searle's method.
2. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
3. Determination the dispersive power of the material of a given prism.
4. Use of carry Foster's bridge to determine unknown resistance.
5. Determination of Young Modulus by flexure method and calculation of bending moment and shear force at a point on the beam.
6. Determination of coefficient of Viscosity by Poiseulle's capillary flow method.
7. Determination of wavelength of light by Newton's ring method.

E. Teaching/ Learning/ Practice pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

F. Examination pattern:

1. Theoretical Examination: Written.
2. Practical Examination: Conduct Practical Examination and viva-voce.

G. Books:

A. *Murrat R. Spiegel, Seymour Lipschutz & Dennis Spellman, " Vector Analysis" Second Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2009.*

B. *Takwale and Puranic, "Classical Mechanics" Tata McGraw-Hill Publishing*

C. *Sengupta & Chatterjeee, "A Treatise on General Properties of Matter " New Central Book Agency (P) Limited*

D. *D. Chattopadhyay and P. C. Rakshit, " Vibrations, Waves and Acoustics" BOOKS and Allied (P) Ltd.*

E. *N. K. Bajaj, "The physics of Waves and Oscillations" Tata McGraw Hill Education Private Limited, New Delhi.*

F. *A. Ghatak, "Optics" 4th Edition, Tata McGraw Hill Education Private Limited, New Delhi. .*

G. *S. O. Pillai, "Solid State Physics", Wiley Eastern Ltd.*

H. *Kittel, "Solid State Physics" 7th edition, Wiley India.*

I. *Richard P. Feynman, Robert B. Leighton and Matthew Sands, " The FEYNMAN Lectures on Physics" Vol. I to Vol. IV, Pearson*

J. *D. Chattopadhyay and P. C. Rakshit, " An Advanced Course in Practical Physics" New Central Book Agency (P) Ltd.*

H. Magazine:

1. *Physics Reports*
2. *Quarterly Reviews of Biophysics*
3. *Resonance*
4. *American Teacher*
5. *Scientific Physics*
6. *Physics Today*
7. *Physics For You*

I. Journals:

1. *Nature*
2. *Physical Review Letter*
3. *Physical Review A & B*
4. *Applied Physics Letters (APL)*
5. *Proceedings of the National Academy of Sciences*
6. *Chemical Physics Letters*
7. *Journal of Physics: (Including A, B, C, D, E, F & G) 8. Journal of Scientific & Industrial Research*
8. *Indian Journal of Engineering & Material Sciences*
9. *Indian Journal of Radio and Space Physics*

Name of the Module: Life Science

Module Code: BIO 101
Semester: 1st
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting knowledge on the origin of Earth and life forms on Earth, appreciating importance of biological diversity and understanding biomolecules being the main component of life,
2. understanding "Cell" – the basic UNIT in different life forms, and structure and function of different tissue systems in plants and animals,
3. imparting knowledge on water relations, nutrient uptake and assimilation, and metabolism in plants,
4. providing knowledge on Bioenergetics of plant and animal cells, different organelles involved in electron transport systems, nervous, digestive and immune systems in animals.

B. Learning Outcomes:

Upon completion of the subjects:

1. students will understand the characteristics of living organisms; appreciate the importance of diversity of life and their interaction with the environment,
2. students will be able to explain the interrelationship between biomolecules and the living system, and influences of biomolecules upon the structure and function of intracellular components,
3. students will have a broad knowledge on bioenergetics of plant and animal cells; and a brief on important biological systems of animal.

C. Subject Matter:

Unit I:

Origin of Life: History of earth, theories of origin of life and nature of the earliest organisms.
Varieties of life: Classification, Five kingdoms, viruses (TMV, HIV, Bacteriophage), Prokaryote (Bacteria-cell structure, nutrition, reproduction), Protista, Fungi, Plantae and Animalia.
Chemicals of life: (Biomolecules)- Carbohydrates lipids, amino acids, proteins, nucleic acids and identification of biomolecules in tissues.

Unit II:

Cell: Cell concept, structure of prokaryotic and eukaryotic cells, plant cells and animal cells, cell membranes, cell organelles and their function, Structure and use of compound microscope.
Histology: Maritimes (apical, intercalary, lateral) and their function; simple tissue (parenchyma, collenchymas, sclerenchyma); Complex tissue (xylem and phloem); Tissue systems (epidermal, ground, vascular); primary body and growth (root, stem, leaf); Secondary growth (root, stem). Animal tissues (Epithelial, connective, muscle and nervous tissues) and their functions in the body.

Unit III:

Transport: Plant water relationships, properties of water, diffusion, osmosis, imbibition, uptake of water by roots and theories of transport of water through xylem (ascent of water in xylem, cohesion-tension theory), apoplast and symplast theory; Transpiration-structure of leaf, opening and closing mechanisms of stomata, factors affecting transpiration and significance of transpiration.
Nutrition: Mineral Nutrition in plants, Heterotrophic nutrition in plants; Photosynthesis (Autotrophic-forms of nutrition), Chloroplast structure, two pigment systems, photosynthetic UNIT, light absorption by chlorophyll and transfer of energy, phosphorylation and electron transport system, Calvin-Benson Cycle (C3), Hatch Slack Pathway (C4), Crassulacan Acid Metabolism (CAM), factors affecting photosynthesis.

Unit IV:

Energy Utilization: (Respiration) - Structure of mitochondria, cellular respiration, relationship of carbohydrate metabolism to other compounds, Glycolysis, fermentation, formation of acetyl co-A, Kreb cycle, Electron Transport System and Oxidative Phosphorylation, ATP, factors affecting respiration;

Elementary canal in humans, nervous and hormonal control of digestive systems, fate of absorbed food materials; Nutrition in humans, Reference values; General characteristics of blood vascular system, development of blood systems in animals, Composition of blood, circulation in blood vessels, formation of tissue fluids, the heart, functions of mammalian blood, the immune system.

D. Teaching/ Learning/ Practice Pattern:

Teaching: 70%
Learning: 30%
Practice: 0%

E. Examination Pattern:

Theoretical Examination: Written

F. Books:

1. *J.N. Mitra, D. Mitra and S.K. Chowdhuri, "Studies in Botany" Volume I & II, Moulik Library Publisher, Kolkata,*
2. *M.J. Pelczar, E.C.S. Chan and N.R. Krieg, "Microbiology", Tata McGraw Hill Education, New Delhi, 1993.*
3. *B.P. Pandey, "Plant Anatomy", S. Chand & Company Ltd., New Delhi, 1997.*
4. *H.S. Srivastava, "Plant Physiology", Rastogi Publishers, Meerut, 1998.*
5. *B.P. Pandey, "College Botany" Volume I & II, S. Chand Publisher, New Delhi, 2012.*
6. *N.A. Campbell, J.B. Reece, "Biology" Person Education, Inc& Dorling Kinderley Publishing, Inc.*

G. Magazines:

1. *National Geographic Chennel, http://science.nationalgeographic.co.in/science/earth*
2. *Wikipedia, The Free Encyclopedia, http://www.bbc.co.uk/science/earth*
3. *Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/HIV*

H. Journals:

1. *Journal of Biology, BioMed Central Ltd, London, England.*
2. *Annals of Botany, Oxford JOURNALS, USA.*
3. *Plant and Cell Physiology, Oxford JOURNALS, USA.*

Name of the Module: Engineering Drawing-I

Module Code: CE 101
SEMESTER: 1st
Credit Value: 2 [P=3, T=0, L=0]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. increase ability to understand engineering drawing,
2. learn to sketch and take field dimensions,
3. learn to take data and transform it into graphic drawings,
4. learn basic auto cad skills,
5. learn basic engineering drawing formats,
6. prepare the student for future engineering positions.

B. Learning Outcome:

Upon completion of the subject**:**

1. student's ability to hand letter will improve,
2. student's ability to perform basic sketching techniques will improve,
3. students will be able to draw orthographic projections and sections,
4. student's ability to use architectural and engineering scales will increase,
5. students ability to produce engineered drawings will improve,
6. student's ability to convert sketches to engineered drawings will increase,
7. students will become familiar with office practice and standards,
8. students will become familiar with auto cad two dimensional drawings,
9. students will develop good communication skills and team work.

C. Subject Matter:

Unit I:

Indian Standards: Line symbols and line groups; Sheet Layout of Rules of printing; Preferred scales.

Unit II:

Theory of Orthographic Projection.

Unit III:

Technical sketching; Multi-planar representation: First and third angle system of projection.

Unit IV:

Glass box concept: Sketching of orthographic views and line.

D. List of Practical:

1. Technical writing of various type of letters.
2. Technical sketching of Scales- Plain, Diagonal, Vanier, Comparative and chord.
3. Technical sketching of Projection of points.
4. Technical sketching of Projection of lines.
5. Technical sketching of Projection of plains.
6. Technical sketching of Projection of solids.
7. Technical sketching of orthographic Projection

E. Teaching/ Learning/ Practice Pattern:

Teaching: 70%
Learning: 30%
Practice: 0%

F. Examination Pattern:

1. Practical Drawing.
2. Assignment.

G. Books:

1. N. D. Bhatt, "Machine Drawing". Charotar Publishing House Pvt. Ltd.

2. V. Laxminarayanan& M. L. Mathur, "A Text Book of Machine Drawing", Jain Brothers, New Delhi

3. Jolhe "Machine Drawing", Charotar Publishing House Pvt. Ltd.

4. Venugopal K and Prabhu Raja V "Engineering Graphics", New Age International Pvt. Ltd.

5. John, K C "Engineering Graphics", PHI Learning Pvt. Ltd.

6. Kulkarni, D. M., Rastogi, A. P., Sarkar, A. K. "Engineering Graphics with Autocad", PHI Learning Pvt. Ltd.

7. Natarajan, K. V "Engineering Graphics", Dhanalakshmi Publisher

8. French and Vierk "Fundamentals of Engineering Drawing", McGraw Hill

9. Venugopal K and Prabhu Raja V "Engineering Graphics", New Age International Pvt. Ltd.

H. Magazine

1. *Machine Design.*
2. *Design to Part Magazine.*

I. Journals

1. *International Journal of Design Engineering.*

Name of the Module: Engineering Mechanics

Module Code: ME 101
SEMESTER: 1st
Credit Value: 3 [P=0, L=3, T=0]
Module Leader:

A. Objectives:

The course is designed to meet with the following objectives:

1. Ability to utilise scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Student gets a basic idea of Centre of gravity, moment of inertia, mass moment of inertia, friction.

B. Learning Outcome:

Upon completion of the subject, students should have the knowledge of:

1. Different type of forces and how to resolve forces.
2. Centre of gravity of different size, shape, and solid.
3. Centre of gravity, moment of inertia, mass moment of inertia, friction.

C. Subject Matter:

Unit I:

Forces and Moments: Force, Moment and Couple, Resultant of forces, Forces in space Equilibrium, FBD, General equations of equilibrium, Analysis of forces in perfect frames, Brief introduction to vector approach.

Unit II:

Friction: Introduction to dry friction, laws of friction, friction of simple machines, inclined planes, Screw jacks.

Unit III:

Centre of gravity and moment of inertia: Centre of gravity of axes, volume and composite bodies, Area moment of inertia and mass moment of inertia for plane figures and bodies.

Unit IV:

Dynamics: Kinematics and Kinetics, Rectilinear motion of particles, determination of position velocity and acceleration under uniform rectilinear motion (uniform and non-uniform accelerated rectilinear motion), Relative motion, construction of x-t, v-t and a-t graphs (simple problems), Projectile motion, Normal and Tangential components, Radial and Transverse components, simple problems, Equation of motion, D. Alembert's principle.

D. List of Practical's: No Practical's

E. Teaching/ Learning/ Practice pattern:

Teaching: 60%
Learning: 40%
Practice: 0%

F. Examination pattern:

1. Theoretical Examination.

G. Books:

1. Mariam & Kraige, "Engineering Mechanics (Vol-II) Dynamics", Wiley.
2. Mariam & Kraige, "Engineering Mechanics, Vol-I (Statics)", Wiley.

3. Timoshenko," Engineering Mechanics", MGH.
4. Nelson, "Engineering Mechanics", TMGH.
5. Shames and Rao, "Engineering Mechanics", Pearson.
6. S. Chakraborty, "Engineering Mechanics", Everest Publishing House.
7. Beer and Johnson, "Vector Mechanics for Engineers", TMGH.

H. Magazines:

1. Popular Mechanics Everyday.
2. Engineering Magazine.

I. Journals:

1. International Journal of Applied Mechanics and Engineering.
2. Journal of Applied Mechanics, ASME.
3. Journal of Engineering Mechanics, ASCE.

Name of the Module: Workshop Practice-I

Module Code: ME 102
SEMESTER: 1st
Credit Value: 2 [P=3, T=0, L=0]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. to acquire skills in basic engineering practice,
2. to identify the hand tools and instruments,
3. to acquire measuring skills,
4. to acquire practical skills in the trades,
5. to acquire practical skills in welding, carpentry, fitting.

B. Learning Outcome:

Upon completion of the subject:

1. should have knowledge of workshop safety.
2. should have knowledge of handling workshop tools, machines.
3. should have knowledge of different welding types.
4. should have knowledge of different carpentry joints
5. should have knowledge of different tools working principle

C. Subject Matter:

Unit I:

Carpentry (Wood Working): Timber, Seasoning and Preservation, Plywood and Ply boards, Carpentry Tools, Engineering applications. Different Joints

Unit II:

Metal Joining: Definitions of welding, brazing and soldering processes, and their applications. Oxy acetylene gas welding process, equipment and techniques. Types of flames and their applications. Manual metal arc welding technique and equipment.AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld joint. Common welding defects such as cracks, slag inclusion and porosity.

Unit III:

Bench work and Fitting

Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses.

Unit IV:

Laying out (bench work): Sawing and Finishing by Filing.

D. List of Practical:

1. T-Lap joints and Bridle joint (Carpentry Shop).
2. Gas Welding practice on mild steel flat/sheet upto 3 mm thick.
3. Lap joint by Gas Welding (upto 3mm thick).
4. Manual Metal Arc Welding practice (upto 5mm thick).
5. Pattern Making. (Carpentry Shop)
6. Laying out (bench work); Sawing and Finishing by Filing.

E. Teaching/Learning/Practice Pattern:

Teaching: 20%
Learning: 20 %
Practice: 60%

F. Examination Pattern:

1. Job making.
2. Viva-voce.

G. Books:

1. *M.L. Begeman and B.H. Amstead, "Manufacturing Process" John Wiley, 1968.*
1. *W.A.J. Chapman and E.Arnold, "Workshop Technology" Vol. 1, 2 & 3, CRC press Prentice Hall*
2. *B.S. Rghuwanshi, "Workshop Technology" Vol. 1 & 2 – Dhanpat Rai and Sons.*
3. *Hazra and choudhary "Workshop Technology" Vol. 1, 2, Media Promoters*
4. *Virender Narula "Workshop Technology", S.K.Kataria & Sons*

H. Magazines

1. *International Metal Working News.*
2. *Industrial Distribution*

I. Journals

1. *International Journal of Machine Tools and Manufacture*
2. *Journal of Manufacturing Science and Engineering, Transactions of the ASME*
3. *Journal of Manufacturing Technology and Research*

Name of the Module: Basic Electrical & Electronics Engineering

Module Code: EE 101
Semester: 1st
Credit Value: 4 [P=2, T=0, L=3]

A. Objectives:

The course is designed to meet with the objectives of:

1. to make the students familiar with the course and its importance,
2. introduction to basic electrical & electronics engineering,
3. basic knowledge of dc circuits, electromagnetism, ac fundamental,
4. introduction to dc, ac single and three phase machine, their construction and working principles,
5. introduction to measurement of electrical quantities,
6. making familiar with p-n junction,
7. briefing to semiconductor devices and their applications.

B. Learning outcomes:

Students successfully completing this module will be able to:

1. students will develop interest in learning the subject and be adequately trained to solve network problems,
2. students will be skilled both theoretically and practically to utilize conventional circuit solving procedures,
3. students will be substantially prepared to take up prospective design assignments.

C. Subject matter:

Unit I:

DC circuits: Definition of electric circuit, network, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, Kirchhoff's law, Principle of superposition. Source equivalence and conversion, Thevenin's theorem, Norton Theorem, nodal analysis, mesh analysis, star-delta conversion. Maximum power transfer theorem with proof.

Electromagnetism: Biot-savart law, Ampere's circuital law, field calculation using Biot-savart &ampere's circuital law. Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faraday's law, selfand mutual inductance. Energy stored in a magnetic field, B-H curve, Hysteretic and Eddy current losses, lifting power of Electromagnet.

Unit II:

AC fundamental: Production of alternating voltage, waveforms, average and RMS values, peak factor, form factor, phase and phase difference, phasor representation of alternating quantities, phasor diagram, behaviour of AC series, parallel and series parallel circuits, Power factor, Power in AC circuit, Effect of frequency variation in RLC series and parallel circuits, Resonance in RLC series and parallel circuit, Q factor, bandwidth of resonant circuit.

Unit III:

Transformers: Construction, Types, emf equation, voltage, current, impedence and turns ratio; auto-transformer. DC machines (motor and generator)–Construction, types, emf equation, equivalent circuit, starting, speed control, braking, applications. Single phase motors, types; need of rotating field, starting, running, speed control and applications.

Unit IV:

P-N Junction: Energy band diagram, Formation of P-N junction, built-in-potential forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics, junction capacitance and varactor diode. Simple diode circuits, load line, linear piecewise model; rectifiers: half wave, full wave, its PIV, DC voltage and current, ripple factor, efficiency, Clipper & Clamper Circuits.

Introduction to 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 mode, early effect. Introduction to Field Effect Transistor: Structure and characteristics of JFET and MOSFET, depletion and enhancement type, CS, CG, CD configurations.

Feedback Amplifiers and Operational Amplifiers.

D. List of practicals: (Minimum eight experiments should be conducted by students)

1. To construct a series-parallel circuits and verify:
   Ohms law, Kirchhoff's laws
   Verify Thevenin's theorem.
   Verify Norton's theorem.
   Verify Maximum Power Transfer theorem.
2. Construct an R-L-C circuit and verify
   Voltage across R, L and C
   Verify the phasor sum of the voltages across the combination of R-L-C.
3. Measurement of power in the circuit made in 2 above and verify:
   The power consumed by Resistance, Inductance and Capacitance and the total power consumed by the circuit.
4. How does the power factor varies in the circuit of 2 above if Resistance, Inductance and Capacitance are varied.
5. Study of VI Characteristics of Silicon Diode.
6. Study of VI Characteristics of Zener Diode.
7. Design and Analysis of a Half wave Rectifier using Diode.
8. Design and Analysis of a center-tap Full wave Rectifier using Diodes
9. Design and Analysis of a Bridge Rectifier Circuit.
10. Design and Analysis of a Clipping Circuit with one voltage source. (Different possible configurations)
11. Design and Analysis of a Clipping Circuit with two voltage source. (Different possible configurations)
12. Design and Analysis of a Clamper Circuit.
13. Analysis of the characteristics of BJT (CE and CB mode)
14. Design and Analysis of fixed bias circuit using NPN transistor (DC)
15. Design and Analysis of emitter bias circuit using NPN transistor (DC)
16. Determination of the characteristics of JFET.
17. Determination of the characteristics of MOSFET.
18. Verification of truth tables of logic gates.

E. Teaching/ Learning/ Practice pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

F. Examination pattern:

1. Theoretical Examination: Written.
2. Practical Examination: Conduct Practical Examination and viva-voce.

G. Books:

1. *Theraja, "Electrical technology, Vol 1 & 2", Nirja Construction & Development Co. (P) Ltd.*
2. *Sen, P.C. "Principles of Electrical Machines and Power Electronics" John wiley and sons.*
3. *V.K.Mehta, "Basic Electrical Engineering" S.Chand and Co. Publication.*
4. *Guru and Hiziroglu "Electric Machinery and Transformers", Saunders College Pub. NY, 1990*
5. *Malvino: "Electronic Principle" Tata McGraw-Hill Publishing Co.Ltd.*
6. *Millman & Halkias: "Integrated Electronics" Tata McGraw-Hill Publishing Co.Ltd.*
7. *Boylestead and Nashelsky, Electronic Devices and Circuits Theory, 9/e, PHI, 2006.*
8. *R.P.Jain,ModernDigitalElectronics,3/e,TMH,2000.*

H. Magazines:

1. *IEEE Industrial Electronics*
2. *2. Electrical Line, Canada.*

I. Journals:

1. *Electrical Engineering, Springer.*

Name of the Module: Communication Skill

Module Code: HSS 101
Semester: 1st
Credit Value: 1 [P=2, T=0, L=0]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. to increase the students ability to improve and utilize the skills necessary to be competent interpersonal communicator,
2. to increase the student's understands of his or her own communication behaviour,
3. to increase the students understands of others communication behaviours,
4. to improve the students communication skills of both social professional contexts,
5. to improve the students ability to demonstrate effective complete resolution skills.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. the students will be able to develop their communication skills on the specific subject.
2. after learning communication skills they will be able to direct effectively in their world place.

C. Subject Matter:

Unit I:

General Principles of Communication and Oral Communication: The Process of Communication, Principles of Communication (communication barriers, levels of Communication, Communication network, verbal, non-verbal) and Professional Communication. The Speech Mechanism, IPA symbols (vowel and consonant sounds), minimal pairs, word transcription, stress and intonation , active listening, types of listening, traits of a good listener, active versus passive listening,

Unit II:

Constituents of Effective Writing and Vocabulary: The sentence and its parts, articles, the verb phrase, tense and aspect, the active and passive, the adjective, interrogative and negative sentences, concord, preposition. Paragraph development, summary writing and reading comprehension. Word formation processes: affixation, compounding, converting, use of words in different parts of speech, idioms and phrases.

Unit III:

Business Correspondence and Communication Strategies: Characteristics of Business Letters, Drafting: Bio-data/Resume/Curriculum vitae (theory). Report Writing: Structure, Types of Reports (theory). Presentation Skills, public speaking and group discussion (theory) and Soft Skills (theory).

D. List of Practical:

1. Issue Writing
2. Writing Resumes and Applications
3. Writing Memos
4. Reading Comprehension
5. Vocabulary
6. Presentation Skills
7. Group Discussion
8. Extempore
9. Debates

E. Teaching/ Learning/ Practice Pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

F. Examination Pattern:

1. Theoretical Examination

G. Books:

1. *Nira Konar, "English Language Laboratory", Prentice Hall India*
2. *Jones, Daniel, Cambridge English Pronouncing Dictionary with CD, New Delhi, 2009.*
3. *Roach, Peter, English Phonetics and Phonology with CD, CUP, India, 1983.*
4. *Cambridge Learners Dictionary with CD, CUP, New Delhi, 2009.*
5. *Rajeevan, Dutt, Sasikumar, A course in Listening and Speaking I & II with CD, CUP, New Delhi, 2007.*
6. *Rajeevan and Dutt, Basic Communication Skills, CUP, New Delhi, 2007.*
7. *Software: Orell Digital Language Lab Software.*
8. *R.C. Sharma and Krishna Mohan Business Correspondence and Report Writing 10. Meenakshi*
9. *Raman and Sangeeta Sharma Technical Communication, Oxford.*
10. *Krishna Mohan and Meera Bannerji ,Development Communication Skills*

H. Magazines:

1. *Communication Skill Magazine*
2. *Magazine for Communication*
3. *Communication Studies*

I. Journals:

1. *Developing Effective Communication Skills.*
2. *Cooperative Communication Skills.*
3. *Improving Communication Skills.*
4. *Key Communication Skills.*
5. *Journal on Communication.*

Name of the Module: Foreign Language (French) (Audit)

Module Code: HSS 103
Semester: 1st
Credit Value: 0[P=2, T=0, L=0]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. the French language course accords to a method created for Indian students who are complete beginners in French and who wish to acquire verbal communication skills in current scenario.

B. Learning outcome:

Students successfully completing this module will be able to:

1. develop four skills in french i.e. reading, writing, speaking, comprehension.

C. Subject matter:

Unit-I:

Articles, Gender and Number of Nouns and Adjectives. Personal and Tonique Pronouns, Demonstrative and Possessive Adjectives, Preposition and Adverbs.

Unit-II:

Pronominal Verbs Conjugation of Verbs of all the Groups in present Tense and Introduction to past and Future tense ,Interrogation, Negation and Imperatives.

Unit-III:

Name of days, seasons. Months, colours, garments body parts and numbers. Computer, Commerce & Marketing related Vocabulary &Terminology, Phonetics and Pronunciation.

D. List of Practical:

1. Issue Writing
2. Writing Resumes and Applications
3. Writing Memos
4. Reading Comprehension
5. Vocabulary
6. Presentation Skills
7. Group Discussion
8. Extempore
9. Debates

E. Teaching/ Learning/ Practice Pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

F. Examination Pattern:

1. Theoretical Examination

G. Books:

1. *Suggested book-Ailes Volume-I*

Name of the Module: Engineering Mathematics-II
Module Code: MAS 201
Semester: 2nd

Credit Value: 4 [P=0, T=1, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting theoretical knowledge to the students about three and more dimensional objects in space and to improve their capability of visualising of objects in space,
2. making student competent enough to construct a differential equation/ mathematical modelling for every real life situation with its solution,
3. giving students theoretical knowledge of vectors with the flavour of calculus,
4. introduce the concepts of laplace and fourier transforms and its application to the solution of differential equations (ode & pde) to the students.

B. Learning Outcomes:

Upon completion of the subject:

1. students will have strong visualising capability in their mind about any object,
2. students are so trained that they will recognize various real life situation/ problem and able to solve them by constructing a differential equation/ mathematical model,
3. students will be able to find the laplace and fourier representation as well as transforms of functions of one variable.

C. Subject Matter:

Unit I:

Coordinate Geometry Of Three Dimensions: Equation of a sphere, plane section of a sphere, tangent plane, orthogonality of spheres, definition and equation of right circular cone and right circular cylinder.

Unit II:

Vector Calculus: Differentiation and integration of vector functions, scalar and vector fields, Gradient, Directional derivative, Divergence, Curl. Line integral, Surface integral and Volume integral, Green's, Gauss' and Stokes' theorems (without proofs) and their simple applications.

Unit III:

Ordinary Differential Equations: Formulation of Differential equations, Linear Differential Equations and reducible to linear form, Exact Equations, Reducible to exact form, Linear differential equations with constant coefficients, Second order ordinary differential equations with variable coefficients, Homogeneous form, Change of dependent variable, Change of independent variable, Normal form, Variation of Parameters, Solution in series of second order LDE with variable co-efficient (C.F. only), Bessel's and Legendre differential equations with their series solutions, Orthogonal properties, recurrence relations and generating function of Bessel functions and Legendre polynomials.

Partial Differential Equation: Linear and non-linear Partial Differential Equation of order one, Linear Partial Differential Equation with constant coefficient, Partial Differential Equation of order two with variable coefficients.

Unit IV:

Basic Transform: Laplace & Fourier.

D. Teaching/ Learning/ Practice Pattern:

Teaching: 70%
Learning: 30%
Practice: 0%

E. Examination Pattern:

1. Theoretical Examination and open book examination.

F. Books:

1. *Shanti Narayan, "Analytic Solid Geometry", S. Chand.*
2. *M. D. Raisinghania, "Vector Analysis", S. Chand.*

3. *R. K. Jain& S R. K Iyengar, "Advanced Engineering Mathematics", Narosa.*
4. *M. D. Raisinghania, "Ordinary & Partial Differential equations", S. Chand.*
5. *M. D. Raisinghania, "Advanced Differential equations", S. Chand.*
6. *H. K. Dass, "Higher Engineering Mathematics", S. Chand & Co.*
7. *B. S. Grewal , "Engineering Mathematics", S. Chand & Co.*
8. *Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern.*
9. *S. L. Ross, "Differential equations", Willey.*
10. *Pal & Das , "Engineering Mathematics", Vol. I, U. N. Dhar.*
11. *J. N. Sharma, A. R. Vasishtha, "Vector Calculus", Krinhna Prakashan Mandir, Meerut.*
12. *P. P. Gupta, G. S. Malik, "Vector Calculus", Kedarnath Ramnath, Meerut.*
13. *Brahma Nand, B. S. Tyagi, B. D. Sharma, "Co-ordinate Solid Geometry", Kedarnath Ramnath, Meerut, Delhi.*
14. *A. R. Vasishtha, D. C. Agarwal, "Analytical Geometry of Three Dimensions", KrinhnaPrakashan Media (P) Ltd, Meerut.*

G. Magazines:

1. *Current Science (Indian Academy of Science).*
2. *The Mathematics Student (Math Student) (Indian Mathematical Society).*
3. *Mathematical Spectrum(The University of Sheffield).*
4. *Mathematics Magazine (Mathematical Association of America).*
5. *+Plus magazine (University of Cambridge).*
6. *Ganithavahini (Ramanujan Mathematical Society).*
7. *Mathematics Today, London Metropolitan University.*

H. Journals:

1. *Journal of Engineering Mathematics, Springer.*
2. *Journal of Computational and Applied Mathematics, London Metropolitan University.*
3. *The Journal of Indian academy of Sciences.*
4. *Bulletin of Pure and Applied Sciences.*

Name of the Module: Basic Elements of Mechanical Engineering
Module Code: ME 201
SEMESTER: 2nd
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. ability to utilise scalar and vector analytical techniques for analysing forces in statically determinate structures,
2. ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems,
3. student gets a basic idea of engineering mechanics, fluid mechanics, strength of material and thermodynamics.

B. Learning Outcome:

Upon completion of the subject:

1. should have knowledge of different type of force resolving,
2. should have knowledge of centre of gravity of different size, shape, and solid,
3. should have knowledge of basic idea of engineering mechanics, fluid mechanics, strength of material and thermodynamics.

C. Subject Matter:

Unit I:

Thermodynamics: Introduction to Thermodynamics, Concepts of system control volume, state, properties, equilibrium, quasi- static process, reversible & irreversible process, cycle. Zeroth Law and Temperature, Heat and Work transfer Definition, Sign convention, various P-dV work done (Isobaric, Isochoric, Polytrophic, adiabatic and isothermal processes) and related problems.

Unit II:

1st Laws of Thermodynamics for closed & open systems (ii) Non Flow Energy Equation (iii) Steady State, Steady Flow Energy Equation and related problems. , Equivalence of two statements, Definition of Heat Engines, Heat pumps, Refrigerators Carnot and related problems. Air Standard cycles – Otto and Diesel cycle and their efficiencies and related Problems.

Unit III:

. Fluid Mechanics: Properties & Classification of Fluids – ideal & real fluids, Newton's law of viscosity, Newtonian & Non Newtonian Fluids, Compressible & Incompressible fluids Pressure at a point, Pascal's law, Measurement of Pressure, Continuity equation, Bernoulli's equation and its application

Unit IV:

Strength Of Materials: Concept of simple stresses and strains. Yield strength, Normal stress Shear stress, Bearing stress, Normal strain, Shearing strain, Hooke's law, poisson's ratio, Examples.

D. Teaching/Learning/Practice Pattern:

Teachnig:60 %
Learning :40 %
Practice : 0%

E. Examination Pattern:

1. Theoretical Examination

F. Books

1. *P.K. Nag , "Engineering Thermodynamics" 2nd Edition, Tata McGraw Hill Publisher*
2. *S.K. Som & G. Biswas, "Introduction to Fluid Mechanics & Fluid Mechines" Tata McGraw Hill*
3. *Timo& Young, "Elements of Strength of Materials" D Van Nostrand Company*
4. *Mariam &Kraige, "Engineering Mechanics (Vol-II) Dynamics" Wiley Publisher*
5. *Meriam &Kraige, "Engineering Mechanics, Vol-I (Statics)" Wiley India*

G. Magazine

1. *Popular Mechanics Everyday*
2. *Engineering Magazine*

H. Journals

1. *International Journal of Applied Mechanics and Engineering*
2. *Journal of Applied Mechanics, ASME*
3. *Journal of Engineering Mechanics, ASCE.*

Name of the Module: Programming in C
Module Code: CSE 201
Semester: 2nd
Credit Value: 4 [P=8, T=0, L=0]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. introducing art, science and engineering of C programming language to the students of all UG programs,
2. teaching and training of different problems in data structures,
3. guiding and training students to write efficient coding,
4. guiding & training students to fragment problems into different functions or units.

B. Learning outcomes:

Students successfully completing this module will be able to:

1. understand the basic terminology used in computer programming
2. write, compile and debug programs in C language in different operating systems.
3. design programs involving decision structures, loops and functions.
4. use and apply the dynamics of memory by the use of pointers in engineering applications.
5. use and apply the differences between structure oriented and function oriented programming in programming applications.

C. Subject matter:

Unit I:

Basic concept: Some basic concept of binary number, Octal number, hexadecimal number system and there conversion among them. Assembly language, high level language, Compiler and assembler (basic concept).

Keyword & Identifiers: History & Importance of C, Basic structure of C programs, C fundamentals: The C character set identifier, Constants and keywords, data types & size, variable names, declaration, statement , C token, symbolic constent.

Operators and Expression: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment & Decrement operators, Condition Operators, Bitwise Operators, Special operators, precedence of arithmetic operators.

Managing Input & output operations: using of printf( ) &scanf( ).

Unit II:

Decision making: Simple If statement, if-else statement, nested if else statement, Switch statement, nested switch, the operator, goto statement.

Decision making & branching: while statement, do-while statement, for statement. Array

Unit III:

String & pointer: One-dimension array, Two-dimension array and multi dimension array. String: Operation on String without using library function and using library function. Pointer: Declaration of pointer variables, accessing the variable by using pointer, pointer increment and decrement operator, pointer and array.

Functions: Basic functions, function type, function with no argument & no return value, function with no argument but return value, function with argument & return value, Storage class identifier, Call by reference, Recursive function. Pointer to function.

Unit IV:

Structure & Union: Defining a structure, accessing of structure variable, structure and array, array within structure. Nested structure, structure & functions, Pointer & structure, Unions.

File management system: Advantage of using file, Open ,close, read. write in the files, Operation on files.

Dynamic memory Allocation: use of Malloc, calloc, realloc, free. Library functions, Linked list concept.

The pre-processor: macro statements.

D. List of practicals: (Minimum eight experiments should be conducted by students)

1. Write a program to find the highest number of a given set of numbers and print the numbers of the set in descending order. [Minimum size of set=50]
2. Write a program to list even numbers and odd numbers separately in ascending order of a given set of minimum size of 50.
3. Write a program to find roots of a given quadratic equation.
4. Write a program to test whether a given number is prime or not.
5. Write a program to check whether a given number is a palindrome or not (For Eg. 121-→121).
6. Write a program to compute the following series and test it for different inputs.

    a) $2 + 4 + 6 + 8 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots$
    b) $f(x) = 1! + 2! + 3! + 4! + \ldots\ldots\ldots\ldots$
    c) $f(x) = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots\ldots\ldots\ldots$
    d) $f(x) = 1 + x + x^2 + x^3 + x^4 + \ldots\ldots\ldots\ldots$

7. Write a program to display the following patterns using nested for loops.

    a)
    ```
    *
    * *
    * * *
    * * * *
    ```
    b)
    ```
    ####
     ###
      ##
       #
    ```
    c)
    ```
    1 0 1 0
      0 1 0
        1 0
          0
    ```
    d)
    ```
      *
     * *
    * * *
   * * * *
    ```
    e)
    ```
    A B C D C B A
      A B C   C B A
        A B     B A
          A       A
    ```
    f)
    ```
    *       *
    **     **
    ***   ***
    ********
    ```

8. Write a C program to find the maximum element from given input array elements.
9. Write a C program to sort an array elements using BUBBLE sort.
10. Implement the C program for the following numbering system conversion:
    1. Decimal to Binary and Vice-versa (By a single algorithm both for integer and fractional part).
    2. Octal to Binary and Vice-versa.
    3. Hexadecimal to Binary and Vice-versa.
11. Write a program to add two given matrices each of size (nXm).
12. Write a program to multiply any two given matrices.
13. Write a program to check whether a given matrix is Identity matrix or not.
14. Write a program to generate calendar of a given year & print both in desk and wall mode.
15. Write a program to implement factorial of a given input using recursive function.
16. Write a program to differentiate between call by value and call by reference.
17. Write a program to pass an array to a function and find minimum value of it.
18. Write a program to explain scope, visibility and the lifetime of variables.
19. Write a program to explain reference variable and its implementation.
20. Write a program to swap two values using pointer and function.
21. Write a mini project to store all records of students and search by their name, roll number or registration number.
22. Write a program the explain the concept of pointer to a structure..
23. Write a program to differentiate between Enumerated data types, Union and Structures.
24. Write a program to create, edit, open, delete a file and perform different operations accordingly.
25. Write a program to backup one file to another file.
26. Write a program to merge two files.
27. Write a mini project to control mouse cursor and display whether left, right or scroll happens.

E. Teaching/ Learning/ Practice pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

F. Examination pattern:

1. Theoretical Examination: Open book and on line.
2. Practical Examination: Conduct Programming test and viva voice.

G. Books

1. *Kerninghan and Ritchie , "The 'C' programming language", Prentice Hall.*
2. *Yashavant P. Kanetkar, "Let Us C", Infinity Science Press, 2008.*
3. *Herbert Schildt, "C: The Complete Reference", McGraw-Hill Education, 2000.*
4. *Balaguruswamy, "Programming In Ansi C, 5E", Tata McGraw-Hill Education, 2011.*
5. *Govil, Agrawal, Mathur & Pathak, "Computer Fundamentals and Programming in C", Jaipur Publication House(JPH)*
6. *M.T. Somashekara, "Programming in C", PHI Learning Pvt. Ltd., 2005.*
7. *Sinha&Sinha, "Foundations of Computing", BPB Publications, 2002.*
8. *B. Dixit, "Computer Fundamentals and Programming in C", Firewall Media, 2009.*
9. *Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 2014.*
10. *N. King, "C Programming: A Modern Approach", W.W. Norton, 2010.*
11. *Zed Shaw, "Learn C The Hard Way", Addison Wesley Professional, 2015.*
12. *Steve Oualline, "Practical C Programming, 3rd Edition", O'Reilly Media, Inc., 2003.*
13. *Ajay Mittal, "Programming In C: A Practical Approach", Pearson Education India, 2010.*
14. *A.P.Godse, D.A.Godse, "Computer Concepts and Programming in C", Technical Publications, 2008.*

H. Magazines:

1. *C/C++ Users, CMP Media LLC publication, United States.*
2. *EPS Software Corp/CODE Magazine, 6605 Cypresswood Drive, Suite 300 Spring, TX 77379.*

I. Journals:

1. *Science of Computer Programming:Methods of Software Design: Techniques and Applications, Elsevier, ISSN:0167-6423*
2. *Programming and Computer Software, Springer, ISSN: 0361-7688.*
3. *Dr. Dobb's Journal, United Business Media publication, United State,ISSN: 1044-789X*
4. *Journal of C Language, CMP Media LLC publication, United States*
5. *C vu Journal, ACCU, UK.*

Name of the Module: Environmental Science
Module Code: CHY 201
Semester: 2nd
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. imparting the knowledge to the students in the area of environmental engineering.
2. providing teaching and learning to make students acquainting with advanced science and technology in environmental science.
3. injecting the future scope and the research direction in the discipline of environmental engineering.
4. making students competent to the research and development in environmental engineering.

B. Learning outcomes:

The course is designed to meet with the objectives of:

1. students successfully completing this module will be able to:
2. students will be adequately trained to become scientist, trainers and chemical engineers.
3. students will be skilled both to control and maintenance in environmental pollution, waste water treatment and other related activities in environmental engineering.
4. students will be substantially prepared to take up prospective research assignments.

C. Subjects Matters:

UNIT I:

Environment: Concepts of Environment, Environmental gradients, Tolerance levels of environment factor, EU, US and Indian Environmental Law. Chemistry in Environmental Engineering: Chemistry of the atmosphere, combustion related air pollution, global environmental problems - ozone depletion, greenhouse effect, acid rain etc.

Ecological Concepts: Biotic and Abiotic components, Ecosystem Process: Energy transfer, Food Chain and Food Web, Water cycle, Oxygen cycle, Carbon cycle, Nitrogen cycle etc., Soil chemistry. Soil composition, properties, identification and classification. Noise pollution

Effect of noise on people, rating systems, commUNITy noise sources and criteria, traffic noise predictio n, noise cotrol. Noise standards, measurement and control.

UNIT II:

Waste Water Treatment: Water Treatment: water quality standards and parameters, Ground water. Water treatment processes, Pre-treatment of water, Conventional process, advanced water treatment process. DO and BOD of Waste water treatment process, primary and secondary treatment of waste water, Activated sludge treatment: Anaerobic digestion, Reactor configurations and methane production.

Water resources, characteristics of water, water pollutants, oxygen demanding wastes, surface water qu ality, groundwater quality, water treatment systems, biomedical wastes treatment technologies and disp osal options.

UNIT III:

Solid waste, Definition and characteristics of industrial and hazardous wastes. Hazardous waste management, Solid Waste Management, Source classification and composition of MSW: Separation, storage and transportation, Reuse and recycling, Waste Minimization Techniques. Hazardous waste and their generation, Transportation and treatment: Incinerators, Inorganic waste treatment. E.I.A., Environmental auditing, Hazardous substances and risk analysis: Hazardous substance legislation, risk assessment, hazard deification, potential carcinogens, toxicity testing in animals, human exposure assessment.

UNIT IV:

Air quality standards, emission standards,emission standards, criteria pollutants, air pollution and meteo rology, atmospheric dispersion, emission controls. Air pollution and pollutants, criteria pollutants, Acid

deposition, Global climate change –greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

D. Books:

1. *G. Kiely,"Environmental Engineering" Irwin/ McGraw Hill International Edition, 1997, ,*
2. *Arcadio P. Sincero & Gergoria A. Sincero , "Environmental Engineering" Prentice Hall India*
3. *M. L. Davis and S. J. Masen, "Principles of Environmental Engineering and Science", McGraw Hill International Edition, 2004*
4. *Curringham & Saigo, "Environmental Science", TMH,*
5. *Gilbert M. Masters & Wendell P. Ela, "An Introduction to Environmental Engineering and Science", PHI Publication.*
6. *Gilbert M Masters, " Introduction to Environmental Engineering and Science" Prentice Hall*
7. *J. G. Henry and G. W Heinke "Environmental Science and Engineering" Benjamin/Cummings Publishers*
8. *M.L. Davis and D.A. cornwell "Introduction to Environmental Engineering" McGraw-Hill Education*

E. Magazines:

1. *Applied Environmental Research Foundation*
2. *Environmental Science and Engineering*
3. *Climate Wire*
4. *Down to Earth*
5. *The Green Economist*
6. *Green Wire*

F. Journals:

1. *Journal of Environmental Science, Elsevier Publication*
2. *Environmental Science and Technology, ACS Publication*
3. *Energy and Environmental Science, RSC Publication*
4. *Environmental International, Elsevier Publication*

Name of the Module: Engineering Physics - II

Module Code: PHY 201
Semester: 2nd
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting theoretical & practical knowledge to the students in the area of engineering physics,
2. providing teaching and learning to make students acquainting with modern state-of-art of engineering,
3. injecting the future scope and the research direction in the field of physics with specific specialization,
4. making students competent to design & development of engineering physics.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to become engineers,
2. students will be substantially prepared to take up prospective research assignments students will be substantially prepared to take up prospective research assignments.

C. Subject Matter:

UNIT I:

Electricity: Coulombs law in vector form, Electrostatic field and its curl, Gauss's law in integral form and conversion to differential form, Electrostatic potential and field, Poisson's Eqn. Laplace's Eqn. (Application to Cartesian, Spherically and Cylindrically symmetric systems-effective 1D problems) Electric current, drift velocity, current density, continuity equation, steady state current Dielectrics-concept of polarization.

UNIT II:

Magnetostatics & time varying Field: Lorentz force, force on a small current element placed in a magnetic field, Biot-Savart law and its applications, divergence of a magnetic field, vector potential, ampere's law in integral form and conversion to differential form, Faraday's law of electromagnetic induction in integral form and conversion to differential form.

Electromagnetic theory: conception of displacement current, Maxwell 's field equations, Maxwell's wave equation and its solution for fee space, E.M wave in a charge free conducting media, skin depth, physical significance of skin depth, E.M. energy flow & poynting vector.

UNIT III:

Quantum Mechanics: Wave particle duality, Compton effect, Photo electric effect, Black body radiation, Heisenberg's uncertainty relation, concept of wave packet**.** Conception of probability and probability density, operators, commutator, Formulation of quantum mechanics and basic postulates, Time dependent Schrodinger's equation, Formulation of Time independent Schrodinger's equation, physical interpretation of wave function, Free particle and particle in a box.

UNIT IV:

Statistical Mechanics: Concept of energy levels and energy states. Microstates, macrostates and thermodynamic probability, equilibrium macrostate. MB, FD, BE statistics (No deduction necessary), fermions, bosons (definitions in terms of spin, examples), physical significance and application, classical limits of quantum statistics Fermi distribution at zero & non-zero temperature, Bose-Einstein statistics – Planck's law of blackbody radiation.

D. List of practicals: (Minimum six experiments are required to be performed)

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 specific charge (e/m) of electron by J.J. Thomson's method.
4. Determination of Planck's constant using photocell.
5. Determination of Rydberg constant by studying Hydrogen/ Helium spectrum.
6. Determination of Stefan's radiation constant.
7. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
8. Determination of Hall co-efficient of semiconductors.
9. Determination of band gap of semiconductors
10. Use of carry Foster's bridge to determine unknown resistance

E. Teaching/ Learning/ Practice Pattern:

Teaching : 40%

Learning : 10%

Practice : 50%

F. Examination Pattern:

1. Theoretical Examination: Open book and on line.
2. Practical Examination: Conducting Experiment and Viva-Voce.

G. Books

1. *Herbert Goldstein, Charles P. Poole and John Safko, " Classical Mechanics" 3rd edition, Pearson.*
2. *N. C. Rana and P. S. Joag, "Classical Mechanics", Tata McGraw Hill Education Private Limited, New Delhi.*
3. *D. Chattopadhyay and P. C. Rakshit, "Electricity and Magnetism" , New Central Book Agency (P) Ltd.*
4. *David J. Griffiths, "Introduction to Electrodynamics," 3rd edition, PHI Learning Private Limited.*
5. *W. H Hayt and J A Buck, "Engineering Electromagnetics" 7th edition, Tata McGraw Hill Education Private Limited, New Delhi.*
6. *Eisenberg and Resnick, "Quantum Physics", 2nd edition, Wiley India.*
7. *Reif, "Statistical Physics" Tata McGraw Hill Education Private Limited, New Delhi.*
8. *S. N. Ghoshal, "Atomic Physics" S. Chand*
9. *Beiser, Mahajan and Choudhury, " Concepts of Modern Physics" Tata McGraw Hill Education Private Limited, New Delhi.*
10. *B. Gupta, "Modern Atomic and Nuclear Physics" Allied Books (P) Ltd.*
11. *Jeremy Bernstein, Paul M. Fishbane and Stephen G. Gasiorowicz " Modern Physics" Pearson.*
12. *Richard P. Feynman, Robert B. Leighton and Matthew Sands, " The FEYNMAN Lectures on Physics" Vol. I to Vol. IV, Pearson*
13. *D. Chattopadhyay and P. C. Rakshit, "An Advanced Course in Practical Physics" New Central Book Agency (P) Ltd.*

H. Magazine:

1. *Resonance*
2. *American Teacher*
3. *Scientific Physics*
4. *Physics Today*
5. *Physics For You*

I. Journals:

1. *Nature*
2. *Physical Review Letter*
3. *Physical Review A & B*
4. *Applied Physics Letters (APL)*

5. *Proceedings of the National Academy of Sciences*
6. *Chemical Physics Letters*
7. *Journal of Physics: (Including A, B, C, D, E, F & G)*
8. *Journal of Scientific & Industrial Research*
9. *Indian Journal of Engineering & Material Sciences*
10. *Indian Journal of Radio and Space Physics*

Name of the Module: Digital Electronics & Logic Design

Module Code: ECE 201
Semester: 2nd
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet the objectives of:

1. to make the students to build a solid foundation about boolean algebra,
2. to make the students to study digital logic gates and circuits,
3. to provide a clear foundation of modern digital system.

B. Learning outcomes:

At the end of this module, students are expected to be able to

1. clear understanding & utilization of logic gates,
2. design and develop of advanced TTL logic circuits,
3. utilize combinational and sequential circuits, counters, ADC and DAC.

C. Subject matter:

UNIT I:

Number Systems: Decimal, Binary, Octal and Hexadecimal systems, conversion of a number from one base to another.

Codes: BCD, Excess- 3, Gray, Reflected, ASCII, EBCDIC.

Algebra for logic circuits: Logic variables; Logic constants; Logic functions- NOT, AND, OR, NAND, NOR, Ex-OR;

Combinational circuits: Full Adder / Subtractor, BCD Adder, LAC Adder, Comparator, Decoder, Encoder, Priority Encoder, MUX/DEMUX & there structures, Combinational logic design using ROM array, Applications of MSI designs.

UNIT II:

Minimization Techniques & System Design: Basic models of sequential M/C, Analysis of Asynchronous and Synchronous circuits, Synthesis of completely and incompletely specified synchronous sequential M/Cs, Combination & Sequential Circuits. Boolean Algebra (including Shanon's expansion theorem and consensus theorem); Ven diagram representation, Canonical representations-min-term, max-term; Karnaugh map simplification, Quine Mc-clusky minimization. Minimization of Multiple Input and multiple Output system. Introduction to state machines. Classification of State Machines. State Machine Applications. Analysis of State Machine, State table, State Diagram, State Equation, State reduction and State assignment.

UNIT III:

Other Gates & Circuits: Difference between combinational and sequential circuits,

Sequential Gates: Triggering of sequential logic circuits. Difference between flip flop and latch – Construction of RS, D, JK, JK master slave, T flip flops using basic gates, preset and clear signal,

Shift Registers: Serial in serial out – Serial in parallel out, Parallel in serial out, Parallel in parallel out, Universal Shift Registers & their Applications.

Counters: Asynchronous and synchronous counter, Ripple counter, Mod-N counter, Up-down counter, Ring counter, Johnson counter, Programmable counter – Applications. Design of Synchronous State Machine (including Counter) and Asynchronous state machine.

UNIT IV:

Logic Families: Comparative studies of different type of logic families like RTL, Diode logic, DTL, TTL, IIL, HTL, ECL, MOS & CMOS etc. with the following characteristics: (a) logic levels, (b) power dissipation, (c) fan in and fan out, (d) propagation delay, and, (e) noise immunity.

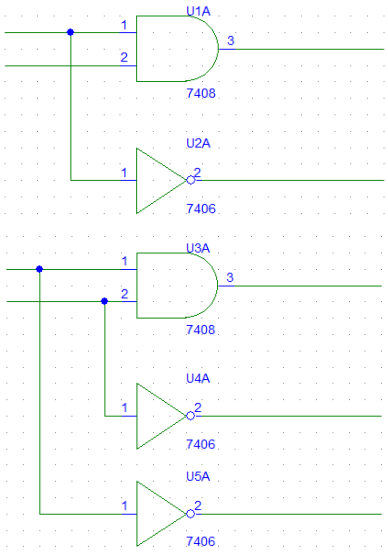
Data Converters: Digital to Analog Converters: Binary weighted resistor type, R-2R ladder type, Specifications and applications of DA converter. Analog to Digital Converter: Comparator type, Successive approximation type, Dual slope AD converter, Flash ADC converter. Specifications and applications of AD converter.

D. List of Experiments: (Minimum eight experiments should be conducted by students)

1. Study Data Hand Book and list atleast 5 chips for each of primary, secondary gates & flip-flops and draw their diagram with pin configuration.
2. Verify Truth Table of NOT, 2-input AND and 2-input OR gate thereby inference.
   i) Single line definition of multiple input AND & OR gate.
   ii) What is the primary difference between NOT gate from AND & OR gate.
3. Study the Truth Table of the following by circuits.

   i)

   ii)



   iii) Compare the Truth Table of i) & ii) and that of AND gate and state inference.
4. Design Gray to Binary and Binary to Gray Converter & test
5. Design and test byte operated even parity generator & then convert it to odd parity generator.
6. Design and test (7,4) Hamming Code Generator and Error Correction decoder.
7. Design a Majority Gate and use it & a XOR gate to realize Adder Circuit & Verify.
8. With Serial Data input design a single circuit for test of >,<and =for two data.
9. Minimize the following logic system with SOP by tabular technique & implement the circuit.
   i) $f_1(A,B,C,D) = m_0 + m_1 + m_2 + m_3 + m_5 + m_6 + m_{10} + m_{13} + m_{15}$
   ii) $f_2(A,B,C,D) = m_0 + m_1 + m_2 + m_3 + m_5 + m_7 + m_{10} + m_{13}$
   iii) $f_3(A,B,C,D) = m_1 + m_2 + m_4 + m_5 + m_6 + m_7$
10. Minimize the following logic circuit defined in POS by tabular minimization technique:
    i) $f_1(X,Y,Z) = M_0.M_1.M_3.M_7$
    ii) $f_2(X,Y,Z) = M_0.M_1.M_2.M_6.M_7$
11. Write a C programmed to implement Tabular Technique for minimization of system as in problem (8) & (9)
12. Test Truth Table of
    i) S – R flip flop
    ii) J – K flip flop
    iii) D – flip flop
    iv) T – flip flop
13. Design 1 bit Read/Write memory with flip-flop and other logic gate & test.
14. Design Serial input & parallel output Shift register & test.
15. Design a binary counter & test.
16. Design one ADC & one DAC circuit & test.

E. Teaching/Learning/Practice Pattern:

Teaching : 40%
Learning : 10%
Practice : 50%

F. Examination Pattern:

1. Theoretical Examination: Open book/ Regular examination and on line test.
2. Practical Examination: Conducting Experiment and Viva-Voice.

G. Books:

1. *J Crowe & B. Hayes-Gill, "Introduction to Digital Electronics", Newnes.*
2. *T. L. Floyd, "Digital Fundamentals"(9th Edition), Prentice Hall.*
3. *Taylor L. Both, "Introduction to Computer Engineering", 3rd Ed., John Wiley & Sons*
4. *R. P. Jain, "Modern Digital Electronics", Tata McGraw Hill.*
5. *R L Morris & J R Miller, "Designing with TTL integrated circuits", McGraw Hill*
6. *C. H. Roth (Jr.), "Fundamentals of Logic design", Cengage Engineering.*
7. *M. Morris Mano, "Digital Logic Design"(3rd Edition), Prentice Hall.*
8. *Malvino & Leach, "Digital Principles and Applications", Tata McGraw Hill.*
9. *Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall.*

H. Magazines:

1. *Planet Analog, http://www.planetanalog.com/*
2. *IEEE Spectrum, http://spectrum.ieee.org/*
3. *Electronics for you, EFY Enterprises Pvt. Ltd, New Delhi., http://www.electronicsforu.com/*
4. *Electropages, http://www.electropages.com/*

I. Journals:

1. *International Journal of Electronics Devices and Circuits.*
2. *IEEE Transaction on Computer-Aided Design of Integrated Circuits and System.*
3. *IEEE Transaction on Computer.*

Name of the Module: Historiography of Science & Technology

Module Code: HSS 201
Semester: 2nd
Credit Value: 3[P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. providing teaching with inclusive learning,
2. imparting theoretical lectures with case discussion,
3. making students aware about the importance of this subject in their future career.

B. Learning Outcomes:

Students successfully completing this module will be able to :

1. students will be to work with efficiency as they had knowledge of the subject,
2. with the backup knowledge their performance will definitely be much better in their workplace.

C. Subject Matter:

Unit I

Introduction: An overview: definitions, Different approaches to the scientific explorations, to introduce humanity's endeavour behind science and its application over the centuries, characteristics of histography of science and technology.

Unit II

Motivation: Nature of drives, needs and motives, work motives, need of hierarchy theory and two factor theory of motivation, How to motivate the workers at work, factors effecting the morale of workers.

Lives of Eminent Scientists: To understand the Background, Opportunities, Achievements and Qualities in their efforts to become Scientist of first order.

Scientific Eras: Course of Civilization and Scientific Endeavour.

Contribution of science: Contribution to the present day World.

Unit III

Answers to the Criticism that Science has created a World full of Pollutions

D. Teaching/Learning/Practice Pattern:

Teaching : 40%
Learning : 10%
Practice : 50%

E. Examination Pattern:

1. Theoretical Examination: Open book/ Regular examination and on line test.

F. Books:

1. *Agassi, Joseph. Towards an Historiography of Science, Wesleyan University Press. 1963.*
2. *Kragh, Helge An Introduction to the Historiography of Science, Cambridge University Press. 1990.*
3. *Kuhn, Thomas. The Structure of Scientific Revolutions, Chicago: University of Chicago, 1962 (third edn, 1996)*
4. *Gopalakrishnan, K.V. Inventors Who Revolutionised Our Lives, National Book Trust, India. 1999.*

G. Magazine:

1. *Science and Technology Magazine*
2. *Histograpghy of contemporary Science and Technology*
3. *Science News Letter*

H. Journal:

1. *Historiography in Graduate Technology*
2. *Innovation, Technology or History*

3. *Historiography of the Sciences*

Name of the Module: Basic Civil Engineering

NATIONAL INSTITUTE OF TECHNOLOGY

(Established by Ministry of Human Resources Development, Govt. Of India)
Yupia, District: Papumpare, Arunachal Pradesh–791112
Fax: 0360–2284972, E-mail: nitarunachal@gmail.com

Syllabus for B.Tech in Electrical Engineering

Module Code: CE 202
Semester: 2nd
Credit Value: 2 2 [P=3, T=0, L=0]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. increase ability to understand engineering drawing,
2. learn to sketch and take field dimensions,
3. learn to take data and transform it into graphic drawings,
4. learn basic engineering drawing formats,
5. prepare the student for future engineering positions.

B. Learning Outcome:

Upon completion of the subject:

1. student's ability to perform basic sketching techniques will improve,
2. students will be able to draw orthographic projections and sections,
3. student's ability to use architectural and engineering scales will increase,
4. students ability to produce engineered drawings will improve,
5. student's ability to convert sketches to engineered drawings will increase,
6. students will become familiar with office practice and standards.

C. Subject Matter:

UNIT I:

Traditional Materials: stones, bricks, lime, cement, timber. Mortar: sand, cement mortar, mud mortar, special mortar, test on mortarConcrete: plain concrete, reinforced cement concrete, reinforced brick concrete

UNIT II:

Metals as Building materials: Ferrous metals, aluminum, copper. Miscellaneous Building materials: Glass, plastics, bitumen, asbestos, paints, distempers, varnishes, solid and hollow concrete Blocks, Roofing and flooring tile

UNIT III:

Superstructures: Types of superstructure based on the method of load transfer, walls, stone masonry, brick masonry, plastering, pointing, flooring, roof, doors and lintels, stairs.

UNIT IV:

Surveying: Introduction to surveying-Object and uses of surveying, primary divisions of surveying, fundamental principles of surveying, classification of surveying, plans and maps, scales.

D. Teaching/Learning/Practice Pattern:

Teaching : 40%
Learning : 10%
Practice : 50%

E. Examination Pattern:

1. Theoretical Examination: Open book/ Regular examination and on line test.

F. Books:

1. *Rakesh Roshan Beohar, "Basic Civil Engineering", Laxmi Publications.*
2. *Ramamurtham, "Basic Civil Engineering", Dhanpat Rai and sons*
3. *S S Bhavikatti "Basic Civil Engineering" New Age international Publishers,*

G. Magazine

1. ***Civil Engineering and construction Review.***

H. Journals

1. *ASCE*
2. *Springer.*

Name of the Module: Workshop Practice-II
Module Code: ME 202
Semester: 2nd
Credit Value: 2 [P=3, T=0, L=0]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. to acquire skills in basic engineering practice,
2. to identify the hand tools and instruments,
3. to acquire measuring skills,
4. to acquire practical skills in the trades,
5. to acquire practical skills in welding, carpentry, fitting.

B. Learning Outcome:

Upon completion of the subject:

1. should have knowledge of workshop safety,
2. should have knowledge of handling workshop tools, machines,
3. should have knowledge of different welding types,
4. should have knowledge of different carpentry joints,
5. should have knowledge of different tools working principle.

C. Subject Matter:

Unit I:

Bench work and Fitting: Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses, plumbing, Sheet metal Work.

Unit II:

Metal Joining: Definitions of welding, brazing and soldering processes, and their applications. Oxy acetylene gas welding process, equipment and techniques. Types of flames and their applications. Manual metal arc welding technique and equipment. AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld joint. Common welding defects such as cracks, slag inclusion and porosity.

Unit III:

Machine Shop: Introduction, Basic Principles of Lathe, Shaper, Milling, Drilling, Grinding, Power Hacksaw,etc.

D. List of Practicals:

1. To practice Gas welding using a 3mm thick mild steel plate. (Welding Shop)
2. To prepare a Lap joint and Butt joint by Gas Welding from 3mm thick mild steel plate (Welding Shop).
3. To practice Manual metal arc welding using a 5mm thick mild steel plate (Welding Shop).
4. To prepare various patterns using wood as a pattern material with the help of specific tools. (Carpentry Shop)
5. To perform various bench working operations like sawing, filling and finishing on a 5mm thick mild steel plate using specific tools (Fitting Shop).
6. To prepare jobs (Square, Angular and Semi Circular grooves) using 5mm mild steel plate using specific tools (Fitting Shop)
7. T-Lap joint and Bridle joint (Carpentry Shop).
8. Gas Welding practice on mild steel flat/sheet upto 3 mm thick.
9. Lap joint by Gas Welding (upto 3mm thick).

10. Manual Metal Arc Welding practice (upto 5mm thick).
11. Pattern Making. (Carpentry Shop)
12. Laying out (bench work); Sawing and Finishing by Filing.

E. Teaching/Learning/Practice Pattern:

Teaching: 20%
Learning: 20 %
Practice: 60%

F. Examination Pattern:

1. Job making.
2. Viva-voce.

G. Books:

1. *M.L. Begeman and B.H. Amstead, "Manufacturing Process" John Wiley, 1968.*
2. *W.A.J. Chapman and E.Arnold, "Workshop Technology" Vol. 1, 2 & 3, CRC press Prentice Hall*
3. *B.S. Rghuwanshi, "Workshop Technology" Vol. 1 & 2 – Dhanpat Rai and Sons.*
4. *Hazra and choudhary "Workshop Technology" Vol. 1, 2, Media Promoters*
5. *VirenderNarula "Workshop Technology", S.K.Kataria & Sons*
6. *Anderson "Shop Theory" Mc Graw Hill.*
7. *H.S.Bawa, "Carpentry: A complete guide", Tata McGraw Hill.*
8. *R.Little, "Welding & Welding Technology", Tata McGraw Hill.*
9. *L.M.Gourd, "Principles of welding technology", Edward Arnold Publishers.*
10. *R.S.Parmer, "Welding processes and technology" Khanna publication.*

H. Magazines

1. *International Metal Working News.*
2. *Industrial Distribution*

I. Journals

1. *International Journal of Machine Tools and Manufacture*
2. *Journal of Manufacturing Science and Engineering, Transactions of the ASME*
3. *Journal of Manufacturing Technology and Research*

Name of the Module: Foreign Language (German / Chinese) (Audit)
Module Code: HSS 202
SEMESTER: 2nd
Credit Value: 2 [P=2, T=0, L=0]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. the french language course accords to a method created for indian students who are complete beginners in french and who wish to acquire verbal communication skills in current scenario.

B. Learning outcome:

Students successfully completing this module will be able to :

1. develop four skills in French i.e. Reading, Writing, Speaking, Comprehension

C. Subject matter:

Unit-I:

Self Introduction, Introducing Friends, Family & persons Topical writing, Essays Description of persons Place, Things, Class, City, Country, House, Plan a Week-End, Excursion,

Unit-II:

Making Resume , Interviews Letter Writing , Rejecting or accepting proposals. Invitation, Dialogues, Tastes & Preferences

Unit-III:

Conversational French between Known & Unknown people, Telephonic Conversation with Friends & Client.

D. List of Practical:

1. Issue Writing
2. Writing Resumes and Applications
3. Writing Memos
4. Reading Comprehension
5. Vocabulary
6. Presentation Skills
7. Group Discussion
8. Extempore
9. Debates

E. Teaching/ Learning/ Practice Pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

F. Examination Pattern:

1. Theoretical Examination

G. Books:

1. *Suggested book-Ailes Volume-II*

Name of the Module: Circuit Theory & Networks
Module Code: EE 301
Semester: 3rd
Credit Value: 4 [P = 2, T = 0, L = 3]
Module Leader: Module

A. Objectives:

The course is designed to meet with the objectives of:

1. imparting knowledge to the students for classification of networks and systems based on different criteria and their analysis using network theorems,
2. applicability of Fourier and Laplace transforms in circuit analysis,
3. making familiar with SPICE modeling,
4. use of MATLAB for circuit solving procedures.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be made aware of the basic Network Theorems and their applicability in DC Bilateral Linear Circuits,
2. students will be skilled both theoretically and practically for circuit modeling and study of various parameters related to circuit theory,
3. students will be trained for use of simulation software like PSPICE and MULTISIM.

C. Subject Matter:

UNIT –I:

Different types of systems &networks: continuous & Discrete, Fixed and Time varying, linear and Non-linear, Lumped and distributed, Passive & Active Networks & Systems and Laplace transform of impulse and sinusoidal steps waveforms for RL, RC, LC and RLC Circuits. Transient analysis of different electrical circuits with and without initial conditions, Fourier series and Fourier Transform.

Concept of complex frequency, transform of standard periodic and non periodic waveforms. Independent and dependent sources and equivalence of sources. Circuit elements and their transformed equivalents, treatment of mutual couplings.

UNIT –II:

Network theorems and their applications in circuit analysis, Formulation of network equations, Source transformations, Loop variable analysis and node variable analysis. Graph of network, concept of tree branch, tree link. Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials.

UNIT –III:

Two port networks, Open circuit Impedance and Short circuit Admittance parameters, Transmission parameters, hybrid parameters, and their inter-relations. Indefinite admittance matrix-their applications to the analysis of active network. Active filter analysis and synthesis using operational amplifier.

Series, parallel and cascade connections of two port networks. Elements of realisability and synthesis of one port network.

UNIT –IV:

SPICE: How SPICE works. Model statement, models for passive and active device, D.C. circuits analysis, small signal analysis, capacitors and inductors in D.C. Circuits, steady state and transient, plotting and printing, input and output Impedance, D.C. sensitivity analysis, harmonic decomposition (Fourier Series), Harmonic re-composition, voltage controlled components.

D. List of Practical:

1. Transient response in R-L and R-C Network: Spice, Simulation/hardware.
2. Transient response in R-L-C Series & Parallel circuits Network: Simulation/hardware.
3. Determination of Impedance (Z) and Admittance(Y) parameters of two port network.
4. Frequency response of LP and HP filters.
5. Frequency response of BP and BR filters.
6. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form.
7. Evaluation of convolution integral, Discrete Fourier transform for periodic & non-periodic signals and simulation of difference equations using MATLAB.
8. Representation of poles and zero sine-plane, determination of partial fraction expansion in z-
9. Domain and cascade connection of second order system using MATLAB
10. Determination of Laplace transform and inverse Laplace transformation using MATLAB
11. Spectrum analysis of different signals

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)
(Some industrial experts will deliver lectures)

F. Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. Sudhakar: Circuits & Networks: Analysis & Synthesis 2/e TMH New Delhi
2. Valkenburg M.E.Van,"Network Analysis", Prentice Hall.
3. Engineering circuit analysis with PSPICE and probe-Roger
4. Engg Circuit Analysis: Hayt6/eTata Mcgraw-Hill
5. A.Chakravarty: Networks, Filters & Transmission Lines
6. D. Chattopadhyay and P.C. Rakshit: Electrica lCircuits
7. A.V. Oppenheimer and A.S.Wilsky: Signals & Systems, PHI
8. R.V.Jalgaonkar.: Network Analysis & Synthasis. EPH.
9. Sivandam-Electric Circuits Analysis. Vikas
10. Reza F.M. and Seely S., "Modern Network Analysis",Mc.Graw Hill Book Company
11. Roy Choudhury D., "Networks and Systems", New Age International Publishers.
12. KuoF.F., "Network Analysis & Synthesis", John Wiley & Sons.

H. Magazines:

1. Electrical Today Magazine.
2. Electrical India Magazine.
3. IEEE Spectrum.

I. Journals:

1. Circuits and Systems, IEEE Transactions
2. Circuits, devices and Systems, IET.

Name of the Module: Electronic Circuits & Devices
Module Code: ECE-301
Semester: 3rd
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. to make the students to build a solid foundation about science & technology of the basic electronic elements, circuits and devices, namely , junction theory, electrons, holes, diodes and transistors,
2. to make the students to study the characteristics and hence functions & performance parameters of basic electronics devices,
3. to provide a clear foundation of making different circuits using different combinations of different diodes and transistors,
4. to understand the measurement parameters and criteria of circuits likes rectifiers, bias circuits, amplifiers.

B. Learning Outcomes:

Upon completion of the subjects:

1. students will have clear understanding & utilization of semiconductor devices & fabrication,
2. students will be able to design and develop different electronic circuits made of different diodes and transistors,
3. students will be able to measure their performances to apply in particular systems.

C. Subject matter:

UNIT - I:

Junction Theory: Conduction in solids. Pure and doped semiconductor, Metal Semiconductor Junction, Concept of holes, Electron and hole mobility, Band Diagram, Ohmic & rectifying effects, Depletion & capacitance effects, Semiconductor-semiconductor junction, p=n junction, homo & hetero junction, Equilibrium band diagram, Potential diagrams of p-n junction.

UNIT - II:

p-n diodes: p-n junction diodes, diode mechanism & I-V characteristics, biased p-n diode, Schottky diode, Avalanche and Zener effect, Zener diode and its I-V characteristics, Degeneration, Large doping, Tunnel diode & its I-V characteristics, Backward diode, Equivalent circuits of diodes, Half wave and Full wave rectifier circuits, clipping and clamping circuits.

UNIT - III:

Transistors Theory and Circuits: Metal-insulator-semiconductor junctions, Band diagram, n-p-n and p-n-p junctions (bipolar junction transistor/BJT), transistors characteristics: Emitter, Collector and Base terminals, I-V characteristics, transfer characteristics, input-output characteristics, current /voltage gain, mutual conductance, transfer resistance (trans resistance & transconductance). Biasing and Stability of transistors' bias circuits in different modes: Self Bias-CE, CB, CC, Compensation techniques, Low and High frequency model of transistor. T and ∏ models & parameters, Voltage & current amplifier. Audio and Radio Amplifier, Power amplifiers – Class A, B, AB, C, Push pull & Tuned amplifier. Analysis of the amplifiers circuits with gain, input & output resistance, power dissipation & stability.

UNIT - IV:

Differential amplifiers: Differential Amplifier: Common mode & Differential mode gain, Constant current source (current mirror etc.) level shifter, Comparator, Schmit Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers including their temperature compensated versions, Trans-conductance multiplier, Precision Rectifier.

D. List of Practical:

1. Design, implementation and measurement with graphical analysis of input and output of clipping and clampers circuits with p-n junction diode
2. Study of the input output of self bias transistor circuits of different modes: CE< CB, CC

3. Measurement of the gain and the trans conductance, and a comparison of the modes.
4. Design, implementation and measurement of gain, input and output resistance of CE mode voltage amplifier
5. Design, implementation and measurement input and output resistance of a RF amplifier with CE mode
6. Design, implementation and measurement with graphical analysis of heat dissipation of a Class C amplifier
7. Design, implementation and measurement of gain of any push pull amplifier
8. Design, implementation and measurement of differential & common mode gain of a differential amplifier
9. Study of the Inverting and Non inverting amplifiers using OPAMP

E. Teaching/Learning/Practice Pattern:

Teaching: 40%
Learning: 10%
Practice: 50%

F. Examination Pattern:

1. Theoretical Examination: Open book/ Regular examination and on line test.
2. Practical Examination: Conducting Experiment and Viva-Voce.

G. Books:

1. *Millman & Halkias, "Integrated Electronics", Tata McGraw Hill, New Delhi,3rd Edition*
2. *Chattopadhyaya, Rakhist, Saha and Porkait, "Foundation of Electronics", Prentice Hall of India, New Delhi, 2nd Edition*
3. *S M Sze, "Physics of Semiconductor Devices", Wiley Inter science, Latest Edition*
4. *Manis Mukherjee, "Foundation of Electronics Devices" Prentice Hall of India, New Delhi, 2nd Edition*
5. *Neaman, " Semiconductor Physics & Devices", Tata McGraw Hill, New Delhi,3rd Edition*
6. *Horowitz & Hill, "The Art of Electronics", Cambridge University Press, Latest Edition*
7. *R L Smith, Electronics: Circuits & Devices, John Wiley & Sons Ltd*
8. *Steetmann and Banerjee, "Solid State Electronic devices" Tata McGraw Hill, 6th Edition.*

H. Magazines:

1. *Planet Analog*
2. *IEEE Spectrum*
3. *Electronics for you*
4. *Electropages*

I. Journals:

1. *International Journal of Electronics Devices and Circuits.*
2. *IEEE Transaction on Circuits and Systems I-Regular Papers.*
3. *International Journal of Electronics Devices and Circuits.*

Name of the Module: Electromagnetic Field Theory
Module Code: PHY 301
Semester: 3rd
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

This course is design to meet the objectives of:
1. imparting theoretical & practical knowledge to students in the area of Electromagnetic Field Theory,
2. providing teaching and learning to make students acquainting with modern state-of –art of Electromagnetic propagation,
3. injecting the future scope and the research direction in the field of Electromagnetisms,
4. making students competent to design & development of Electromagnetisms.

B. Learning Outcomes:

Upon completion of the subjects:
1. students will be adequately trained to become experts in the field of Electromagnetisms,
2. students will be skilled both theoretically & practically to do operation, repairing, and maintenance works of the devices based on concept of Electromagnetisms,
3. students will be substantially prepared to take up prospective research assignments.

C. Subject Matter:

UNIT–I:

Static Electric Fields: Review of vector analysis, Coulomb's Force Law–Electric field intensity and potential Charge distributions. Electric flux and flux density: Gauss law and its applications –boundary conditions – Gauss divergence theorem– Poisson's and Laplace equations and their solutions. Electric Current: Charge conservation and continuity equation–conductivity and Ohm's law Interior and Exterior field conductors and boundary conditions.

Gauss's law in integral and differential forms, Analysis of multi-dielectric arrangement like cables and bushings, Field equations in cartesian, cylindrical and spherical coordinates. Physical significance of Divergence.

UNIT–II:

Polarisibility of dielectrics: Dielectric Constant, Artificial dielectric, capacitance, spherical shell, parallel plate, coaxial and parallel wire lines, dielectric strength, and energy stored in a capacitor and in an electric field.

UNIT–III:

Steady magnetic fields: Postulates– magnetic forces, magnetic fields, straight wires and wire loops, solenoid and torroid; Ampere"s law and its applications, magnetic field strength, and parallel wire/lines, energy stored in an inductor and in a magnetic field, Stoke's theorem, vector potential and its applications, boundary conditions. Ampere's law in integral and differential forms, Physical interpretation of curl and Stoke's theorem.

UNIT–IV:

Maxwell's Equations and E.M. Waves: Maxwell's equations in various forms, wave equations in free space and material media, plane, waves in dielectric and conducting media. Radiation: Basic principles, radiation from dipole, transmission lines.

Use of Maxwell's equation: Flow of energy and Poynting vector, energy density in a plane wave, energy, velocity, complex pointing vector theorem. Reflection of E.M. waves: Reflection of plane waves from perfect conductors and dielectrics, linear, elliptic and circular polarization, reflection coefficient and standing wave ratio, Brewster's angle, total reflection, surface waves.

D. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%

Practice: 50%

(Teacher is to divide components for T/R/P)

E. Examination Pattern

1. Theoretical Examination: Written
2. Practical Examination: Conducting experiments and viva-voce.

F. Books:

1. *Martin A. Plonus, Applied Electromagnetic, McGraw-Hill, 1978.*
2. *W.H.Hayt, Engineering Electromagnetics (Special Indian Edition), 7/e, TMH, 2006.*
3. *J.D.Kraus and D.A. Fleisch, Electromagnetics (International Edition), 5/e, TMH, 1999.*
4. *Jordan and Balman, Electromagnetic Waves and Radiating Systems, 2/e, PHI, 2006.*
5. *Peterson, Scott L.Ray, Mitra, Computational Methods for Electromagnetics, Wiley, 1998.*
6. *Ramo, Whinnery and Duzer, Field's waves in Electromagnetic systems, 3/e, Wiley, 1994.*
7. *Matthew N.O. Sadiku, Elements of Electromagnetics, 4/e, Oxford University Press, 2006.*
8. *Joseph A. Edminister and Priye, Schaums outline series Electromagnetics, 2/e, TMH, 2006.*

G. Magazines:

1. *IEEE Spectrum*
2. *Engineering and Technology Magazine. (E & T)*

H. Journals:

1. *Micro Electro Mechanical Systems (MEMS) Journals, IEEE.*

Name of the Module: Behavioural Science
Module Code: HSS 301
Semester: 3rd
Credit Value: 2 [P=0, T=0, L=2]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting theoretical lectures with case discussion,
2. providing teaching with inclusive learning,
3. making students aware about the importance of this subject in their future career.

B. Learning Outcomes:

Upon completion of the subject:

1. students will be able to work with efficiency as they had knowledge of the subject,
2. with the backup knowledge their performance will definitely be much better in their workplace.

C. Subject Matter:

UNIT - I:

Behavioural Science: An overview: definitions, Man the critical factor, Behavioural science and its historical development.

Motivation: Nature of drives, needs and motives, work motives, need hierarchy theory and two factor theory of motivation, how to motivate the workers at work, factors effecting the moral of workers.

UNIT – II:

Industrial Sociology: Concept and Definitions; Importance for Engineers; Growth; Criticism of the Haw throne Studies; Nature and scope of Industrial sociology, Industry and Community, Industry and Tradition in India.

Society and Technical Change: Concept of social change, meaning and definitions of social change, nature of social change. Factors such as Natural, Cultural, Economic, Planning, Technological, Indian Information Technology Scenario, Effect of Technology on Social Institutions.

Society and Environment: Meaning and Definitions, Characteristics, Classification of Environment, Physical Environment and its Influence, Social Environment and its some basic elements, Environment in Industry, Illumination, Noise, Atmospheric Conditions, Music and Colour.

UNIT – III:

Groups: Meaning and Definitions, types of Groups, characteristics, functions of formal and informal groups, merits and demerits of in formal groups.

UNIT – IV:

Human relations: Historical overview, definitions, early and later approaches to human relations, strategies for establishing healthy human relations.

Labour management relations: Industrial relations; meaning, objectives and definitions, Dunlop's theory of industrial relations, Psychological and Gandhian approach to industrial relations, industrial relations in Japan and India, industrial relation in coming years, challenges of coming years, new dimensions of industrial relations, the ways of industrial peace. Trade unions; meaning and definitions, functions of Indian trade Unions, recent emerging trends in Indian trade unions.

D. Teaching/ Learning Pattern:

Teaching	: 50%
Learning/ case presentation	: 30%
Assignment	: 10%
Attendance	: 10%

E. Examination Pattern:

Theoretical Examination	: 50
Class test	: 30
Assignment	: 20

F. Books:

1. *Wendell L. French, Human Resource Management (4th Ed.) Proston: Honshto Mittin, 1998.*
2. *H.Fayol, Industrial and General Administration, Paris: Dunod, 1916.*
3. *Mintzberg, the Nature of Managerial Works: Upper Saddle River, N.J Prentice Hall, 1973.*
4. *Fred N.Ker Linger, Behavioral Research: A conceptual Approach, New York: Holt Rinehart and Winston, 1979*
5. *Milter William R. And Stephen Rollnick, Motivational Interviews, (3rd ed.), Sept 7, 2012.*
6. *Daniel Kahnmen, Thinking Fast and Slow, April 2, 2013.*
7. *Elizabeth, D. Hutchison. Essentials of Human Behaviour, September 3, 2013.*
8. *Susan P. Robbins, Pranal Chatterjee, Edward R. Canda, Contemporary Human Behaviour Theory, 2013.*

G. Magazine:

1. *Leadership Quarterly*
2. *HBR Magazine*

H. Journal:

1. *Journal of Behavioural Sciences*
2. *Behavioural and Brain Sciences*
3. *Journal of Contextual Behavioural Sciences*
4. *Harvard Business Review*

Name of the Module: Signals & Systems
Module Code: EE 302
Semester: 3rd
Credit Value: 3 (P = 0, T = 0, L = 3)
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. imparting knowledge to the students for classification of networks and systems based on different criteria and their analysis using network theorems,
2. applicability of Fourier and Laplace transforms in circuit analysis,
3. making familiar with SPICE modeling,
4. use of MATLAB for circuit solving procedures.

B. Learning Outcomes:

Students successfully completing this module will be:

1. aware of the basic principles of signal processing and different transformation techniques,
2. skilled both theoretically and practically for circuit modeling and study of various parameters related to circuit theory,
3. trained for using of simulation software like PSPICE and MULTISIM.

C. Subject Matter:

Unit I:

Introduction to Signals and Systems, Definition of signals and systems, communication and control systems as examples, Classification of signals: Continuous time and discrete time, even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. Time-domain operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, time shifting and folding, precedence rule. Elementary signals: exponential, sine, step, impulse and its properties, ramp, parabola, rectangular, triangular, signum, sinc. Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

System Analysis, System modelling: Input output relation, impulse response, block diagram, integro-differential equation and state-space representation. Definition of impulse response, convolution integral, convolution sum, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential and unit step to rectangular, rectangular to rectangular only. Computation of convolution sum by all methods. Properties of convolution, system interconnection, system properties in terms of impulse response, step response in terms of impulse response.

Unit II:

Signal and System Analysis in Frequency Domain using Fourier Transform (FT) : Definition and necessity of CT and DT Fourier series and Fourier transforms. Analogy between CTFS, DTFS and CTFT, DTFT. CT Fourier series, CT Fourier transform and its properties, problem solving using properties, amplitude spectrum, phase spectrum of signals. Amplitude response and Phase response of systems. Duality between time and frequency domain using sinc and rectangular signals. Limitations of FT and need of Laplace- transform (LT) and Z-transform(ZT).

Unit III:

System Analysis in Frequency Domain using Laplace Transform: Definition, properties, ROC and pole zero concept. Application of Laplace transforms to the LTI system analysis. Inversion using duality, numericals based on properties. Signal analysis using LT.

Unit IV:

Correlation and Spectral Density: Definition , correlogrm, analogy between correlation, covariance and convolution, conceptual basis, auto-correlation, cross correlation, energy/power spectral density, properties of correlation and spectral density, interrelation between correlation and spectral density. Probability, Random Variables and Random Signals: Experiment, sample space, event, probability, conditional probability and statistical independence. Random variables: Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF. Statistical averages, mean, moments and expectations, standard deviation and variance. Probability models: Uniform, Gaussian, Binomial. Evolution and definition of random signal /random process through probability via random variable.

D. Books:

1. *Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India.*
2. *Simon Haykins, "Introduction to Analog and Digital Communications", Wiley India.*
3. *B.P. Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford University Press, 2004.*
4. *Charles Phillips, "Signals, Systems and Transforms", 3rd Edition, Pearson Education.*
5. *Tarun Kumar Rawat, "Signals and Systems", Oxford University Press, India.*
6. *Peyton Peebles, "Probability, Random Variable, Random Processes", 4th Edition, Tata Mc Graw Hill.*

E. Magazines:

1. *IEEE Signals &Systems Magazine.*
2. *Electronics Business Magazine.*
3. *IEE ASSP Magazine*

F. Journals:

1. *IEEE journal on selected Areas in communication.*
2. *Springer*
3. *IEEE Spectrum*
4. *Bell Systems Technical Journal*
5. *Electrical Power Systems Research, Elsevier Journal.*
6. *Energy Conversion, IEEE Journal*

Name of the Module: Electrical & Electronic Measurements Systems
Module Code: EE 303
Semester: 3rd
Credit Value: 4(P = 2, T = 0, L = 3)
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. study of construction of various measurement instruments and their principle of operation,
2. measurement techniques for fundamental circuit parameters,
3. introduction to digital electronic instruments, salient features and applications,
4. study of transducers, multiplexers, PLL.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. realize the advantages and the necessity of measurement systems in all Engineering and Scientific Works,
2. know about the constructional features and operation principles of Measurement Devices, their classification,
3. substantially prepared to use the knowledge in practical works.

C. Subject Matter:

UNIT-I:

Review of Electromechanical ammeter, voltmeter, wattmeter, ohmmeter, multimeter and energy meter. Measurement of insulation resistance- use of guard wires and guard rings. Insulation Megger. Measuring with C.T and P.T.; ratio and phase angle errors, testing.

UNIT-II:

Measurement of R, L and C with bridges and potentiometer, Kelvin's double bridge DC potentiometer, AC potentiometer- polar type and rectangular type.

UNIT-III:

Analog electronic instruments: Ampere, Volt, Watt, kWh, Time, frequency and phase angle measurement using CRO, spectrum and wave analyzer, multimeter. PLL and its applications. Multiplexers.

UNIT-IV:

Instrumentation: Transducer, classification and selection of strain gauge, LVDT, Capacitive, piezoelectric, Hall effect, Digital transducers -Motion encoders (absolute and incremental). Signal conditioning for transducers. Measurement of temperature, weight, pressure and flow. Basic principle of Smart sensors, principle of data acquisition systems (DAS).

D. List of Experiments:

1. Using Kelvin's Bridge for measurement of low resistance.
2. Measurement of insulation resistance.
3. Measurement of capacitance and loss angle of capacitor using Schering Bridge.
4. Measurement of inductance and Q-factor using Owen Bridge.
5. Measurement of ratio and phase angle errors of instrument transformers using
(a) Comparison method (b) absolute method
6. Using (a) integrating type (b) dual-slope type electronic voltmeter
7. Spectrum analyser and its use for analysing frequency spectra of periodic and non-periodic signals
8. Using LVDT or displacement transducers.
9. Resistance strain gauges using unbalanced bridge circuits.
10. Measurement of temperature using Pt-100, thermocouple and and thermistor.
11. Using absolute (grey-coded) and incremental rotary encoders.
12. Performing time division and frequency division multiplexing.
13. Phase locked loops and applications for phase measurements.

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

F. Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. *Swahney, A.K.," Electrical and Electronic Measurements and Instrumentation"*
2. *Helfric AD and Cooper WD, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 1992*
3. *Jones BE, "Instrumentation, Measurement and Feedback"*
4. *Golding and Widdis, "Electrical Measurements and measuring instruments"*
5. *Kalsi, "Electronic Instrumentation", TMH*

H. Magazines:

1. Electrical Business Magazine, (Online edition of Electrical Industry Magazine)
2. Instrumentation and Measurement Magazine, IEEE.

I. Journals:

1. *Instrumentation and Measurement, IEEE Transactions.*
2. *Science, Measurement and Technology, IET Journal.*
3. *Measurements, Elsevier Journal.*

Name of the Module: Electrical Machine - I
Module Code: EE 304
Semester: 3rd
Credit Value: 4(P = 2, T = 0, L = 3)
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. study of laws of electromagnetic and electro mechanics, constructional features of Transformer and DC Machines, Characteristics and their operations,
2. calculation of machine design and modeling parameters,
3. familiarity with various tests performed and working procedures.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be made familiar with DC Machines used practically, their operating and control characteristics,
2. students will be well acquainted with the methods of designing of DC machines and modelling,
3. students will be substantially prepared to take up prospective research assignments.

C. Subject Matter:

UNIT-I

Electromagnetic and transformers: Review of laws of Electromagnetic and Electromechanics, Maxwell‟s equations. Three-Phase transformers, special constructional features – cruciform metering, alternative winding arrangements, cooling methodology, conservators, breathers, Buchholz relay, alternative phase connections, vector phase groups. Phase conversions-3 to 1, 3 to 2, 3 to 6 and 3 to 12; 1-3 phase, Auto-Transformer. Parallel operation and load sharing. Special Purpose Transformers: Pulse, isolation, welding, rectifier, high frequency. Losses, Efficiency, Voltage Regulation and Tests and applications. Instrument transformer. Derivation of equivalent circuit of transformers. Determination of equivalent circuit parameters, tertiary windings.

UNIT-II

DC Generator: Review of constructional features. Methods of excitation, Armature windings, Power balance, Voltage and torque equations. Operation as generator – Self excitation principles. Characteristics, Armature reaction, Commutation. Voltage regulation and parallel operation of DC Generators.

DC Motor: Operation of a dc machine as a Motor –Characteristics and their control. Starting, speed control including solid state controllers. Braking. Losses, Efficiency. Testing and applications of dc motors.

UNIT-III

Polyphase Synchronous Generator: Constructional features. Polyphase Distributed AC Windings: Types, Distribution, coil span and winding factors. Excitation systems, emf equation and harmonic elimination. Generator Mode: Interaction between excitation flux and armature mmf, equivalent circuit model and phasor diagram for cylindrical rotor machine. Salient pole machines: two reaction theory, equivalent circuit model and phasor diagram. Power angle equations and characteristics. Voltage regulation and effect of AVR. Synchronizing methods, Parallel operation and load sharing, active and reactive power control, operation on infinite bus-bar. Analysis under sudden short circuit. Transient parameters.

UNIT-IV

Poly-phase Synchronous Motor: Motoring mode, Transition from motoring to generating mode, Phasor diagram, steady state operating characteristic, V-curves, starting, synchronous condenser, hunting–damper winding effects, speed control including solid state control.

D. **List of Experiments**

1. O.C.C of DC Generator.
2. D.C. Shunt generator build up
3. Load Test on DC Generator
4. Starting, Running, and reversing of DC motor
5. Speed Control of DC motor by field and armature.
6. Hopkinson's Test
7. Swinburn's Test
8. O.C.T and S.C.T of alternator.
9. V-curve of alternator
10. Sudden S.C. Test on alternator and determination of Xd,
11. Parallel of operation of alternator
12. Phase conversion, 3-Φ to 1-Φ, 3-Φ to 6-Φ, Scott connection.

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

F. Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. *Mcpherson, George, "Introduction to Electric Machines and Transformers", John Wiley and Sons, 1980.*
2. *Nasser Syed, A., "Electric Machine and Transformer, New York, Macmillan, 1984.*
3. *Say, M.G. and Taylor, E.O., "Direct Current Machines" Second Ed., ELBS, 1985.*
4. *Say, M.G., "Alternating Current Machines", (5thEd.)ELBS, 1986*
5. *Fitzgerald, Kingsley C. and Umans, S.D., "Electric Machinery", (5th Ed.,), McGraw-Hill Book Co.92,*
6. *Sen, P.C., "Principal of Electric Machines and Power Electronics", (2ndEd.), John Wiley & Sons 1997.*
7. *Clayton, A.E., "Performance and Design of Direct Current Machines", 3rd Ed. Pitman 1961.*
8. *Del Toro, V., "Electrical Machines & Power Systems", 1985, PHI, Englewood Cliffs, 1985.*

H. Magazines:

1. *Electronic Engineering Times.*
2. *Electricity Today T & D Magazine.*

I. Journals:

1. *The journal of the institute of electrical and electronics engineers, Japan.*
2. *Electrical Power Systems Research, Elsevier Journal.*
3. *Energy Conversion, IEEE Journal.*

Name of the Module: Discrete Mathematics
Module Code: MAS 301
Semester: 3rd
Credit Value: 4(P = 0, T =1, L = 3)
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. To extend student's Logical and Mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
2. Apply logical reasoning to solve a variety of problems.

B. Learning Outcomes:

Upon completion of the subject:

1. Students will have acquired greater precision in logical argument and have gained a core mathematical understanding of discrete mathematics.
2. Students will have learned and practised basic concepts of mathematical proof (direct proof, proof by contradiction, mathematical induction).
3. Students will be able to handle the standard logical symbols with some confidence.
4. Students will have learned elementary combinatorial and counting techniques and how to apply them to simple problems.
5. Students will be able to simplify complex mathematical expressions and apply general formulae to specific contexts.
6. Students will have learned how to state precisely and prove elementary mathematical statementsand solve problems.
7. Students will have a basic understanding of information technology and its use in Mathematical contexts .

C. Subject Matter:

Unit I:

Sets and Propositions: Combinations of Sets, Finite and Infinite Sets, Unaccountably Infinite Sets, Mathematical Induction, Principle of Inclusion and Exclusion , Multisets, Propositions.

Permutations, Combinations, and Discrete Probability: The Rules of Sum and Product, Permutations, Combinations, Generation of Permutations and Combinations, Discrete Probability, Conditional Probability, Information and Mutual Information.

Relations and Functions : A Relational Model for Data Bases, Properties of Binary Relations, Equivalence Relations and Partitions, Partial Ordering Relations and Lattices, Chains and Antichains, A Job-Scheduling Problem, Functions and the Pigeonhole Principle.

Unit II:

Graphs and Planar Graph: Basis Terminology, Multigraphs and Weighted Graphs, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, The Traveling Sales person Problem.

Trees and Cut-Sets: Trees, Rooted Trees, Path Lengths in Rooted Trees, Prefix Codes, Binary Search Trees, SpanningTrees and Cut-Sets, Minimum Spanning Trees.

Unit III:

Discrete Numeric Functions and Generating Functions: Manipulation of Numeric Functions, Asymptotic Behaviour of Numeric Functions, Generating Functions, Combinatorial Problem.

Recurrence Relations and Recursive Algorithms: Recurrence Relations, Linear Recurrence Relations with Constant Coefficients, Homogenous Solutions, Particular Solution.

Unit IV:

Group and Rings : Groups, Subgroups, Generators and Evaluation of Powers, Cossets and Lagrange's Theorem, Permutation Groups and Burnside's Theorem, Codes and Group Codes, Isomorphism and Auto morphisms, Homomorphism and Normal Subgroups, Rings, Integral Domains, and Fields.

Boolean Algebras: Lattices and Algebraic Systems, Principle of Duality, Basic Properties of Algebraic System, Defined by Lattices, Distributive and Complemented Lattices, Boolean Lattices and Boolean Algebras, Uniqueness of Finite Boolean Algebras, Boolean Functions and Boolean Expressions, Propositional Calculus.

D. **Teaching/ Learning/ Practice Pattern:**

Teaching: 70%

Learning: 30%

Practice: 0%

E. **Examination Pattern:**

1. Theoretical Examination:

F. Books:

1. *C.L. Liu, "Elements of Discrete Mathematics", Mc Graw Hill.*
2. *Kolman B, Busby R. C, Ross S.C, "Discrete Mathematical Structures", Pearson Education.*
3. *D.S Malik & M.K.Sen, "Discrete Mathematical Structures: Theory & Applications", Thomson India Edition.*
4. *T. Veerarajan, "Discrete Mathematics", Mc Graw Hill.*
5. *N. Chandrasekaran, M. Umaparvathi, "Discrete Mathematics", PHI Learning Private Limited.*
6. *Babu Ram, "Discrete Mathematics", Pearson.*
7. *S. Lipschutz, Marc L. Lipson, "Discrete Mathematics", Schaum's outlines.*
8. *Norman L. Biggs, "Discrete Mathematics", Oxford.*
9. *S. K. Chakraborty, B. K. Sarkar, "Discrete Mathematics",*
10. *K. D. Joshi, "Applied Discrete Structures", New Age International Publishers.*

G. Magazines:

1. *Current Science (Indian Academy of Science)*
2. *The Mathematics Student (Math Student) (Indian Mathematical Society)*
3. *Mathematical Spectrum(The University of Sheffield)*
4. *Mathematics Magazine (Mathematical Association of America)*
5. *+Plus magazine (University of Cambridge)*
6. *Ganithavahini (Ramanujan Mathematical Society)*
7. *Mathematics Today, London Metropolitan University.*

H. Journals:

1. *SIAM Journal on Discrete Mathematics.*
2. *Open Journal of Discrete Mathematics. Website: http:// www. scirp. org/journal/ojdm/*
3. *Discrete Mathematics, Elsevier.*
4. *Journal of Discrete Mathematics, Hindawi Publishing Corporation.*

Name of the Module: Entrepreneurship and Innovation
Module Code: HSS 401
Semester: 4th
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. students will be able to involved themselves in the business activities,
2. students will be able to start innovative practices in their entrepreneurial activities,
3. students will be able to develop their skills on the traits that they want to carry forward,
4. students will be able to start activities on Forest based Technology.

B. Learning Outcomes:

Upon completion of the subject:

1. students will be able to start their venture more scientifically,
2. students will be able to start their venture by linking with the financial institutions.

C. Subject Matter:

UNIT I:

Introduction to Entrepreneurship: Meaning, Role of Entrepreneur, Entrepreneur Process: different approaches, Motivation for becoming an Entrepreneur.

SME Concept, its role, status, prospects and policies for promotion of SMEs.

Importance of Entrepreneurship: innovations, Qualities of successful Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Issues & Problems Entrepreneurial Practices.

UNIT II:

Importance of Entrepreneurship: innovations, Converting Innovation to Economic Value which includes, Growth Strategies, Value Position, Market Segments, Value Chain Structure, Revenue Model, etc., Qualities of successful Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur, Issues & Problems Entrepreneurial Practices.

Contribution of Entrepreneurs: Towards R&D, creates Wealth of Nation & Self prospect with Challenge.

Entrepreneur Carrier: Different Stages, Entrepreneur Development Programmers (EDPs).

Unit III:

Characteristics of Entrepreneurship: Risk taker, Perceptive, Curious, Imaginative, Persistent, Goal setting, Hard-working, and Research & Management Skill, Organising & Controlling, Soft skills and Feasibility.

Women Entrepreneurship: Opportunities, promotion Hurdles and Prospects of women Entrepreneurs.

Factors & Models of Entrepreneurial Development.

Social Entrepreneurial Initiative: Solving social Problems, Business plan, Strategic Plan vs Business Plan.

UNIT IV

Forest based Industries: Mobilization of resources from NTFP products, Processing units, Technical and Financial Feasibility study and analysis of projects under self-employment scheme including small entrepreneur.Farm based enterprises for production and postproduction of agri-produce:

Crops: Cereals, Legumes, Oilseeds; Horticulture crops: Fruits and vegetables; Livestock production: Poultry, Fishery, Medicinal and Aromatic plants.Handlooms & Sericulture; Handicraft, coir, jute & leather Micro entrepreneurial skills development and good production practices.

D. Teaching/ Learning/ Practice Pattern:

Teaching: 70%
Learning: 30%
Practice: 0%

E. Examination Pattern:

1. Theoretical Examination

F. Books:

1. Management and Entrepreneurship N. V. R. Naidu, Naidu I. K. International Pvt Ltd, 01-Jan-2008

2. Social Enterprise Developing Sustainable Businesses Frank Martin and Marcus Thompson Palgrave Macmillan

3. Small Business Management and Entrepreneurship David R. Stokes, Nicholas Wilson Cengage Learning EMEA, 2006 - Business & Economics

4. Entrepreneurship: Theory, Process, Practice Donald F. Kuratko Cengage Learning, 14-Nov-2008 Business & Economics

5. Essentials of entrepreneurship and small business management Thomas Zimmerer, Norman M. Scarborough, Doug Wilson Pearson/Prentice Hall, 2008 - Business & Economics

6. Entrepreneurship 6/E Robert D. Hisrich Tata McGraw-Hill Education, 2011 - Entrepreneurship

G. Magazines:

H. Journals:

1. *International Journal of Entrepreneurship*
2. *International Journal of Innovation Management*
3. *Journal of Small business and Entrepreneurship*
4. *Journal of Human Values.*
5. *Journal of Management Research*

Name of the Module: Numerical Methods
Module Code: MAS 402
Semester: 4th
Credit Value: 2(P = 2, T = 0, L = 2)
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. introducing the basic concepts of round off error, truncation error, numerical stability and condition, Taylor polynomial approximations; to derive and apply some fundamental algorithms for solving scientific and engineering problems: roots of nonlinear equations, systems of linear equations, polynomial and spline interpolation, numerical differentiation and integration, numerical solution of ordinary differential equations,
2. application of computer oriented numerical methods which has become an integral part of the life of all the modern engineers and scientists. The advent of powerful small computers and workstation tremendously increased the speed, power and flexibility of numerical computing,
3. injecting future scope and the research directions in the field of numerical methods.

B. Learning outcomes:

Upon Completion of the subjects:

1. students will be skilled to do Numerical Analysis, which is the study of algorithms for solving problems of continuous mathematics,
2. students will know numerical methods, algorithms and their implementation in 'C' for solving scientific problems,
3. students will be substantially prepared to take up prospective research assignments.

C. Subject Matter:

UNIT I

Errors in computation: Overflow and underflow; Approximation in numerical computation; Truncation and round off errors; Propagation and control of round off errors; Chopping and rounding off errors; Pitfalls (hazards) in numerical computations (ill conditioned and well-conditioned problems).

UNIT II

Interpolation: Lagrange's Interpolation, Newton's forward & backward Interpolation Formula. Extrapolation; Newton's Divided Difference Formula; Error; Problems.

UNIT III

Numerical Differentiation: Use of Newton's forward and backward interpolation formula only.

UNIT IV

Numerical Integration: Trapezoidal formula (composite); Simson's 1/3rd formula (composite); Romberg Integration (statement only); Problems.

UNIT V

Numerical Solution of System of Linear Equations: Gauss elimination method; Matrix Inversion; Operations Count; LU Factorization Method (Crout's Method); Gauss-Jordan Method; Gauss-Seidel Method; Sufficient Condition of Convergence.

UNIT VI

Numerical Solution of Algebraic and Transcendental Equations: Iteration Method: Bisection Method; Secant Method; Regula-Falsi Method; Newton-Raphson Method.

UNIT VII

Numerical solution of Initial Value Problems of First Order Ordinary Differential Equations: Taylor's Series Method; Euler's Method; Runge-Kutta Method (4th order); Modified Euler's Method and Adams-Moulton Method.

D. List of Practical: (Minimum six experiments are required to be performed)

1. Assignments on Interpolation: Newton forward & backward, Lagrange.
2. Assignments on Numerical Integration: Trapezoidal Rule, Simson's 1/3rd Rule.
3. Assignments on Numerical solution of a system of Linear Equations: Gauss elimination, Gauss Jordan, Matrix Inversion, Gauss Seidel.
4. Assignments on Solution of Algebraic Equations: Bisection, Secant, Regula-Falsi, Newton- Raphson Methods.
5. Assignments on Ordinary Differential Equations: Taylor Series, Euler's Method, Runge-Kutta (4th Order).

E. Teaching/Learning/Practice Pattern:

Teaching : 40%
Learning : 10%
Practice: 50%
(Teacher is to divide components for T/R/P)

F. Examination Pattern:

Theoretical Examination : Open book and on line.
Practical Examination : Conducting Experiments and Viva-Voce.

G. Books:

5. *D. Kincaid and W. Cheney, Numerical Analysis: Mathematics of Scientific Computing, 3rd Ed., AMS, 2002.*
6. *E. Atkinson, An Introduction to Numerical Analysis, Wiley, 1989.*
7. *S. D. Conte and C. de Boor, Elementary Numerical Analysis - An Algorithmic Approach, McGraw-Hill, 1981.*
8. *C.M. Bender and S.A. Orszag, Advanced Mathematical Methods for Scientists and Engineers, McGraw-Hill Book Co., 1978.*
9. *John H. Mathews, Numerical Methods for Mathematics Sciences and Engineering 2nd ed. Prentice Hall of India, New Delhi 2003.*
10. *M.K.Jain, S.R.K. Iyengar and R.K. Jain, Numerical method for Scientific and Engineering Computation, New Age International Pvt. Ltd. 3rd edition, 1993,*
11. *V Rajaraman, Computer Oriented Numerical Methods, Pearson Education 3rd edition , 2013*
12. *Steven C. Chapra, Numerical Methods for Engineers, 4th Ed., McGraw Hill, 2002.*
13. *Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Prentice Hall, 2006.*
14. *Günther Hämmerlin and Karl-Heinz Hoffmann, Numerical Mathematics, Springer-Verlag, 1991.*

H. Magazines:

1. *Current Science (Indian Academy of Science)*
2. *The Mathematics Student (Math Student) (Indian Mathematical Society)*
3. *Mathematical Spectrum(The University of Sheffield)*
4. *Mathematics Magazine (Mathematical Association of America)*
5. *+Plus magazine (University of Cambridge)*
6. *Ganithavahini (Ramanujan Mathematical Society)*

I. Journals:

1. *Numerische Mathematik,*
2. *Acta Numerica*
3. *SIAM Review*
4. *Journal of Computational Physics*

5. *SIAM Journal on Numerical Analysis*
6. *SIAM Journal on Scientific Computing*
7. *IMA Journal of Numerical Analysis*
8. *Mathematics of Computation*
9. *Foundations of Computational Mathematics*

Name of the Module: Electrical Machine - II
Module Code: EE 401
Semester: 4th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet the objectives of:

1. study of Construction and operation of AC Electrical Machines,
2. calculation of Machine parameters and Modelling,
3. brief study of special electrical motors (PMBL), etc.,
4. introduction to the theory of machine control and practical applications.

B. Learning Outcomes:

Upon completion of the course:

1. students will be made familiar with AC Machines used practically, their operating and control characteristics,
2. students will be well acquainted with the methods of designing of AC machines and modelling,
3. also, Students will be substantially prepared to learn about special electrical machines and to use various software like MATLAB for simulation and research works.

C. Subject Matter:

UNIT-I

Three phase Induction motor: Review or constructional details. Review of Polyphase Distributed AC Windings. Production of EMF, Coupled circuit equations, steady state analysis–equivalent circuit, Phasor diagram, power flow diagram and torque-slip characteristics.

MMF of poly phase distributed winding, winding factors of distributed winding, production of rotating magnetic field, derivation of equivalent circuit and determination of equivalent circuit parameters.

UNIT-II

Starting and speed control Effect of rotor resistance starting, double squirrel cage rotor. Speed control schemes including solid state and vector control. Braking effect of space/time harmonics and analysis. Testing losses and Efficiency. Induction generators–Grid connected and self-excited mode–Applications.

UNIT-III

Single Phase Motors: Induction Types Doubles revolving field theory, equivalent circuit, characteristics, starting of single phase motor, shaded pole machines. Synchronous types Hystereris motor, reluctance motor, stepper motors– variable reluctance and permanent magnet type. PM Synchronous motor–brushless motor, universal motor.

UNIT-IV

Special Electric Motors: Switched reluctance motor, linear machines –power energy and levitation types, PM

Brushless dc motors. Machines for control Systems: Disc motors, printed Circuit motors. Servomotors-and d.c, tachogenerators, Synchros, Disk machines. Space harmonics: Crawling & cogging.

D. List of Experiments

1. Determination of complete torque speed characteristics of three phase induction machine in braking, motoring and generation regions and its calibration.

2. Understanding the effect of rotor resistance on the load characteristics of a wound–rotor induction motor.
3. Determination of equivalent circuit parameters, prediction of performance. Verification from actual load test. (b) Separation of losses of Induction motors and estimation of efficiency.
4. Speed control of Induction motor–Conventional, electronic. Solid state speed control using (i) V constant, (ii)
V/f constant, (iii) slip–energy injection.
5. Load characteristic of Induction generator working in (i) Grid connected mode (ii) Self Determination of equivalent circuit parameters of a single phase Induction motor. Prediction of torque–speed characteristic. Verification from load test.
6. Determination of torque step rate characteristic of a stepper motor. Determination of operating range.
7. Load characteristic of universal motor, operating and and ac supply Comparison of performance.
8. Experimental determination of performance characteristics of two phase servomotor.
9. Load characteristic of hysteresis motor and shaded pole motor.
10. Characteristic of permanent magnet motor.
11. Characteristic of switched reluctance motor.

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)

F. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. Mc Pherson George, "Introduction to Electric Machines and transformers", John Wiley and Sons, 1980.
2. Nasser Syed,A., "Electric Machine and Transformer", New York, Macmillan, 1984.
3. Sen., P.C., "Thyristor DC Drives", New York Wiley, 1991.
4. Fitzgerald, Kingsley C. and Umans,S.D., "Electric Machinery",(5th Ed.,),McGraw-Hill 1992.
5. Clayton, A.E., "Performance and Design of Direct Current Machines",3rd Ed. Pitman 1961.

H. Magazines:

1. Asia Electronics Industry.
2. Electricity Today T & D Magazine.

I. Journals:

1. The journal of the institute of electrical and electronics engineers, Japan.
2. Electrical Power Systems Research, Elsevier Journal.
3. Energy Conversion, IEEE Journal.

Name of the Module: Power Electronics - I
Module Code: EE 402
Semester: 4th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet the objectives of:

1. teach students about energy conversions and processing using various power electronic converters,
2. develop among students, knowledge and understanding of power devices, converters and apply their mathematical skills for solving practical problems,
3. also includes the design methodologies for equipment and their modelling.

B. Learning Outcomes:

Upon completion of the course:

1. students will be having knowledge of power electronics circuits used for AC-DC Conversions, signal conditioning,
2. students will be able to design converters for specific purpose and select semiconductor devices relevant to the working requirements,
3. students will be substantially prepared to take up research assignment in relevant topics.

C. Subject Matter:

UNIT-I

Power Semiconductor Devices : History of development of Power Electronic devices, Constructional features, Characteristics, rating and specification, gate/base drive circuits, protection including cooling and application consideration of diodes, SCRS, GTO, BJTS, MCT, MOSFET and IGBT. Electromagnetic interference.

UNIT-II

AC to DC Converters : Operation and analysis of Single phase and multi-phase uncontrolled and controlled rectifiers with R, RL and back EMF load, effect of source inductance, freewheeling effect, power factor improvement methods for phase controlled rectifiers, filters.

UNIT-III

AC to AC Voltage Converter: Operation and analysis of single phase integral cycle and phase controlled converters, Configuration of three phase controllers.

UNIT-IV

DC to DC Converters: Single phase and three phase bridge inverters, VSI and CSI, voltage control–PWM & Square wave operation, Harmonics and their reduction techniques.

DC to AC Converters and: Single phase and three phase bridge inverters, VSI and CSI, voltage control-PWM and square wave operation, Harmonics and their reduction techniques, Cycloconverters: Single phase and three phase- configurations and operating principle of cycloconverters.

Protection including fuses, snubbers and clamps, Steady and switching power loss in devices : its effect & minimization, Cooling and Heat-sinks.

D. List of Experiments

1. Determination of V.I. characteristic of SCRS triac & diac.
2. Performance analysis of BJT, IGBT, GTO & MOSFET
3. Designing UJT firing circuit for the control of SCRS.
4. Generation of PWM control signal for Single Phased dc to ac inverter.

5. Use of the single phase half controlled & fully controlled AC to DC Converter and effect of firing angle control on load voltage & waveforms.
6. Use of back to back connected SCR/triac Controlled AC Voltage controller and its waveforms with Variation of firing angle.
Use chopper circuit for the control of DC Voltage using (1) Pulse width control (2) Frequency Control & (3) Current limit Control.
8. Designing a Single Phase inverter and obtaining its waveform.
9. Designing Three phase firing circuit with synchronization, and testing with three phase AC to DC bridge converter.
10. Testing of waveforms of digital firing modules.
11. Testing of a Three Phase bridge inverter with different types of loads.
12. Analysis of harmonics & reactive power measurement in AC mains with rectifier and AC Voltage Controller loads.

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)

F. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. *Rashid Muhammad,H., "Power Electronics: Circuits, Devices and Applications",2ndEd.Prentice-Hall, 1998.*
2. *Mohan Ned, Undeland Tore, M. and Robbins William, P., "Power Electronics: Converter, Applications and*
3. *Design", John Wiley &Sons, 1994.*
4. *Landev Cyrill, W., "Power Electronics", McGraw Hills, London, 1981.*
5. *Dewan, S.B.and Satrughan A., "Power Semiconductor Circuits", John Wiley & Sons,1975*

J. Magazines:

1. Power Electronics Letters, IEEE.
2. Power Electronics Magazine, IET.

H. Journals:

1. Power Electronics, IEEE Transactions.
2. Electrical and Electronics Engineering, Elsevier.
3. The Journal of Institute of Electrical and Electronics Engineer, Japan.

Name of the Module: Power System - I
Module Code: EE 403
Semester: 4th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. introduction to the Generation, Transmission and Distribution Sector of Power System, types and operations,
2. modelling of overhead transmission lines,
3. brief Study of modern FACTS Devices used, their performance and operation,
4. introduction to EHV/HVDC new technology transmission systems.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to become Power System Engineers to work in area of Generation, Transmission and Distribution,
2. students will be skilled both theoretically and practically to do transmission line modelling, fault calculations, repairing and maintenance works,
3. students will be made aware of modern devices used for operation and control, and will be made substantially prepared for getting acquainted with new transmission technologies of HVDC and communication techniques like SCADA.

C. Subject Matter:

UNIT-I

Generation of Electric Power: Brief description of Thermal, hydro nuclear and gas power plants & other non- conventional power plants.

Legal aspects of electricity supply- Electricity acts, rules and codes. Standards followed in power supply, environmental and safety measures, Factors influencing tariffs, types of consumers, different types of tariffs.

Calculation of line parameters with symmetrical and unsymmetrical spacings.

UNIT-II

Transmission and Distribution Systems: DC 2–wire and 3–wire systems, AC single phase, three phase and 4-wire systems, and comparison of copper efficiency. Distribution Systems: primary and secondary distribution systems, concentrated & uniformly distributed loads on distributors one and both ends, ring distribution, sub mains and tapered mains, voltage drop and power loss calculations, voltage regulators.

UNIT-III

Overhead Transmission Lines and Cables: Types of Conductors, Line parameters; calculation of inductance and capacitance of single and double circuit transmission lines, three phase lines with stranded and bundle conductors, Generalized ABCD constants and equivalent circuits of short, medium & long lines. Line Performance: regulation and efficiency of short, medium and long lines, Series and shunt compensation, Introduction to FACTS. Calculations of capacity of cables, charging current, stress, grading, heating of cables, Construction and characteristics of HV & EHV cable.

UNIT-IV

Overhead Line Insulators and Mechanical Design of Transmission Lines: Type, string efficiency, voltage distribution in string of suspended insulators, grading ring, preventive maintenance.

Different types of tower, sag- tension calculations, sag-template, string charts, vibrations & damaging Corona-losses, radio & audio noise, transmission line–communication line interference.
Introduction to EHV/HVDC transmission: Brief description of both the systems with working & constructional details.

D. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)
(Some Industrial expert will deliver talks)

E. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

F. Books

1. Grainger John, J. and Stevenson, Jr. W.D., "Power System Analysis", McGraw Hill, 1994.
2. Harder Edwin.I, "Fundamentals of Energy Production", John Wiley and Sons, 1982.
3. Deshpande, M.V., "Elements of Electric Power Station Design", A.H. Wheeler and Company, Ald 1979.
4. BurkeJames,J., "PowerDistributionEngineering;FundamentalsandApplications"MarcelDekk.,1996.
5. "Electric Transmission and Distribution Reference Book", Westing house Electric Corporation: East Pittsburg, Pa, 1964.
6. Wadhwa, C.L.,"Electric Power Systems", Second Edition, Wiley Eastern Limited,1985.
7. Nagrath,I.J. and Kothari, D.P., "Power System Engineering", Tata McGraw Hill, 1995.

G. Magazines:

1. Electricity Today, T & D Magazine.
2. Electrical Line, Line Magazines.
3. Electrical India Magazine, (Online Magazine)
4. Power and Energy Magazine, IEEE.

H. Journals:

1. Power Apparatus and Systems, IEEE Transactions.
2. Power Delivery, IEEE Transactions.
3. Power Engineer Magazine, IET.
4. Electrical Power, Elsevier.

Name of the Module: Introduction to Microprocessors and Microcontrollers
Module Code: EE 404
Semester: 4th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objective:

The course is design to meet with the objectives of:

1. to study the Architecture of microprocessor and microcontroller,
2. to study the Interrupts and DMA,
3. to study the synchronous, asynchronous, interrupt driven using 8255.

B. Learning Outcomes:

Upon completion of the subject, the students will be able to:

1. design a microprocessor,
2. configure or design a microprocessor-based system,
3. understand efficiency of microprocessor-based systems,
4. write code or a compiler for a microprocessor which takes advantage of the advanced architectural techniques.

C. Subject Matter:

UNIT I:

8086 Architecture, Introduction to 8086 Microprocessor, 8086 Architecture-Functional diagram. Register Organization, Memory Segmentation. Programming Mode!. Memory addresses. Physical memory organization. Architecture of 8086, signal descriptions of 8086- common function signals. Minimum and Maximum mode signals. Timing diagrams. Interrupts of 8086. Instruction Set and Assembly Language Programming of 8086:Instruction formats, addressing modes, instruction set, assembler directives, macros, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

UNIT II:

I/O Interface: 8255 PPL various modes of operation and interfacing to 8086. Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter.

Interfacing with advanced devices: Memory interfacing to 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine. Introduction to DOS and BIOS interrupts, Interfacing Interrupt Controller 8259 DMA Controller 8257 to 8086.

UNIT III:

Communication Interface: Serial communication standards, Serial data transfer schemes. 8251 USART architecture and interfacing. RS- 232. IEEE-488, Prototyping and trouble shooting.

Introduction to Microcontrollers: Overview of 8051 microcontroller. Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, simple program

UNIT IV:

8051 Real Time Control: Interrupts, timer/ Counter and serial communication, programming Timer Interrupts, programming external hardware interrupts, programming the serial communication interrupts, programming 8051 timers and counters.

The AVR RISC microcontroller architecture: Introduction, AVR Family architecture, Register File, The ALU. Memory access and Instruction execution. I/O memory. EEPROM. I/O ports. Timers. UART. Interrupt Structure.

D. List of Practicals:

1. Assembly language program (ALP) to add array of N hexadecimal numbers stored in the memory. Accept input from the user.
2. 8086 ALP to perform non-overlapped and overlapped block transfer (with and without string specific instructions). Block containing data can be defined in the data segment.
3. 8086 ALP to convert 4-digit Hex number into its equivalent BCD number and 5-digit BCD number into its equivalent HEX number. Make your program user friendly to accept the choice from user for: (a)HEX to BCD (b) BCD to HEX (c) EXIT. Displaying proper strings to prompt the user while accepting the input and displaying the result.
4. 8086 ALP for the following operations on the string entered by the user.

a) Calculate Length of the string b) Reverse the string

c) Check whether the string is palindrome

Displaying appropriate messages to prompt the user while accepting the input and displaying the result.

5. 8086 ALP to perform string manipulation. The strings to be accepted from the user is to be stored in data segment of program-l and write FAR PROCEDURES in code segment program_2 for following operations on the string:

(a) Concatenation of two strings

(b) Number of occurrences of a sub-string in the given string

Using PUBLIC and EXTRN directive. Create .OBJ files of both the modules and link them to create an EXE file.

6. 8086 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use successive addition and add and shift method. Accepting input from the user.
7. 8087ALP to obtain:

i) Mean ii) Variance iii) Standard Deviation

For a given set of data elements defined in data segment. Also displaying result.

8. 8086 ALP to convert an analog signal in the range of 0V to 5V to its corresponding digital signal using successive approximation ADC and dual slope ADC. Finding resolution used in both the ADC's and compare the results.

E. Books:

1. *D. V. Hall. Micro processors and Interfacing, TMGH. 2'1 edition 2006.*
2. *Kenneth. J. Ayala. The 8051 microcontroller, 3rd edition, Cengage learning, 2010*
3. *Advanced Microprocessors and Peripherals - A. K. Ray and K.M. Bhurchandani, TMH, 2nd edition 2006.*
4. *The 8051 Microcontrollers, Architecture and programming and Applications -K.Uma Rao, Andhe Pallavi,,Pearson, 2009.*
5. *Micro Computer System 8086/8088 Family Architecture. Programming and Design - By Liu and GA Gibson, PHI, 2nd Ed.,*
6. *Microcontrollers and application, Ajay. V. Deshmukh, TMGH, 2005*

F. Magazines:

1. *IEEE Microcontrollers and Microprocessors Magazine.*
2. *Electronics Business Magazine.*
3. *IEE ASSP Magazine*

G. Journals:

1. *IEEE journal on selected Areas in communication.*
2. *Springer*
3. *IEEE Spectrum*
4. *Bell Systems Technical Journal*

5. *AT&T Bell Laboratory Technical Journal*
6. *Electronics Letter*
7. *International Journal of wireless Information Networks.*
8. *British Telecom Technological Journal*
9. *AT&T Technical Journals*

Name of the Module: Control System Engineering
Module Code: EEE 405
Semester: 4th
Credit Value: 3[P = 2, T = 0, L = 3]
Module Leader:
Module Tutor(s):

A. Objectives:

The course is designed to meet with the objectives of:

1. imparting theoretical and practical knowledge to the students in the area of process control engineering,
2. study of basic characteristics of feedback control systems,
3. introduction to FRA and State Variable Analysis,
4. study of basic concepts of optimal control and non-linear control.

B. Learning outcomes:

Students successfully completing this module will be able to:

1. understand the basic terminology used in control system engineering,
2. use and apply skills in designing and operation of control systems employed in various industries.

C. Subject matter:

UNIT I:

Introduction: Concept of feedback and Automatic Control. Electrical analogy of physical systems. Transfer Function. Design and Compensation in control systems. Block diagram representation of Control Systems. Block Diagram Algebra, Signal Flow Graph, and Mason's gain formula. Modelling in state space.

UNIT II:

Control system components: Error sensing devices, potentiometer, Synchros, D.C. and A.C. tachometers, servomotors, modulators and demodulators.

Mathematical modelling of physical systems: State space representation of differential equations, Liquid level systems, Pneumatic systems, Hydraulic systems, Thermal systems, Transformation of mathematical models in MATLAB.

UNIT III:

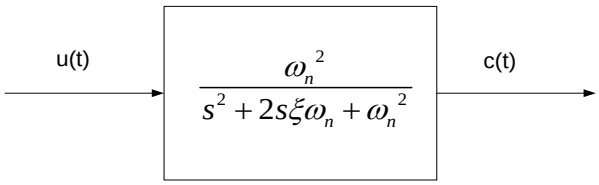
Steady State and Transient Analysis: Introduction to first order, second order and higher order control systems, Transient analysis of closed loop systems, Transient errors and their minimisation, steady state error and their minimisation, error coefficients, P, PI and P-I-D type controllers, Effects of integral and derivative control on system performance, Tuning methods: Ziegler-Nichol's Tuning, Zero placement approach, degrees of freedom.

UNIT IV:

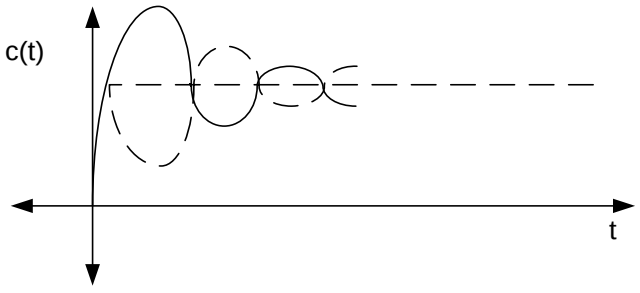
Stability of Control Systems: Routh-Hurwitz (R-H) criteria, Nyquist criteria, BodePlots. PolarPlots, Nichols chart, measures of relative stability- gain margin and phase margin. Construction of RootLoci for simple system, effects of the movement of poles and zeros, Lead compensation, Lag compensation, Lead-Lag compensation, Improvement of system performance through compensation. Case studies on control voltage, current, frequency, position and speed. Control of liquid level, density, flow, temperature, etc. Relative stability analysis, State space analysis, controllability, observability.

D. List of practical:

1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox & PSPICE.
2. Determination of step response for first order& second order system with unity feedback and their display on CRO. Calculation and verification of time constant, peak overshoot, setting time etc. from the response.
3. Simulation ofstep response&impulseresponsefortype-0, type-1& type-2 systems with unity feedback using MATLAB &PSPICE.
4. Determination of RootLocus, Bode-Plot, Nyquist Plot using MATLAB-Control system toolbox for 2nd order system. Determination of different control system performance indices from the plots.
5. Determination of PI,PD,PID controller action of first order simulated process.
6. Experimental determination of approximate transfer function from Bode plot.
7. Determination of approximate transfer function experimentally from Bode plot.
8. Evaluation of steady state error, setting time, percentage peak overshoot, gain margin, phase margin, with addition of lead compensator & by compensator in forward path transfer function for unity feedback control system using PSPICE.
9. Determination of control system specifications for variations of system parameters in practical position control system.
10. a. Design of a second order linear time invariant control system and study of system response with unit step input.



b. Design a scheme for minimization of possible oscillation with generation of the dotted signal as shown below.



c. Generalization of the technique for oscillation free response based on above idea (b).

E. Teaching/Learning Practice Pattern:

Teaching: 50%

Learning: 40%

Practice: 10%

F. Examination Pattern:

1. Theoretical Examination: On line.
2. Practical Examination: Performing experiments and viva voce.

G. Books:

1. *Kuo B.C. Automatic Control System, Prentice Hall of India.*
2. *Das Gupta S: Control System Theory; Khanna Pub.*

3. *Nagrath I J & Gopal M: Control Systems Engineering, New Age International Pub.*
4. *Ogata K: Modern Control Engg. Prentice Hall of India.*
5. *Dorf R C & Bishop R.H.: Modern Control System; Addison – Wiley.*
6. *Bolton: Industrial Control & Instrumentation, Orient Longman.*
7. *Nakra: Theory & Applications of Automatic Control, New Age International.*
8. *Gopal: Modern Control System Theory, New Age International.*
9. *Gopal: Digital Control Engineering, New Age International.*
10. *Sinha: Control Systems, New Age International.*

H. Magazines:

1. *Industrial Electronics Magazine, IEEE.*
2. *Control and Automation Magazine, IEEE.*
3. *Process control and engineering, Elsevier.*
4. *Control and Automation Magazine, IET.*

I. Journals:

1. *Intelligent Systems, IEEE Transactions.*
2. *Journal of Control Theory and Applications, Springer Publications.*

Name of the Module: Smart Materials and Devices

Module Code: EE 406
Semester: 4th
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. concept and performance evaluation of different dielectrics,
2. familiarity with the characteristics of different types of insulation mediums used in Electrical Engineering and their breakdown phenomenon,
3. basic knowledge about the magnetic properties of the materials and their applications,
4. introduction to Semiconductor device and fabrication technologies, study of various effects and characteristics.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be well acquainted with the knowledge of types and property of each class of Insulators used in Electrical Engineering,
2. students will be able to select the insulation medium for particular purpose based on the requirements,
3. students will be made aware of fabrication technologies and advancements done in area of semiconductor devices.

C. Subject Matter:

UNIT-I

Dielectrics: Properties of static field. Static dielectric constant, polarization, dielectric constant of monoatomic gases & polyatomic molecules, internal fields in solids & liquids, Ferro electric materials, spontaneous polarization, piezoelectricity.

UNIT-II

Properties in alternating fields: Frequency dependence of electronic, ionic polarisability, complex dielectric Constant, dielectric loss, dipolar relaxation, breakdown in dielectrics. General properties of common dielectrics (Electrical, mechanical chemical and thermal). Gaseous dielectrics, liquid insulating materials, solid insulating materials, films.

UNIT-III

Conductors: Electron gas model of a metal, Relaxation time, collision time, mean free path, electron scattering & resistivity, heating effect of current, thermal conductivity, superconductivity, electrical conducting materials (Cu, Al) & their application. Mechanical properties like corrosion, solid curability, contact resistance.

UNIT-IV

Magnetic properties of materials: Magnetization, origin of permanent magnetic dipole moment, classification of Magnetic of materials, dia, para, ferro, anti-ferro & ferromagnetism, magnetic anisotropy, magneto-striction, Soft &hard magnetic materials for electrical applications. Semiconductors and Devices: Density of carriers in intrinsic semiconductor &in n-type & p-type semiconductor, conductivity, Hall effect, drift & diffusion current, Einstein relation.

D. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice: 50%
(Teacher is to divide components for T/R/P)

E. Examination Pattern

Theoretical Examination : Written

Practical Examination: Conducting experiments and viva-voce.

F. Books:

1. Electrical Engineering Material---Dekker A.J. (PHI)

2. A course in Electrical Engineering Material—Seth & Gupta

3. Electrical Engineering Material---Rajput A.K.

4. Electrical Engineering Material---C.S. Indulkar & S. Thiruvengadam.

G. Magazines:

1. Electrical Apparatus Magazine, Barks Publications

2. Electrical Magazine, Electricity Forum

H. Journals:

1. *DEIS, IEEE Transactions*
2. *Electrical Insulations, IET.*

Name of the Module: Industrial Management
Module Code: HSS 501
Semester: 5th
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting theoretical lectures with case discussion,
2. providing teaching with inclusive learning,
3. making students aware about the importance of this subject in their future career.

B. Learning Outcomes:

Upon completion of the subject:

1. students will be work with efficiency as they had knowledge of the subject,
2. with the backup knowledge their performance will definitely much better in their workplace.

C. Subject Matter:

UNIT I

Concept of Management: Various approaches to Management, Management as–anart, a Science, and a Profession, Managerial skills, Process o management, Planning-Mission, Goals, Strategy, Program and Procedure; Decision making-process ,decision making under risk and uncertainty, Models of decision making.

UNIT–II

Principles of Organization: Organizational Structure, span of control, staffing function with emphasis on, Performance Appraisal, Training and Development.

UNIT–III

Direction and coordination: Motivation and Leadership, control function-Process and Techniques.

UNIT–IV

Production Management: Types of Production, Locational Decisions, Plant layout and design, Production Planning scheduling and control: work study, method Study, and Wage Payment schemes and Bonus, Productivity–concept and measurement.

Material Management: Inventory Planning, Procurement-functions, procedures and control, storing-planning procedure and control, issue and pricing, Inventory control Techniques, Value analysis and Engineering.

D. Teaching/ Learning Pattern:

Teaching	: 50%
Learning/ case presentation	: 30%
Assignment	: 10%
Attendance	: 10%

E. Examination pattern:

Theoretical Examination	: 50
Class test	: 30
Assignment	: 20

F. Books:

1. Badiru ,A (ed),2005, Hand Book of Industrial and System Engineers, CRC press.

2. Blanch and, B& Fabrycky,W. 2005. System Engineering Analysis (4th Ed.). Prentice Hall.

3. Salvendy, G.(Ed.)2001.Hand Book Of Industrial Engineering: Technology &Operations Management, Wiley-Inter service.

4. Turner, W.et.al.1992 Introduction to Industrial and System Engineering (3rd ed.) Prentice Hall.

G. Magazine:

H. Journals:

1. *Group and Organization Management*
2. *Journal of Organizational Behaviour*
3. *Journal of Management.*

Name of the Module: Power System - II
Module Code: EE 501
Semester: 5th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

The course is designed to meet the objectives of:

1. introduces students to the concepts of performance of power system under various faults, like LG, LLG, LLL, LLLG etc. and their effects on power system, Single line diagram for fault analysis, tools for analyzing faults in power system, Symmetrical components, Unsymmetrical faults, PU system, Positive, Negative and Zero sequences components, Z bus formation,
2. study how to analysis the power system under various faults. And to solve this power system constraints which are the tools to make use of. Solving faults problems has become a new challenged to power Engineers,
3. to introduce the advent of powerful symmetrical components has become very useful tools to solve these constrains. Recognizing the importance of concepts of fault analysis in power system, this module is can be introduced in the Electrical Engineering curriculum.

B. Learning outcomes:

Following these course students will be able:

1. to do fault Analysis, this is the study of methods for solving problems of number of faults in power system,
2. to know symmetrical components and PU system and their implementation in solving power system faults.

C. Subject Matter:

UNIT I

Performance of transmission line. Introduction, short, Medium and long transmission line ,'Pi' and 'Tee' representation of medium transmission line with ABCD constants, Ferranti effect, Bundled conductor, transposition, skin effects and proximity effects.

Representation: Introduction, Balanced and unbalanced system, Single line diagram of balanced three phase networks, one line diagram of power system, Impedance or Reactance diagram, Per unit system, Equivalent circuit diagram of transmission line.

UNIT II

Symmetrical components: Introduction, operator, sequence impedance and sequence networks on power system, Transmission line, Transformers, Synchronous machine. Positive, Negative and zero sequences in power system.

UNIT III

Symmetrical Fault Analysis: Symmetrical faults in Transmission line, Transients in transmission line,Short circuit synchronous machine on load and on no load condition. Algorithm for short circuit studies. Formation and implementation of ZBUS in solving faults.

UNIT IV

Unsymmetrical Fault Analysis: Unsymmetrical faults in transmission line, Symmetrical components analysis of unsymmetrical faults. Single – line to ground (LG) fault, Line to line

(LL) fault, Double line to ground (LLG) faults, Open Conductor faults. Bus impedance matrix methods for analyzing of unsymmetrical faults.

D. Learning and teaching approach used:

Lecture	:	3 hours per week
Tutorial and Computer based simulation session	:	0 hour per week
Laboratory practical	:	2 hours per week
Self study	:	6 hours per week

E. List of Practical:

1. Study of various tools for solving faults in transmission line.
2. Modeling of transmission faults using MATLAB programming.
3. System faults analysis using Bus impedance matrix in MATLAB.
4. ZBUILD and SYMFAULT programs.
5. Single line to Ground (LG) fault using program.
6. Double line to Ground (LLG) fault using program.
7. Single line to Ground (LG) fault using program.
8. Line to line (LL) fault using program.
9. Unbalanced fault program.

F. Books:

1. *Modern Power Syatem Analysis – Nagrath and Kothari.- Tata McGraw-Hill*
2. *Electrical Power System – C. L Wadhwa- New Age International*
3. *Power Syatem Analysis – Hadi Saadat- Tata McGraw-Hill*
4. *MATLAB and its application in Engineering – Bansal, Goel and Sharma-Pearson*
5. *Electrical Power – Dr. S. L.Uppal -Khanna Publication*

G. Magazines:

1. *Electrical Today.*

H. Journals:

1. *IEEE Transactions on Power Delivery.*
2. *Power system letter.*

Name of the Module: Electrical Machine Design - I
Module Code: EE 502
Semester: 5th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objectives:

This module introduces students to the concepts of designing a machine for power system uses. This course will give a basic idea of:

1. various parts of electrical machines,(while in EE 503 & EE 604, the actual designing will be done), Cooling and heating of Machines, selection of machines, designing of windings, And Armature reaction and its effects on Machine performances,
2. how to build a new motor or Transformer with minimum cost. Recognizing the importance of designing machines, this module is can be introduced in the Electrical Engineering curriculum.

B. Learning Objectives:

Following these course students will be able:

1. to understand the basics of designing machines,
2. to design a smaller and large circular electromagnets,
3. to design a DC machine windings.

C. Subject Matter:

UNIT I

Principles of electrical Machine Design: Introduction, Design factors, Limitations in design, mechanical parts, Modern trends in design of electrical machine, Biot Savart's law, soft magnetic materials, Electrical steel sheets, Classification of insulating materials.

UNIT II

Cooling & heating of electrical machines, heat dissipation, temperature gradient,cooling of rotating electrical machine, Methods of cooling, induced and forced ventilation, temperature rise-time curve, rating and selection of machines, methods of measurement of temperature rise.

UNIT III

Magnetic circuit calculation, various losses in electrical machines, Electromagnets: design of magnetic coils, design of small and large circular magnets, design of friction clutch. Armature winding: DC armature winding design, Sequence diagrams, Lap and wave winding, concentric winding, reduction of eddy current in conductors in rotating machine.

UNIT IV

DC machine design: Constructional details, stator, poles, interpoles, main field winding, interpole winding, armature winding, commutator, methods of applying brushes to commutator. Design : output equation, choice of average gap density, choice of ampere conductor per meter, selection of number of poles, guiding factors for choice of no. of poles, length of air gap, estimation of air gap length. Armature Reaction: Introduction, flux distribution at load, effects of armature reaction, reduction of effect of armature reaction, armature design, choice of armature winding, number of armature slots, armature voltage drop, depth of armature core.

D. List of Practical:

1. Study of various parts of machines.
2. Designing a lap and wave winding for given problems.
3. Design of small circular magnets.
4. Design of large circular magnets.
5. Estimation of air gap length of given DC machine.
6. Design of armature slots.

E. Learning and teaching approach used:

Lecture	:	3 hours per week
Tutorial and Computer based simulation session	:	1 hour per week
Laboratory practical	:	0 hours per week
Self study	:	6 hours per week

F. Books:

1. A text book of machine design – R.S. Khurmi & J.K Gupta.
2. Electrical Machine design data book –A.S. & R. Palani
3. Electrical Machine Design – Nagrath & Kothari - Tata McGraw-Hill
4. Design of Electrical machine – Upadhyay – New Age international.
5. Design and testing of electrical machine – M.V. Deshpande - PHI learning pvt ltd.
6. A course in electrical machine designs - A.K. Sawhney – Dhanpat Rai & co.

I. Magazines:

1. *Electrical Today.*
2. *Electrical Machines and Drives.*
3. *Industrial Electronics.*

J. Journals:

1. *IEEE Transactions on Power Delivery.*
2. *Power system letter.*
3. *Power Electronics Letter.*

Name of the Module: Innovative and Creative Designing of Systems
Module Code: EE 503
Semester: 5th
Credit Value: 1 [P=2, T=0, L=0]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. designing of AC and DC machines, classification of armature windings,
2. study of transformer design and evaluation of losses and efficiency,
3. concepts of domestic wiring, distributors and feeders, and study of load curves,
4. make sound judgment in the designing of machine,
5. continue to advance their knowledge and assimilate new future technologies.

B. Learning Outcomes:

Students successfully completing this module will be:

1. adequately trained to design new machines of their own,
2. skilled for taking up research assignments related to designing of Electrical machines.

C. Subject Matter:

UNIT–I

DC machine design: Main dimensions, output equation, choice of number of poles, choice of type of winding, Design of commutator and brushgear, design of field poles and field windings.

UNIT–II

Armature windings: Basic principles and classification of armature windings, single layer and double layer windings, simple and multiple windings. Different types of AC windings, commutator windings, AC winding factors.

Fine Arts of Armature Windings: Scale drawing of different types of winding designs.

Armature reaction in AC machines, causes and elimination of harmonics. Skin effect and eddy current losses in armature conductors. Design of different types of motor starters, field regulators.

UNIT–III

Transformer design: Single-phase and three-phase main dimensions, core and winding design, magnetizing current, losses, reactance of windings, tank design. Fine Arts of Induction motor design: Three-phase-main dimensions. Stator and rotor windings. Calculation of no load and pull out currents. Torque and speed calculations. Distribution design: Fixing location of distribution transformer. Plotting of load curves and determination of maximum demand. Design of distributors and feeders. Design of domestic wiring.

UNIT-IV

Fine Arts in Transformer Designing: Drawing of shell type & core type transformer. Drawing of tanks with cooling tubes (round and rectangular).

Drawing of armature windings and slots for Squirrel cage motor, drawing of rotor bars, drawing of the parts of slip ring motor. Drawing of armature slots and windings, stator slots and winding for salient and non-salient pole synchronous machines.

D. List of Practical:

1. By simple experiment, verify the magnetic laws using Coil, permanent magnet and Galvanometer.
2. Verify the rotating magnetic field with stator and ball.
3. Measure magnetic flux using flux meter.
4. Design a 1 phase 1 KVA, 230/15V loading transformer and assemble the core.
5. Design 3 phase 1 KVA transformer and assemble winding, core, etc.,
6. Design 3 phase 1 KVA transformer (delta/star connected) and wind one coil set.
7. Design armature for 5 KW dc machine and insert one coil set.
8. Design field pole for 5 KW dc machine and assemble one pole and insert in the body.
9. Design and assemble ceiling fan.
10. Design and assemble a 3 HP induction motor

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)

F. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

G. Magazines:

1. Electrical Design.
2. Electricity Today, (T & D) Magazine.
3. Electrical Business Magazine.

H. Journals:

1. Power Apparatus and Systems (PAS), IEEE Transactions.
2. System Engineering and Electronics, Elsevier.
3. The Transactions of the Institute of Electrical Engineers of Japan.

Name of the Module: Embedded Systems
Module Code: EE 504
Semester: 5th
Credit Value: 3 [P=3, T=0, L=0]
Module Leader:

A. Objective:

The course is designed to meet with the objectives of:

1. analysis, optimization, and implementation of embedded systems,
2. enabling the students to adapt to a changing environment with the widespread use of embedded systems,

B. Learning Outcomes:

Upon completion of the subjects the students are expected to:

1. obtain the knowledge, skills and capabilities necessary for immediate employment in developing embedded systems,
2. be prepared for professional practice:
   a) as embedded engineers,
   b) as participants in embedded development teams, and
   c) as effective participants in a multidisciplinary team..

C. Subject Matter:

UNIT -I:

Introduction to Embedded Systems Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

UNIT -II:

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the Type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT -III:

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

UNIT -IV:

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling. Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

D. Books:

1. *Embedded Systems - Raj Kamal, TMH.*
2. *Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.*
3. *Embedded Systems – Lyla, Pearson, 2013*

4. *An Embedded Software Primer - David E. Simon, Pearson Education.*
5. *Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill*

E. Magazines:

1. *IEEE Embedded Systems Magazine.*
2. *Electronics Business Magazine.*
3. *IEE ASSP Magazine*

F. Journals:

1. *IEEE journal on selected Areas in communication.*
2. *Springer*
3. *IEEE Spectrum*
4. *Bell Systems Technical Journal*
5. *AT&T Bell Laboratory Technical Journal*
6. *Electronics Letter*
7. *International Journal of wireless Information Networks.*
8. *British Telecom Technological Journal*
9. *AT&T Technical Journals*

Name of the Module: Stochastic Process
Module Code: MAS 501
Semester: 5th
Credit Value: 4 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting theoretical knowledge and practical application to the students in the area of Stochastic Process,
2. introducing the basic notions of probability theory and develops them to the stage where one can begin to use probabilistic ideas in statistical inference and modeling, and the study of stochastic processes,
3. iroviding confidence to students in manipulating and drawing conclusions from data and provide them with a critical framework for evaluating study designs and results,
4. injecting future scope and the research directions in the field of stochastic process.

B. Learning outcomes:

Upon Completion of the subjects:

1. students will add new interactive activities to fill gaps that we have identified by analysing student log data and by gathering input from other college professors on where students typically have difficulties,
2. students will add new simulation-style activities to the course in Inference and Probability,
3. students will be substantially prepared to take up prospective research assignments.

C. Subject Matter:

UNIT I:

Theory of Probability: Random Experiment, Sample space; Random Events; Probability of events. Axiomatic definition of probability; Frequency Definition of probability; Finite sample spaces and equi probable measure as special cases; Probability of Non-disjoint events (Theorems). Counting techniques applied to probability problems; Conditional probability; General Multiplication Theorem; Independent events; Bayes' theorem and related problems.

Random variables (discrete and continuous); Probability mass function; Probability density function and distribution function. Distributions: Binomial, Poisson, Uniform, Exponential, Normal, t and $\chi 2$. Expectation and Variance (t and $\chi 2$ excluded); Moment generating function; Reproductive Property of Binomal; Poisson and Normal Distribution (proof not required). Transformation of random variables (One variable); Chebychev inequality (statement) and problems.

UNIT II:

Approximation Theory: Binomial approximation to Poisson distribution and Binomial approximation to Normal distribution (statement only); Central Limit Theorem (statement); Law of large numbers (Weak law); Simple applications.

UNIT III:

Sampling Theory: Population; Sample; Statistic; Estimation of parameters (consistent and unbiased); Sampling distribution of sample mean and sample variance (proof not required).

Estimation Theory: Point estimate, Maximum likelihood estimate of statistical parameters (Binomial, Poisson and Normal distribution). Interval estimation.

Testing of Hypothesis: Simple and Composite hypothesis; Critical Region; Level of Significance; Type I and Type II Errors; Best Critical Region; Neyman-Pearson Theorem (proof not required); Application to Normal Population; Likelihood Ratio Test (proof not required); Comparison of Binomial Populations; Normal Populations; Testing of Equality of Means; $\chi 2$—Test of Goodness of Fit (application only).

UNIT IV:

Correlation and Regression: Simple idea of bivariate distribution; Correlation and Regression; and simple problems.

D. Teaching/Learning/Practice Pattern:

Teaching : 70%
Learning : 30%
Practice: 0%
(Teacher is to divide components for T/R/P)

E. Examination Pattern:

Theoretical Examination & Open book examination.

F. Books:

1. *P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2000.*
2. *Khazanie, Ramakant. Basic Probability Theory and Applications Santa Monica, CA: Goodyear, 1976.*
3. *Ross, Sheldon M. Introduction to Probability Models, New York, NY: Academic Press, 1972, 1985. Third Edition.*
4. *S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.*
5. *Cramer, Harald. Random Variables and Probability Distributions, New York, NY: Cambridge University Press, 1970. Third Edition.*
6. *Parzen, Emanuel. Modern Probability Theory and Its Applications New York, NY: John Wiley, 1960.*
7. *Rothschild, V. and Logothetis, N. Probability Distributions New York, NY: John Wiley, 1986.*
8. *Bailey, Norman T.J. The Elements of Stochastic Processes with Applications to the Natural Sciences New York, NY: John Wiley, 1990.*
9. *Bhat, U. Narayan. Elements of Applied Stochastic Processes, New York, NY: John Wiley, 1984. Second Edition.*
10. *Karlin, Samuel and Taylor, Howard M. A First Course in Stochastic Processes, New York, NY: Academic Press, 1975. Second Edition.*
11. *Karlin, Samuel and Taylor, Howard M. A Second Course in Stochastic Processes New York, NY: Academic Press, 1981.*
12. *Medhi, Stochastic Processes, 3rd Ed., New Age International, 2009.*
13. *Ross, Sheldon M. Stochastic Processes New York, NY: John Wiley, 1983.*
14. *N.G. Das, "Statistical Methods", Vol-I & Vol-II, Mc Graw Hill.*
15. *Murray R. Spiegel, "Probability and Statistics", McGrawHll, Schaum's Outline Series.*

G. Magazines:

1. *Current Science (Indian Academy of Science)*
2. *The Mathematics Student (Math Student) (Indian Mathematical Society)*
3. *Mathematical Spectrum(The University of Sheffield)*
4. *Mathematics Magazine (Mathematical Association of America)*
5. *+Plus magazine (University of Cambridge)*
6. *Ganithavahini (Ramanujan Mathematical Society)*

H. Journals:

1. *Advances in Probability and Related Topics (Marcel Dekker)*
2. *Annals of Applied Probability (Institute of Mathematical Statistics)*
3. *Annals of Probability (Institute of Mathematical Statistics)*
4. *Communications on Stochastic Analysis*
5. *Electronic Journal of Probability*
6. *Séminaire de Probabilités (Lecture Notes in Mathematics, Springer-Verlag)*
7. *Stochastic Modelling and Applied Probability (Springer-Verlag) Stochastic Processes and their Applications*

Name of the Module: Power Electronics - II
Module Code: EE 505
Semester: 5th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objective:

The course is design to meet with the objectives of:

1. to study advanced topics of power electronics,
2. to study improved power quality ac-dc converters,
3. to study power quality mitigation devices,
4. to Study Different FACTS Devices,
5. to Study Different Types of HVDC Transmission.

B. Learning Outcomes:

Upon completion of the subjects:

1. design Different Power Electronics Circuits,
2. understand efficiency in Advanced Power Electronics Based Circuit Designing.

C. Subject Matter:

UNIT I

Advanced solid state devices: MOSFETs, IGBT, GTO, IGCT etc. Power modules, intelligent power modules, gating circuits. Thermal design, protection Digital signal processors used in their control. Non-isolated dc-dc converters: Buck, boost, buck-boost, Cuk, SEPIC, Zeta in DCM and CCM. Isolated dc-dc converters: Flyback, forward, Cuk, SEPIC, Zeta, half bridge, push-pull and bridge in DCM and CCM. Single-phase, single-stage converters (SSSSC), power factor correction at ac mains in these converters. Their application in SMPS, UPS, welding and lighting systems.

UNIT II

Single-phase improved power quality ac-dc converters: Buck, boost, buck-boost, PWM VSC (Voltage source converters), multilevel VSCs, PWM CSC (Current voltage source converters). Three-phase improved power quality ac-dc converters: VSC , multilevel VSCs, multipulse VSCs, PWM CSC (Current voltage source converters). Multipulse ac-dc converters: Diode and thyristor based converters.

UNIT III

Power quality mitigation devices: Passive filters, active filters, hybrid filters, DTSTCOM (Distribution static compensator), DVR (Dynamic voltage restorer) and UPQC (Universal power quality conditioner). 1. FACTS devices: TCR (Thyristor controlled reactor), TSC (Thyristor switched capacitors). STATCOM (Static synchronous compensator).SSSC(Static series synchronous compensator). UPFC (Unified power flow controller), IPFC (Interline power flow controller).

UNIT IV

HVDC (High voltage direct current) system: 12-pulse converter based HVDC systems. HVDC light, HVDC PLUS (Power universal link). Multi pulse and multilevel VSC based flexible HVDC systems. Solid state controllers for motor drives: Vector control and direct torque control of induction, synchronous, permanent magnet sine fed, synchronous reluctance

motors. Permanent magnet brushless dc (PMLDC) and switched reluctance motors. LCI (load commutated inverter) fed large rating synchronous motor drives. Energy conservation and power quality improvements in these drives.

D. List Of Practical:

1. Boost Converter
2. Buck Converter
3. Flyback Converter Design
4. Sine PWM simulation in Matlab
5. Space Vector PWM Simulation in Matlab
6. Vector Control Of Induction Machine
7. 12-pulse converter based HVDC systems designing.

E. Teaching Approach:

Lecture	: 3 hours per week
Tutorial and Computer based simulation session	: 0 hour per week
Laboratory practical	: 2 hours per week
Self-study	: 6 hours per week

F. Books:

1. R. S. Ramshaw, "Power Electronics Semiconductor Switches", Champman & Hall, 1993.

2. N. Mohan, T. M. Undeland and W. P. Robbins, "Power Electronics, Converter, Application and Design", Third Edition, John Willey & Sons, 2004.

3. M. H. Rashid, "Power Electronics, circuits, Devices and Applications", Pearson, 2002, India.

4. K. Billings, "Switch Mode Power Supply Handbook", McGraw-Hill, 1999, Boston.

5. A. I. Pressman, "Switch Mode Power Supply Design", McGraw-Hill, 1999, New York.

6. N. G. Hingorani and L. Gyugyi, "Understanding FACTS", IEEE Press, Delhi, 2001.

7. B. K. Bose, "Power Electronics and Variable Frequency Drive", Standard Publishers Distributors, 2000.

8. Bin Wu, "High-Power Converters and AC Drives", IEEE Press, A John Wiley & Sons, Inc Publication, New York,2006.

9. G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, second edition, 1994, Avarua, Rarotonga, Cook Islands.

10. R. C. Duagan, M. F. Mcgranaghan and H. W. Beaty, "Electric Power System Quality", McGraw-Hill, 2001, 1221 Avenue of the Americas, New York.

11. Vijay K. Sood, "HVDC and FACTS Controllers - Applications of Static Converters in Power Systems", Kluwer Academic Publishers, Masachusetts, 2004.

12. J. Arrillaga, Y. H. Liu and N. R. Waston, "Flexible Power Transmission-The HVDC Options", John Wiley & Sons, Ltd, Chichester, UK, 2007.

G. Journals

1. *Power Electronics Letter, IEEE.*
2. *IEEE Transactions on Power Electronics, IEEE.*
3. *International Journal of Power Electronics and Drives Systems.*
4. *Power System Control, Elsevier Trans*
5. *Automatic Control, IEEE*

Name of the Module: Power System Reliability
Module Code: EE 506
Semester: 5th
Credit Value: 4 [P=0, T=1, L=3]
Module Leader:

Objectives:

The course is designed to meet with the objectives of:

1. introduction to the Reliability assessment of power system,
2. reliability modelling of power system components.

A. Learning Outcomes:

Students successfully completing this module will be:

1. adequately trained to become Power System Engineers to work in area of Generation, Transmission and Distribution,
2. skilled both theoretically and practically to do transmission line modelling, fault calculations, repairing and maintenance works,
3. made aware of modern devices used for operation and control, and will be made substantially prepared for getting acquainted with new transmission technologies of HVDC and communication techniques like SCADA.

B. Subject Matter:

UNIT – I

Reliability Fundamentals – Introduction, Need for Reliability Engineering, Definition, Cause of Failure, Catastrophic Failures and Degradation Failures, Characteristics Types of Failures. Mission oriented and continuously operated systems, repairable and non-repairable systems. Useful life of Components, the exponential case of chance failures. Reliability measures- failure pdf, failure cdf, reliability function, hazard function, mean-time to failure (MTTF), *aposteriori* failure and survival probability. Data analysis.

Fundamental of Set Theory, Probability Theory, Random Variables, Discrete Distributions- Binomial and Poisson, Continuous Distributions: Gaussian, Exponential, Weibull, Gamma, and Log-normal. Stochastic Processes, Markov's Chains, reliability of repairable systems.

UNIT – II

Reliability Analysis of Series – Parallel Systems – Block Diagrams, K – out of M systems, OC an SC Failures, Standby Systems Analysis of Non –Series Parallel Systems – Cut Set Approach, Boolean Algebra, Baye's Theorem.

UNIT – III

Reliability Prediction, Reliability Allocation, Redundancy Techniques for Reliability Optimization.

UNIT – IV

Maintainability and Availability, Software Reliability, Reliability Testing, Economics of Reliability Engineering and Reliability Management.

Generating unit unavailability; Comparison of deterministic and probabilistic criteria; Recursive algorithm for capacity model building; Recursive algorithm for unit removal. Reliability of Substation- Effect of failure modes; Simulation of failure modes; Evaluation of reliability indices. Reliability of distribution systems.

C. Teaching Approach:

Lecture	: 3 hours per week
Tutorial and Computer based simulation session	: 1 hour per week
Self-study	: 6 hours per week

D. Books:

1. *Plant Maintenance and Reliability Engineering, N.V.S. Raju, Cengage Learning India.*
2. *Reliability Engineering, O.H. Pandey & Bhupesh, S.K. Kataria & Sons.*
3. *Reliability Engineering: Theory and Practice, Alessandro Birolini, Springer.*
4. *Matrix and Models in Software Quality Engineering, S.H. Kan, Pearson.*
5. *Reliability Engineering, K.C. Kapur and Petch, Wiley.*
6. *Reliability Evaluation of Power Systems, Roy Billinton and Ronald N. Allan , Springer.*

E. MAGAZINES:

1. Asia Electronics Industry.
2. Electricity Today T & D Magazine.

F. JOURNALS:

1. The journal of the institute of electrical and electronics engineers, Japan.
2. Electrical Power Systems Research, Elsevier Journal.
3. Energy Conversion, IEEE Journal.

Name of the Module: Electrical Estimating & Costing
Module Code: EE 507
Semester: 3rd
Credit Value: 5(P = 2, T = 1, L = 3)
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. to inculcate in the mind of students the real meaning of electrification,
2. calculation of various internal / external wiring parameters,
3. to give practical knowledge, on building wirings.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be well acquainted with the internal and external wiring estimates,
2. students will be well acquainted with the methods of designing of innovative wiring system,
3. students will be substantially prepared to learn about special techniques of estimations.

C. Subject Matter:

UNIT-I

Tools: - Screw drivers, Pliers, drilling machine, electrical symbols etc. Wires and wire splicing, sizes of wire, casing capping fitting, conduit pipe, GI and PVC. Lighting accessories:- fitting of switches, plugs, Isolators, MCB box, MCB switches, main switch, change over, control panel, switch boards, Bulbs, fans, florescent tubes, Compact Florescent lamp (CFL), LED. Protective devices:- Main features of a good protective devices.

UNIT-II

Estimating and conductor size calculation:- Introduction, Price catalogue, Schedules of rates, Labour rates. Current carrying capacity, segregation for circuits, Conductor sizes for domestic wiring, Conductor size calculation for UG cables and OH lines. Sizes of LT/HT poles.

UNIT-III

Internal wiring:-Type of wirings, Casing capping wiring, wooden beat wiring and PVC/GI conduit wirings. Earthing, Recognition of building plan for wiring, Estimation for T-I,T-II,T-III,T-IV buildings, estimation of G+2, G+3.

UNIT-IV

External Electrification:- Poles, and other components like cross arms, disc insulators, conductors, etc. Service connection:- Its type and estimation using SR. Estimation for LT distribution and street light fittings. Extracts from Indian Electricity Amendment rules 1972/1956. Estimates for 11 kV feeders and substations.

D. List of Experiments:

1. Design a four points switch box with three pin for plug with electrical tools in PVC switch box.
2. Design a test lamp system, and test in 230 volt, using holder and wire.
3. Estimate the electrification of given room, with all components considered, in micro soft excel.
4. Estimate the electrification of given four rooms with proper circuit separation, using given SoR.
5. Estimate the cost of internal electrification for G+4 building.
6. Estimate the cost of service connection of the given building, using proper SoR.
7. Estimate the cost for 2.5 kM LT lines, feed from step down transformer.

8. Estimate the cost of 200 kM HT line with 11kV line with step down transformer.

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

F. Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

G. Boo

ks:

1. Electrical wiring, Estimating and costing, by S.L. Uppal.
2. Electrical wiring, Estimating and costing, by K.B. Bhatia.
3. A course in Power system, by J.B. Gupta.
4. Principal of Power System, by V.K Mehta.
5. Schedule of rates, Delhi, DGSN, Arunachal Pradesh, APH &WCL

H. Magazines:

1. EE Times.
2. Electricity Today T & D Magazine.
3. Electrical Contractor, National Electrical Contractor Association, USA.

I. Journals:

1. The journal of the institute of electrical and electronics engineers, Japan.
2. Electrical Power Systems Research, Elsevier Journal.
3. Energy Conversion, IEEE Journal

Name of the Module: Computer Aided Electrical System Design
Module Code: EE 601
Semester: 6th
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. OBJECTIVE:

The course is design to meet with the objectives of:

1. to familiarize students with the concepts of electric drives,
2. to study DC Drives,
3. to study AC Drives,
4. to provide in-depth knowledge of power converters fed AC and AC drives in open and closed loop,
5. control of Different AC and DC Drives.

B. Learning Outcomes:

Upon completion of the subjects:

1. design a Power Electronics Converters,
2. configure or design a Drives,
3. understand efficiency of Different Drives.

C. Subject Matter:

Unit I

Introduction: Conventional design procedures - Limitations - Need for field analysis based design – Review of Basic principles of energy conversion - Development of Torque/Force.

Unit II

Mathematical Formulation Of Field Problems: Electromagnetic Field Equations - Magnetic Vector/Scalar potential - Electrical vector /Scalar potential - Stored energy in Electric and Magnetic fields - Capacitance - Inductance- Laplace and Poisson's Equations - Energy functional.

Unit III

Philosophy of Numerical Methods: Mathematical models - Differential/Integral equations - Finite Difference method - Finite element method - Energy minimization - Variation method- 2D field problems - Discretization - Shape functions - Stiffness matrix - Solution techniques.

CAD: Elements of a CAD System -Pre-processing - Modeling - Meshing - Material properties- Boundary Conditions - Setting up solution - Post processing.

Unit IV

Computer Aided Manufacturing (CAM): Introduction to Computer Numerical Control (CNC), Structure of NC machine tools, Designation of axes, Drives & actuation systems, Feedback devices, CNC tooling, Automatic tool changers & Work holding devices. Design applications: Voltage Stress in Insulators - Capacitance calculation - Design of Solenoid Actuator - Inductance and force calculation - Torque calculation in Switched Reluctance Motor.

D. Teaching Approach:

Lecture	: 3 hours per week
Tutorial and Computer based simulation session	: 0 hour per week
Laboratory practical	: 0 hours per week
Self-study	: 6 hours per week

E. Books:

1. S.J Salon, 'Finite Element Analysis of Electrical Machines', Kluwer Academic Publishers, London, 1995.
2. Nicola Bianchi, 'Electrical Machine Analysis using Finite Elements', CRC Taylor&Francis, 2005.
3. Joao Pedro, A. Bastos and Nelson Sadowski, 'Electromagnetic Modeling by finite Methods', Marcell Dekker Inc., 2003.
4. P.P.Silvester and Ferrari, 'Finite Elements for Electrical Engineers', Cambridge university press,1983.
5. D.A.Lowther and P.P Silvester, 'Computer Aided Design in Magnetics', Springer, verlax new York, 1986.
6. Ibrahim Zeid and Sivasubramanian, R., CAD/CAM Theory and Practice, Tata McGraw Hill Publications, New Delhi, 2009.
7. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill Publications, 2005.
8. Rao, P.N., CAD / CAM Principles and Applications, McGraw Hill Publishers, New Delhi, 2010.

Name of the Module: Engineering Ethics &IPR
Module Code: HSS 601
Semester: 6th
Credit Value: 3 [P=0, T=0, L=3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting theoretical lectures with case discussion,
2. providing teaching with inclusive learning,
3. making students aware about the importance of this subject in their future

B. Learning outcomes:

Upon completion of the subject:

1. students will be able to work with efficiency as they had knowledge of the subject,
2. with the backup knowledge their performance will definitely be much better in their workplace.

C. Subject Matter:

Third, Values & Ethics (VE): Society deserves to have its future engineers ethically sound and valued oriented. Values make one to take decision about right and wrong, should and shouldn't, good and bad. Values help one to understand which are more or less important, which is useful when we have to trade off meeting one value over another. Without having understood the subject of values, the integrity of engineers will not reach up to the expected level that makes it essential to introduce the subject in engineering. DA pamphlet: said "Values are what we, as a profession, judge to be right." Doing what is right or wrong is what we mean by ethics. To behave ethically is to behave in a manner consistent with what is right or moral. Teaching values will add to integrity, professionalism, caring, teamwork, stewardships and socially responsible.

D. Teaching/ Learning:

Teaching	: 50%
Learning/ case presentation	: 30%
Assignment	: 10%
Attendance	: 10%

E. Examination pattern:

Theoretical Examination	: 50
Class test	: 30
Assignment	: 20

F. Books:

1. Chowdhury, Subir, Blending the best of the East & West, EXCEL
2. Ghosh, Vikas, Ethics and Mgmt. & Indian Ethos,
3. Pherwani, Business Ethics, EPH
4. Balachandran Raja, Nair, Ethics, Indian Ethos and Mgmt., Shroff Publishers
5. Velasquez, Business Ethics: concept and cases, Pearson

G. Magazine:

1. Industry Week

H. Journals:

1. *Journal of Business Ethics*
2. *The Journal of Ethics*

3. *Ethics, University of Chicago Press*
4. *Kennedy Institute of Ethics Journal*
5. *Journal of Global Ethics*

Name of the Module: Disaster Management
Module Code: HSS 602
Semester: 6th
Credit Value: 2 [P=0, T=0, L=2]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting theoretical lectures with case discussion,
2. providing teaching with inclusive learning,
3. making students aware about the importance of this subject in the future prospect.

B. Learning outcomes:

Upon completion of the subject:

1. students will be able to work with efficiency as they had knowledge of the subject,
2. with the backup knowledge their performance will definitely be much better in their workplace.

C. Subject Matter:

UNIT I:

Introduction: Disaster preparedness, Goals and objectives of ISDR Programme, Risk identification, Risk sharing. Disaster and development: Development plans and disaster management. Alternative to dominant approach, disaster-development linkages, Principle of risk partnership.

UNIT II:

Disaster management and risk reduction in garment industry: Types of disasters and disaster plans: Processing machines and utilities. Sustainable livelihoods and their Protection – Recovery from disaster –fire, boiler mishap. Garment Industry health monitoring and Disaster aids.

UNIT III:

Awareness of risk reduction: Trigger mechanism, constitution of trigger mechanism, risk reduction by education, disaster information network, and risk reduction by public awareness.

UNIT IV:

Development planning on disaster: Implication of development planning, financial arrangements, areas of improvement, disaster preparedness, and community based disaster management, emergency response. Seismicity: Seismic waves, Earthquakes and faults, measures of an earthquake, magnitude and intensity ground damage, Tsunamis and earthquakes.

D. Teaching/ Learning/Practice Pattern:

Teaching	: 50%
Learning/ case presentation	: 30%
Assignment	: 10%
Attendance	: 10%

E. Examination pattern:

Theoretical Examination	: 50
Class test	: 30
Assignment	: 20

F. Books:

1. *Pardeep Sahni, Madhavi Malalgoda and Aariyabandu, Disaster risk reduction in south Asia, PHI, 2009*
2. *Amita Sinvhal, Understanding Earthquake Disasters, TMH, 2010.*
3. *MHA, GOI-UNDP, Disaster Management in India, 2009*
4. *NDMA, 'Incident Response Guidelines', 2009*
5. *Disaster Management Act, 2005.*

G. Magazines:

H. Journals:

1. *Asian Journal of Environment and Disaster Management.*
2. *International Journal of Disaster management.*
3. *IDRIM Journal.*
4. *Journal of Disaster Risk Studies.*
5. *Emergency Management Review.*

Name of the Module: Electrical Drives
Module Code: EE 602
Semester: 6th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:

A. Objective:

The course is design to meet with the objectives of:

1. to familiarize students with the concepts of electric drives,
2. to study DC Drives,
3. to study AC Drives,
4. to provide in-depth knowledge of power converters fed AC and AC drives in open and closed loop,
5. control of Different AC and DC Drives.

B. Learning Outcomes:

Upon completion of the subject, the students will be able to:

1. design a Power Electronics Converters,
2. configure or design a Drives,
3. understand efficiency of Different Drives.

C. Subject Matter:

UNIT I

Introduction: Definition of electric drive, type of drives; Speed torque characteristic of driven unit/loads, motors, joint speed-torque characteristic; Classification and components of load torque. Heating and cooling of motors, operating duty cycles. Choice of couplings and bearings. Acceleration time, energy loss in starting. Effect of flywheels. Review of power converters used in drives, multi-quadrant operation of electric drive, example of hoist operation in four quadrant.

Speed Control of Motors: Review of braking and speed control of dc motor and induction motor, multi-quadrant operation, loss minimization in adjustable speed drives.

DC Drives: Single-phase half controlled and fully controlled converter fed dc motor drives, operation of dc drives with continuous armature current, voltage and current waveforms; Concept of energy utilization and effect of freewheeling diode; Operation of drive under discontinuous current, expression for speed-torque characteristic.

Chopper fed DC Drives: Principle of operation and control techniques, chopper circuit configurations used in dc drives: Type A, B, C, D and E; Motoring operation of chopper fed separately excited dc motor, steady state analysis of drive with time-ratio control.

Closed Loop Control of DC Drives: Drives with current limit control, single-quadrant closed loop drive with inner current control loop, advantage of inner current control loop in drives, Brushless DC motor drive.

UNIT II

Stability Analysis: Mathematical modelling of induction motor drives, transient response and stability analysis.

AC Drives: Variable voltage, rotor resistance and slip power recovery control of induction motors, torque-speed characteristics under different control schemes; Variable frequency

control of induction motor, analysis of induction machine under constant V/f operation, constant flux operation and controlled current operation.

Inverter fed AC Drives: Voltage source inverter fed induction motor drive in open loop, frequency and voltage control in PWMVSI; Operation of closed loop slip-speed controlled VSI fed induction motor drive; Current source inverter, advantage of CSI fed drives, closed loop slip speed controlled CSI fed drive

FOC-IM Drive: Drive configuration, mathematical modeling, direct and indirect FOC, influence of parameters, VSI and CSI fed schemes, adaptive drive control

UNIT III

Synchronous Motor Drives: Introduction to Synchronous motors, Operation from fixed frequency supply, Synchronous motor variable speed Drives, Variable Frequency control of multiple synchronous motors, Self-controlled synchronous motor drive employing load, Starting large synchronous machines, Self-controlled synchronous motor drive employing a Cyclo converters, PMAC motor drive

Brushless DC Drive: Self control, CSI with load commutation, low speed commutation, inverter control strategies and performance.

Permanent Magnet SM Drive: Principle of operation, converter configuration, synchronization, trapezoidal and sinusoidal drive control structures and performance.

Switched Reluctance Motor Drive: Principle of operation, converter circuits, sensors, speed control and performance.

UNIT IV

Estimation of Drive Motor Rating: Selection of motor power capacity for continuous duty at constant load and variable loads; Selection of motor capacity for short time and intermittent periodic duty, permissible frequency of starting of squirrel cage motor for different duty cycles.

D. List Of Practical:

1. Study of Phase – Controlled Rectifier (Full Converter) Based Dc Motor Drive.
2. Study of Dc – Chopper Based Dc Drives
3. Study of IGBT Based 3-Phase Induction Motor Drive.
4. Generation of PWM Control Signal for MOSFET Inverter Using Microcontroller.
5. Generation of PWM Control Signal For MOSFET Inverter Using Dsp(Tms320050).
6. Pspice Simulation Of MOSFET Chopper Based Dc Drives.
7. Pspice Simulation Of MOSFET Inverter Based Induction Motor Drive.

E. Teaching Approach:

Lecture	: 3 hours per week
Tutorial and Computer based simulation session	: 0 hour per week
Laboratory practical	: 2 hours per week
Self-study	: 6 hours per week

F. Books:

1. Dubey G. K., "Fundamentals of Electric Drives", 2nd Ed., Narosa Publishing House. 2007

2. Pillai S. K., "A First Course in Electric Drives", 2nd Ed., New Age International Private Limited.2008

3. Sen P. C., "Thyristor DC Drives", John Wiley and Sons. 1991

4. Dubey G. K., "Power Semiconductor Controlled Drives", Prentice Hall International Edition. 1989

5. Murphy J. M. D. and Turnbull F. G., "Power Electronics Control of AC Motors", Peragmon Press. 1990

6. Bose B. K., "Power Electronics and Variable Frequency Drives", IEEE Press, Standard Publisher Distributors.2001

7. Krishnan R., "Electric Motor Drives – Modeling, Analysis and Control", Prentice Hall of India Private Limited.

8. Leonard W., "Control of Electric Drives", Springer Press.

G. JOURNALS AND MAGAZINE:

1. *Power Electronics Letter, IEEE.*
2. *IEEE Transactions on Power Electronics, IEEE.*
3. *International Journal of Power Electronics and Drives Systems.*
4. *Power System Control, Elsevier Transactions*
5. *Automatic Control, IEEE*

Name of the Module: Power System Operation and Control
Module Code: EE 603 (I-Course)
Semester: 6th
Credit Value: 4[P=3, T=0, L=3]
Module Leader:
Module Tutor(s):

A. Objectives:

The course is designed to meet with the objectives of:

1. to have an overview of power system operation and control,
2. model power frequency dynamics to design power frequency controllers,
3. model reactive power-voltage interaction and the control actions to be implemented for maintaining voltage profile against varying system load.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to become Operation Engineers in field of Process Control,
2. students will be skilled theoretically about designing and operation of control systems employed in various industries,
3. students will be substantially prepared to take up prospective research assignments

C. Subject Matter:

UNIT-I

Economic Operation of Energy Generating Systems: Introduction, Input-output characteristics of thermal and hydel power plants, Incremental fuel cost (IFC) curve, Constraints in economic operation of power system, Analytical approach to determine the economic dispatch problem (without losses and with losses), Loss co-efficient, Transmission loss formula, Derivation of real and reactive power governed loss formula.

Optimal power flow using N-R method, Gradient method and linear programming method.

UNIT-II

Power System Load Flow: Sparse matrix techniques. AC/DC power flow studies, Optimal power flow analysis Unit Commitment: Introduction to dynamic programming, Unit commitment using dynamic programming method Load Frequency Control: Automatic load frequency control (ALFC), Turbine speed governing system, Steady-state performance of the speed governing system, Responses of primary ALFC loop (steady-state and transient), Extension of ALFC loop to multi-area systems (two area only), Tie line power flow model

UNIT-III

Hydro-thermal Scheduling: Optimum scheduling of hydro-thermal system, Aspects of hydro scheduling, Cost of water, Long-term energy scheduling in a hydro-thermal system, Short-term hydro thermal scheduling, Hydro-thermal scheduling with network losses considered, A modern approach to hydro-thermal scheduling.

UNIT-IV

State Estimation: Static as well as dynamic Deregulation: What is deregulation? Background to deregulation and current situation, Benefits of a competitive electricity market.

D. List of Practical:

1. Visit local substation
2. Intro to PSCAD/EMTDC and Understanding of Reactive Power and Power Factor Correction in AC Circuits
3. Transmission Line and Modeling
4. Performing Power Flow Studies.
5. Newton Raphson method of load flow analysis using Matlab software
6. Gauss Seidal Load Flow analysis using Matlab software.
7. Including an HVDC Transmission Line for Power Flow
8. Power Quality, Explanation of THD
9. Synchronous Generators
10. Voltage Regulation
11. Transient Stability
12. Making a Power System Reliable
13. AGC and Economic Dispatch
14. Short Circuit Faults and Overloading of Transmission Lines
15. Fault Analysis with Relay Settings
16. Switching Over-Voltages and Modeling of Surge Arresters

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)
(Some experts will deliver talks)

F. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. *Abhijit Chakrabarti, and Sunita Halder, Power System Analysis: Operation and Control, India: Prentice Hall.*
2. *D.P. Kothari, and I.J.Nagrath, Modern Power System Analysis, India: Tata McGraw Hill, 3rd edition.*
3. *O.I.Elegard, Electric Energy Systems Theory, An Introduction, India: Tata McGraw Hill, 2nd edition.*
4. *Mahalanabis, A.K., Kothari, D.P. and Ahson, S.I., "Computer Aided Power System analysis and Control", TMH, New Delhi, 1988.*
5. *Indulkar, C.S. and Kothari D.P., "Power System Transients: A Statistical Approach", Prentice Hall of India, New Delhi, 1996.*

H. Magazines:

1. Control and Automation Magazine, IEEE.
2. Control Systems Magazine, IEEE.
3. Control and Automation Magazine, IET.

I. Journals:

1. Control Systems Technology, IEEE Transactions.

2. Power System Control, Elsevier Transaction.

Name of the Module: Machine Design Using Numerical Technique
Module Code: EE 604
Semester: 6th
Credit Value: 4 [P=2, T=0, L=3]
Module Leader:
Module Tutor(s):

A. Objectives:

The course has been designed to fulfil the following outcomes:

1. to study MMF calculation and thermal rating of various types of electrical machines,
2. outline Of Electromagnetic Fields Vector Analysis Electromagnetic Fields Fundamental Equations,
3. basic Principles Of Finite Element Methods and Introduction Field Problems with Boundary Conditions Classical Method for the Field Problem Solution,
4. applications of the Finite Element Method to Two-Dimensional Fields,
5. to design core, yoke, windings and cooling systems of transformers,
6. to design stator and rotor of induction machines,
7. to design stator and rotor of synchronous machines and study their thermal behavior.

B. Learning outcomes:

Upon completion of course students will be:

a. acquainted with the concept of design of various types of electrical machines
b. conversant with the fundamentals and common procedures, Electrical Machine Analysis Using Finite Elements offers a superior analytical framework that allows one to adapt to any electrical machine, to any software platform, and to any specific requirements that you may encounter.

C. Subject Matter:

UNIT -I:

MODELLING OF ELECTRO STATIC AND MAGNETIC DEVICE.

Modelling with respect to the time, Static problems, Quasi- static problems, Time-varying problems, transient, time domain, Frequency domain, Time-harmonic problems,

Geometry modelling: - Reduction of the geometrical dimensions, Boundary conditions, Transformations.

UNIT -II:

TRANSFORMERS

Output Equations – Main Dimensions - KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

INDUCTION MOTORS

Output equation of Induction motor – Main dimensions – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of poly phase machines- Magnetizing current - Short circuit current – Circle diagram - Operating characteristics.

SYNCHRONOUS MACHINES

Output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators – Rotor design

UNIT -III:

EXAMPLE OF COMPUTED MODELS

Electromagnetic and electrostatic devices, Synchronous machine excited by permanent magnet, Static analysis, Sequential analysis, Loading method, End-winding reactance, Electromagnetic shielding, Thin iron plate elements, Impedance boundary condition, Permanent magnet mini-motors, 4-pole motor with block shaped magnets, Mini disc-type motor, Design of electrostatic micro motors, Coupled thermo-electromagnetic problems, Three Phase High voltage power cables, Coupled simulation for electrical machines, Modelling of thermal contact resistances

UNIT -IV:

NUMERICAL OPTIMIZATION

Electromagnetic optimization problems, Optimization problem definition, Methods, Non-stochastic direct search algorithms, Strategy of Hooke and Jeeves , A theoretical optimization, Stochastic direct search algorithms, Simulated annealing, Self-adaptive evolution strategy, Differential evolution, Indirect methods, Response surface methodology and design of experiments, General response surface methodology , Adaptive coupling of evolution strategy and multi quadrics approximation. Shape optimization for small DC motor, Pole shape optimization of a synchronous, generator, Optimization of an actuator using a magnetic equivalent circuit model, Design of a lifting magnet.

D. List of Practical:

1. Study of various parts of transformer.
2. Designing a transformer core.
3. Design of insulation for transformer.
4. Design of yoke for transformer.
5. Design of tank and tube for transformer.
6. Design of choke.
7. Design of welding transformer.
8. Design of Current transformer.

E. Teaching Approach:

Lecture	: 3 hours per week
Tutorial and Computer based simulation session	: 0 hour per week
Laboratory practical	: 0 hours per week
Self-study	: 6 hours per week

F. Books:

1. *Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.*
2. *Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.*
3. *A.Shanmugasundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age Intenational Pvt. Ltd., Reprint 2007.*
4. *Nicola Bianchi "Electrical Machine Analysis Using Finite Elements" CRC PRESS.*
5. *Kay Hameyer, Ronnie Belmans "Numerical Modelling and Design of Electrical Machines and Devices", WIT Press.*
6. *Clayton A E & Hancock N N: The Performance and Design of Direct Current Machines; CBS Publishers and Distributors.*
7. *Say M G: The Performance and Design of Alternating Current Machines; CBS Publishers and Distributors.*

G. Magazines:

1. Electricity Today T & D Magazine

H. Journals:

1. The journal of the institute of electrical and electronics engineers, Japan.
2. Electrical Power Systems Research, Elsevier Journal.
3. Energy Conversion, IEEE Journal.
4. International Journal of Machine Tools and Manufacture.
5. Journal of Manufacturing Science and Engineering, Transactions of the ASME

Name of the Module: Mass Communication for Technology
Module Code: HSS 701
Semester: 7th
Credit Value: 3[P=0, T=0, L-3]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. imparting theoretical lectures with case discussion,
2. teaching with inclusive learning,
3. making students aware about the importance of this subject in their future career.

A. Learning Outcomes:

Upon completion of the subject:

1. students will be able to work with efficiency as they had knowledge of the subject,
2. with the backup knowledge their performance will definitely much better in their workplace.

B. Subject Matter:

Fourth, Dissemination of Scientific & Technical knowledge (DSTK): Difficulties with distribution of scientific and technical information is rapid increasing with unprecedented spade of science and technology. Further, engineers are made to meet with this challenge. The subject should cover the knowledge so as to establish adequate and effective distribution of information. Lack of information cannot make a sound engineer. Engineers should be specialists in information dissemination for which a course on DSTK is of paramount importance. Engineers should be made to write articles and research papers fluently and confidently. They should be taught to organize seminar and conferences deliver talks as well in the seminars and conferences. They should also be taught the technique of publishing magazines and journals. DSTK should be a subject of 4th year.

C. Teaching/ Learning/ Practice Pattern:

Teaching	: 50%
Learning/ case presentation	: 30%
Assignment	: 10%
Attendance	: 10%

D. Examination pattern:

Theoretical Examination	: 50
Class test	: 30
Assignment	: 20

E. Books:

1. *Murthy, D.V.R. Development of Journalism, Dominant Publishers, 2001*
2. *Naarula, Uma. Development Communication Theory and Practice, Har-Anand Publication Ltd New Delhi; 1990.*
3. *Sharma, Suresh Chandra, Media Communication and Development, Rawat Publication, 1987.*
4. *UNESCO, 'Different Theories and Practice', 1982.*

F. Magazines:

G. Journals:

1. *Mass Review*
2. *Journal of Communication Studies*
3. *Mass Communication and Society*

4. *Journal of Mass Communication*

Name of the Module: Computer Aided Power System Analysis
Module Code: EE 701
Semester: 7th
Credit Value: 3[P=2, T=0, L=2]
Module Leader:

A. Objectives:

The course is designed to meet with the objectives of:

1. introduction to the modelling of power equipment, power flow equations and formation of Y-bus matrix,
2. study of various power flow solution algorithms and their use in AC/DC Power System analysis,
3. study of symmetrical and asymmetrical faults,
4. stability analysis and use of digital computer in power system solutions.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to work with MATLAB for modeling of power flow problems,
2. students will be skilled to work as Power System Engineers and to do fault analysis of the system with help of software like MATLAB, PSSE, DiG-Silent, etc.,
3. students will be substantially prepared to take up relevant research works.

C. Subject Matter:

UNIT I

General Introduction: Modern Power Systems Operation and Control, Different types of Power System
Analysis.

UNIT II

AC Power Flow Analysis: Introduction, Modelling of Power System Components, Power Flow Equations, Formation of Ybus Matrix, Power Flow Solution Algorithms: Gauss – Siedel Load Flow Method, Newton Raphson Load Flow Method, Fast Decoupled Load Flow Method And DC Load Flow Method, AC-DC System Power Flow Analysis Sequential and Simultaneous Solution Algorithms.

UNIT-III

Sparse Matrices: Sparsity directed Optimal Ordering Schemes, Solution Algorithms-LU Factorization, Bi-factorization and Iterative Methods.

UNIT-IV

Analysis of Faulted Power System: Symmetrical and Asymmetrical Faults, Zbus Formulation, Short Circuit Analysis of Large Power Systems using Zbus, Analysis of Open Circuit faults. Stability Analysis: Classification of Power System Stability, Swing equation and its solution, Classical Model of Synchronous Machines and Excitation System, Transient Stability Analysis of Multi-Machine Systems, equal area criterion, Eigen Analysis of Dynamical Systems, Small Signal Stability Analysis using Classical Model. Basic Concepts of Voltage Stability Analysis –causes of voltage instability, analysis of static voltage stability, sub synchronous resonance in power system.

D. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%

Practice : 50%
(Teacher is to divide components for T/R/P)

E. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

F. Books:

1. Modern Power System Analysis by I.J. Nagrath & D.P. Kothari.
2. Power System Analysis and Design with Personal Computer Application by J.D. Glover and M. Sharma, PWS– KENT Publishing Company.
3. Computer Techniques to Power System Analysis by M.A. Pai.
4. Power System Analysis by J.J. Grainger and W.D. Steverson, MGH.
5. Electrical Power Systems by C.L. Wadhwa.
6. Power System Analysis and Design by B.R. Gupta.
7. Computer methods in power system analysis by G.W. Stagg and A.H. Liabiad.

G. Magazines:

1. IEEE Spectrum.
2. E & T Magazine, IET, U.K.
3. Power and Energy Magazine, IEEE.

H. Journals:

1. Power and Energy Society, (PES) IEEE Transactions.
2. Electrical Power Systems Research, Elsevier.
3. Electrical Power Systems Research, Taylor and Francis.

Name of the Module: High Voltage Engineering
Module Code: EE 702
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:
Module Tutor(s):

A. Objectives:

The course focuses to make students capable to:

1. design a simple protection system for a section of a power system, such as a feeder, a transformer or a motor,
2. select appropriate hardware for certain applications in power system protection and high voltage engineering,
3. describe the principles of the generation and measurement of high voltage AC, DC and impulse voltages,
4. describe the fundamentals of breakdown and partial discharge in insulating solid and gas at high voltages,
5. appreciate the advantages of new technological solutions in new and existing power system installations.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be trained with the HV testing methodologies particular to the type and class of devices,
2. students will be made well acquainted to International Standards of Designing and Testing,
3. students will be substantially prepared to take up prospective research assignments.

C. Subject Matter:

UNIT-I

Over voltages in Electric power systems, Causes of over voltages and its effect on power system – Lightning, switching surges and temporary over voltages-protection against over voltages.

UNIT-II

Electrical Breakdown in Gases, Solids and Liquids, Gaseous breakdown in uniform and non-uniform fields–corona discharges –Vacuum breakdown -conduction and breakdown in pure and commercial liquids–breakdown mechanisms in solid and composite dielectrics. Partial discharge phenomenon and its detection.

UNIT-III

Generation of High Voltages and High Currents, Generation of High DC, AC, impulse voltages and currents. Triggering and control of impulse generators.

UNIT-IV

Measurement of High Voltages and High Currents, Measurement of High voltages and High currents –

Digital techniques in high voltage measurement.

High Voltage Testing & Insulation Coordination, High voltage testing of electrical power apparatus – power frequency, impulse voltage and DC testing–International and Indian standards.

D. List of Practical:

1. Theoretical analysis of the design of a high voltage test laboratory and equipment.
2. Measurement of HVAC using capacitive potential divider and determining the value of unknown capacitor.
3. Measurement of HVAC using Sphere Gaps with consideration of air density correction factor.
4. Determination of flashover voltage of pin type and string type insulators.
5. Measurement of HVDC using Sphere Gap.
6. Generation of HV Impulse waveforms and analysis using Digital Storage CRO. (Positive and Negative waveforms).
7. Generation of Front Chopped and Tail Chopped HV Impulse wave-shapes.

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)

F. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. *M.S. Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, 3rd Edition, 2004.*
2. *E. Kuffeland, W.S. Zaengl, 'High Voltage Engineering Fundamentals', Pergamon press, Oxford, London, 1986.*

H. Magazine:

1. Electrical Insulation Magazine, IEEE.
2. Dielectrics, IET Magazine.
3. E & T, IET, U.K.

I. Journals:

1. DEIS (Dielectric and Insulation Systems), Kolkata Chapter, IEEE.
2. Power and Energy Society, IEEE Transactions.
3. Power Delivery (PD), IEEE Transactions.
4. Journal of Power, Korea Power National Institute.

Name of the Module: Power Plant Engineering
Module Code: EE 703
Semester: 7th
Credit Value: 2[P=0, T=0, L=2]
Module Leader:
Module Tutor(s):

A. Objectives:

The course is designed to meet with the objectives of:

1. students will become familiar with power plant systems, terms and definitions and basic power plant engineering design calculations,
2. students will become familiar with the proper design and application of power plant related equipment,
3. Students will become familiar with methods of diagnosing and correcting equipment mis-operation or misapplication,
4. students will become familiar with recognized standards utilized in the design and operation of power plant equipment,
5. students will prepare and present topical issues relevant to power plant design and operations.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to become Power Plant Engineers,
2. students will be skilled theoretically and practically design of various power plant, operation, maintenance and repairing works,
3. students will be substantially prepared to take up prospective research assignments.

C. Subject Matter:

UNIT I:

INTRODUCTION TO POWER PLANTS & BOILERS

Layout of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants-Combined Power Cycles– Comparison and Selection, Load Duration Curves.

Steam Boilers and Cycles–High Pressure and Super Critical Boilers–Fluidised Bed Boilers

UNIT II:

STEAM POWER PLANT

Different systems of thermal power plant: fuel, air and flue gas systems, pulverisers, Condensate and feedwater system, Construction and functioning of condenser, deaerator and closed feed water heaters, HP - LP By-pass systems, Auxiliary Steam System, Turbine gland steam system. Cooling water system, Cooling Towers—principle of operation and types, Ash handling, electrostatic precipitators.

NUCLEAR AND HYDEL POWER PLANTS

Nuclear Energy–Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety.

Hydel Power Plant–Essential Elements, Selection of Turbines, Governing of Turbines-Micro Hydel developments. Fast Breeder Reactor.

UNIT III:

DIESEL AND GAS TURBINE POWER PLANT

Types of Diesel Plants, Components, Selection of Engine Type, Fundamental concept of gas turbine control and monitoring system , Applications Gas Turbine Power Plant–Fuels-Gas Turbine Material–Open and Closed Cycles–Reheating–Regeneration and Intercooling–Combined Cycle.

UNIT IV:

OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS

Geothermal–OTEC–Tidal- Pumped storage- Solar thermal central receiver system.

Cost of Electric Energy– Fixed and operating Costs–Energy Rates–Types of Tariffs–Economics of load sharing, comparison of economics of various power plants.

D. List of Practical:

1. Study of fluidized bed combustor.
2. Study of power plant instruments
3. Trial on steam power plant
4. Study of non-conventional power plant
5. Tariff study
6. Study of environmental impact of power plant
7. To plot the characteristics of fuse wire
8. Trial on diesel power plant

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)

F. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. EI-Wakil M.M, "Power Plant Technology", McGraw-Hill 1984.
2. AroraS.C and Domkund war S, "A course in Power Plant Engineering", Dhanpatrai, 2001.
3. Nag P.K, "Power plant Engineering", Tata McGraw-Hill, 1998.
4. G.R. Nagpal, "Power Plant Engineering", Hanna Publishers, 1998.
5. K.K.Ramalingam, "Power Plant Engineering", Scitech Publications, 2002.
6. G.D.Rai, "Introduction to Power Plant Technology", Khanna Publishers, 1995.
7. R.K. Rajput, "Power Plant Engineering", Laxmi Publications, 1995.
8. Frank D.Graham, "Power Plant Engineers Guide", D.B. Taraporevala Sons & Co, New Delhi, 1993.
9. T.Morse Frederick, "Power Plant Engineering", Prentice Hall of India, 1998

H. Magazine:

1. Power Plant Design Magazine, IEEE.
2. Power and Energy Magazine, IEEE.
3. Renewable Power Generation, IET.

I. Journals:

1. Electrical Power Systems Research, Elsevier.
2. Power Delivery (PD), IEEE Transactions.
3. Power and Energy Society, IEEE Transactions.

Name of the Module: Switchgear & Protection
Module Code: EE 704
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:
Module Tutor(s):

A. Objectives:

The course is designed to meet with the objectives of:

1. fundamentals of protection equipment used in power systems, concept of primary and backup relaying,
2. imparting theoretical and practical knowledge of modern switchgear and current trends in protective relaying,
3. constructional Features and testing methodologies of AC and DC Circuit breakers.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to work with switchgears with a detailed knowledge of protection measures to be followed and characteristics of make – break devices,
2. students will be skilled both theoretically and practically to do operation, repairing and maintenance works in switching stations,
3. students will be substantially prepared to take up prospective research assignments

C. Subject Matter:

UNIT-I

Protection: Importance of protective relaying power systems –fundamental requirements of a good protection scheme–Primary and Back-up Relaying.

UNIT-II

Classification of Relays: Constructional (Viz., elector mechanical and Static Relays) and Functional viz. Over current, Directional, Differential, Distance relays etc. their principles and applications.

Current Trends in Protective Relaying: Microprocessor and PC based Relaying.

UNIT-III

Switchgear: Classification of Switchgear, Fault Analysis, Symmetrical Faults on a synchronous machine, Fault clearing process, Arcing Phenomena and principles of arc interruption.

UNIT-IV

Circuit Breaker: AC and DC circuit breakers, Different types of circuit breakers and their constructional features, Testing and Selection of circuit breakers.

Auto- reclosing feature – three pole & single pole autoreclosing, Problems of capacitive and low inductive current interruptions

Distance relays their settings, errors and remedies to errors.

Static & Digital Relaying: Generalised approach for two input and multi input comparators, Phase and amplitude comparison, inputs for different types of static distance protection, hardware for static relays, concept of digital relaying, main components of digital relays

D. List of Practical:

1. To perform the operation of definite time overcurrent relay.
2. To plot the characteristics of single pole over current or earth fault using static i.d.m.t. relays.
3. To perform operation of of static over voltage relay.
4. To plot the characteristics of electromagnetic idmt relay (model no.icm-21np).
5. To perform operation of static definite time reverse power relay (model apdr-21).
    A) To analyse the magnetisation characteristics of c.t.
    B) To analyse the problem associated with c.t. magnetisation.
6. To plot the characteristics of fuse wire.
7. To perform operation of directional over current relay (acdr 11 hpd).
8. Plotting the characteristics of impedance relay (abb-rakzb).
9. To perform operation of transformer differential protection.
10. To perform unrestricted earth fault relays.

E. Teaching/Learning/Practice Pattern

Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)
(Some industrial Experts will deliver talks)

F. Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

G. Books:

1. The Elementary Council, "Power System Protection", Vol.1-3, Peter Peregrinus, 1990
2. Van, A.R., & Warrington, C., "Protective Relays: Their Theory and Practice", Vol.1 & 2, Chapman and Hall,
1969.
3. Paithankar, Y.G., "Transmission Network Protection: Theory and Practice", Marcel Dekker, Inc., 1998.
4. GEC Measurements, "Protective Relays: Application Guide", GEC Measurements, 87.
5. Switchgear principles—P.H.J. Crane.
6. Switchgear and Protection—S.S. Rao
7. Switchgear and Protection--M.V .Despande

H. Magazines:

1. Power Apparatus and System Magazine (PAS), IEEE.
2. Electrical Insulation Magazine, IEEE.
3. Power Energy Magazine, IEEE.

I. Journals:

1. Power Delivery (PD) Journal, IEEE.
2. Electrical Power Applications, IET.
3. Electrical Power, Elsevier.

Name of the Module: Utilization of Electrical Power
Module Code: EE 705
Semester: 7th
Credit Value: 3[P=0, T=0, L=3]
Module Leader:
Module Tutor(s):

A. Objectives:

The course is designed to meet with the objectives of:

1. introduction to various electrical loads and lighting systems,
2. characterization and performance analysis of electrical loads.

B. Learning Outcomes:

Students successfully completing this module will be able to:

1. students will be adequately trained to become Power System Engineers to work in area of Generation, Transmission and Distribution,
2. students will be skilled both theoretically and practically to do transmission line modelling, fault calculations, repairing and maintenance works,
3. students will be made aware of modern devices used for operation and control, and will be made substantially prepared for getting acquainted with new transmission technologies of HVDC and communication techniques like SCADA.

C. Subject Matter:

UNIT – I

Economics of Power Supply: Base load and Peak load, Principles of power plant design, Factors affecting economics of Generation and Distribution of Power, Economics of load sharing, Tariffs, Power factor improvement.

UNIT – II

Electric Heating and Welding: Advantages of Electric Heating, Modes of heat Transfer, Resistance Heating, Arc heating, Induction heating, Dielectric Heating, Infrared or Radiant heating. Welding: Welding Processes, Resistance and Arc welding, TIG, MIG welding, Electron beam and Ultrasonic Welding, Plasma and Laser beam Welding, Electrodes, Under water welding, defects in welding and testing.

UNIT – III

Illumination: Laws of illumination, polar curves and Photometry. Measurement of Illumination. Artificial sources of light, Incandescent Lamps, halogen lamps, Arc Lamps, Discharge lamps such as Sodium vapour, mercury vapour lamp, neon and fluorescent lamps. Lighting schemes, calculation of illumination, Street lighting, Industrial lighting flood lighting.

UNIT – IV

Electric Traction: Traction systems, Ideal Traction, Railway Electrification – AC and DC systems, A.C. locomotives, Tramways, Trolley bus, Diesel Electric Traction. Overhead Equipment. Traction AC, DC motors, control. Electrical, mechanical and regenerative Braking.

Electrolytic Processes: Electro deposition, Anodizing, electro polishing, cleaning and pickling, Electro-metallurgy. Power supplies Refrigeration and air conditioning: Air-

Refrigeration systems, Brayton cycle, domestic refrigerator, water coolers, Refrigerants, controls. Air conditioning: Psychometrics, thermodynamics of human body, factors affecting human comfort, air conditioning systems, load estimation, ice plants.

D. Books:

1. *Utilization of Electrical Power, R.K. Rajput, Laxmi Publications.*
2. *Utilization of Electrical power: Including Electrical Drives and Traction, N.V. Suryanarayana, New Age International.*
3. *Generation and Utilization of Electrical Power, S. Sivanagaraju, Pearson Publications*

E. Magazines:

1. *Asia Electronics Industry.*
2. *Technology Integrator.*
3. *Electricity Today T & D Magazine*

F. Journals:

1. The journal of the institute of electrical and electronics engineers, Japan.
2. Electrical Power Systems Research, Elsevier Journal.
3. Energy Conversion, IEEE Journal

Name of the Module: Research Paper Communication
Module Code: HSS-702
Semester: 7th
Credit Value: 1[P=2, T=0, L=0]
Module Leader:

A. Objectives:

The course is design to meet with the objectives of:

1. business research is a process of planning, acquiring, analyzing and disseminating relevant data, information and insights to decision makers in ways that mobilize the organization to take appropriate actions that, in turn, maximize business performance,
2. making students aware about the importance of this subject in their future career.

B. Learning Outcomes:

Students successfully completing this module will be able to :

1. understanding of research process and type,
2. formulate the research problem,
3. design the research,
4. able to collect data,
5. analyze the data using spss,
6. interpret the results,
7. write the report.

C. Subject Matter:

Unit-1:

Introduction to Business Research-Meaning and Significance of Research in Business; Different Approaches to Research – Scientific Methods and Non-scientific Methods;

Unit-II:

The Research Problem and Design-Formulation and Definition of Business Research Problem; Formulation of Research Hypotheses, Business Research Design – Meaning and Formulation

Unit-III:

Sampling Design and Measurement Techniques- The Sampling Design Process; Types of Sample Design –Probability and Non-probability Sampling Designs.

Unit-IV:

Data Collection Tools and Data Processing-Questionnaires and Observation Forms; Questionnaire Design Process;

Unit-V:

Analysis of Data- Basic Data Analysis – Descriptive Statistics; Univariate Statistics – Hypotheses Testing; Bivariate Analysis – Test of Differences and Measures of Association; Multivariate Analysis.

Unit-VI

Business Research Report-Importance of the Report & Presentation; Business Report Format; Report Writing; Oral Presentation; Research Follow-up

D. Teaching/ Learning/ Practice Pattern:

1. Teaching : 50%
2. Learning/ case presentation : 30%
3. Assignment : 10%
4. Attendance : 10%

E. Examination pattern:

1. Theoretical Examination : 50
2. Class test : 30
3. Assignment : 20

F. Reading List:

Books:

1. *Zikmund, Babin, Carr & Griffin. Business Research Methods, Cengage Learning. 8th Edition.*
2. *Bryman & Bell. Business Research Methods, Oxford. 3rd Edition.*
3. *Cooper & Schindler. Business Research Methods, TMH*
4. *C.R. Kothari, Research Methodology: Methods and Techniques,New Age International*,

G. Magazines:

1. *R & D Magazine*
2. *Research Magazine*
3. *Scientific Magazine*

H. **Journals**:

1. *Mass Review*
2. *Journal of Communication Studies*
3. *Mass Communication and Society*
4. *Journal of Mass Communication*
5. *Communicator*
6. *Journal of Communication*

Name of the Module: Energy Audit
Module Code: EE 701A
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Subject Matter:

Unit-I
Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, Indian energy scenario, Sectoral energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.
Unit-II
Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, benchmarking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering, precautions, thermography, smart metering.
Unit-III
Energy Action Planning: Key elements, force field analysis, Energy policy purpose, perspective, contents, formulation, ratification, Organizing – location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability. Human resource development techniques, Information system-designing barriers, strategies; Marketing and communicating- training and planning.
Energy Monitoring and Targeting: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences(CUSUM). Energy Management Information Systems (EMIS)
Unit-IV
New & Renewable sources (NRES): Concept of renewable energy, Solar energy, wind energy, biomass boilers and gasifiers, biogas, biofuels, hydro, fuel cells, energy from wastes, bio-methanation, wave, tidal, geothermal.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.

MAGAZINE:
1. IEEE Spectrum.
2. Electricity Today (T & D) Magazine.
3. Electrical Business Magazine (online edition of Electrical Line Magazine).

JOURNALS:
1. Energy Conversions, IEEE Transactions.
2. Power Apparatus and System (PAS), IEEE Transactions.
3. Journal of Automation and Control, SCEI, U.K.
4. Power Delivery (PD), IEEE Transactions.

Name of the Module: Special Electrical Machines
Module Code: EE 702A
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Study of synchronous reluctance motor (SRM) - operational characteristics, construction and phasor diagrams.
2. Study of stepper motors and their applications.
3. Introduction to PMBL DC Motors and Permanent Magnet Synchronous Motors and their microprocessor based control systems.

Learning Outcomes:

1. Students will be adequately trained with concepts of advanced electrical machines.
2. Students will be skilled to work on the evolving new concepts of machineries like bearingless motors, etc.
3. Students will be substantially prepared to take up prospective research assignments.

Subject Matter:

Unit-I
Synchronous Reluctance Motors: Constructional features –Types–Axial and radial air gap motors– Operating principle–Reluctance–phasor diagram- Characteristics–vernier motor.
Unit-II
Stepping Motors: Constructional features–Principle of operation –Variable reluctance motor–Hybrid motor–Single and multi-stack configurations –Theory of torque predictions – Linear and non-linear analysis–Characteristics–Drive circuits.
Unit-III
Switched Reluctance Motors: Constructional features–Principle of operation–Torque prediction–Power controllers–Non-linear analysis–Microprocessor based control- Characteristics–Computer control.
Unit-IV
Permanent Magnet Brushless D.C. Motors: Principle of operation–Types–Magnetic circuit analysis– EMF and torque equations–Power controllers–Motor characteristics and control. Permanent Magnet Synchronous Motors: Principle of operation–EMF and torque equations–Reactance–Phasor diagram–Power controllers-Converter-Volt-ampere requirements–Torque speed characteristics
- Microprocessor based control.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

Books:

1. T.J.E. Miller, "Brushless Permanent Magnet and Reluctance Motor Drives", Clare and on Press, Oxford, 1989.
2. P.P. Aearnley, "Stepping Motors–A Guide to Motor Theory and Practice", Peter Perengrinus, London, 1982.

MAGAZINES:
1. IEEE Xplore
2. Electricity Today T & D Magazine

JOURNALS:
1. The journal of the institute of electrical and electronics engineers, Japan.
2. Electrical Power Systems Research, Elsevier Journal.
3. Energy Conversion, IEEE Journal

Name of the Module: Biomedical Instrumentation
Module Code: EE 703A
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Classification of biomedical instruments according to diagnostic, therapeutic and their clinical use.
2. Operational Principles governing use of Transducers in Biomedical Instrumentation.
3. Elaborate study of patient monitoring systems and devices used and their safety aspects.

Learning Outcomes:

1. Students will be adequately trained to work in industries manufacturing instruments of medical use.
2. Students will be substantially prepared to take up research works in field of Medical Science and Technology.
3. Students will be skilled to use various biomedical instruments and would be aware about their applicability in details.

Subject Matter:

Unit-I:
Anatomy and Physiology: Elementary ideas of cell structure, heart and circulatory system, control nervous system, Musclo-skeletal system, Respiratory system Body temperature and reproduction system. Classification of Biomedical Equipment: Diagnostic, therapeutic and clinical laboratory equipment.

Unit-II:
Bio-electric signals and their recording: Bioelectric signals (ECG, EMG, ECG, EOG & ERG) and their characteristics, Bio-electrodes, electrodes tissue interface, contact impedance, effects of high contact impedance, types of electrodes, electrodes for ECG, EEG and EMG.
Unit-III:
Transducers for Bio-medical Application: Resistive transducers -Muscle force and Stress (Strain gauge), Spirometry (Potentiometer), humidity, (Gamstrers), Respiration (Thermistor), Inductive Transducers -Flow measurements, muscle movement (LVDT) Capacitive Transducers-Heart sound measurement, Pulse pick up Photoelectric Transducers - Pulse transducers, Blood pressure, oxygen Analyses Piezoelectric Transducers –Pulse pick up, ultrasonic blood flow meter Chemcial Transducer -Ag-Ag fall as(Electrodes, Ph electrode.
Unit-IV:
Bio-electric Signal recording machines: Physiological pre-amplifier and specialized amplifiers, ECG lead systems details of ECG, EMG, and EEG machines. Patient Monitoring system : Heart rate measurement pulse rate measurement, respiration, rate measurement, blood pressure measurement, microprocessor applications in patient monitoring. X-Ray Machine: Basic X-Ray components and circuits, types of X-ray machines e.g. general purpose, dental image intensifier system, table shooting and maintenance of X-Ray machine. Safety Aspect of Medical Gross current, Micro Current shock, safety standards rays and considerations, safety testing instruments, biological effects of X-rays and precaution.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

Books:

1. Medical Instrumentation by John. G. Webster–John Wiley & Sons.
2. Principles of Applied Biomedical Instrumentation by Goddes & Baker–John Wiley & Sons.
3. Biomedical Instrumentation & Measurement by Carr & Brown-Pearson
4. Biomedical Instrument by Cromwell-Prentice Hall of India, New Delhi
5. Handbook of Medical instruments by R.S. Khandpur–TMH, New Delhi
6. Medical Electronics and Instrumentation by Sanjay Guha–University Publication
7. Introduction to Bio-medical electronics by Edwand J. Bukstein–sane and Co. Inc. USA.

MAGAZINES:

1. Industrial Electronics, IEEE Magazine.
2. Science, Measurement & Technology, IET.

JOURNALS:

1. S&T e-Digest.
2. IFSA Sensors and Transducers Journals.
3. Measurements, Elsevier.

Name of the Module: Flexible AC Transmission Systems (FACTS)
Module Code: EE 704A
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Introduction to the concept of FACTS and the types of devices used with an emphasis on working principle.
2. Operation of TCSC in various modes and its applications.
3. Also a brief study of emerging facts controllers and their coordination with existing system.

Learning Outcomes:

1. Students will be able to understand the new methods adopted in power system control.
2. Students will understand the quantitative treatment of control coordination.
3. Students will be skilled to work for modeling and development of new devices used for reactive power control and other factors.

Subject Matter:

Unit I:
Introduction: The concept of flexible AC transmission - reactive power control in electrical power transmission lines- uncompensated transmission line– series and shunt compensation. Overview of FACTS devices- Static Var Compensator (SVC)– Thyristor Switched Series capacitor (TCSC)–Unified Power Flow controller (UPFC)- Integrated Power Flow Controller (IPFC).

Unit II:
Static Var Compensator (Svc) And Applications: Voltage control by SVC–advantages of slope in dynamic characteristics–influence of SVC on system voltage. Applications- enhancement of transient stability– steady state power transfer– enhancement of power system damping– prevention of voltage instability.

Unit III:
Thyristor Controlled Series Capacitor (Tcsc) And Applications: Operation of the TCSC- different modes of operation– modelling of TCSC– variable reactance model– modelling for stability studies. Applications- improvement of the system stability limit– enhancement of system damping– voltage collapse prevention.

Unit IV:
Emerging Facts Controllers: Static Synchronous Compensator (STATCOM) –operating principle –V-I characteristics –Unified Power Flow Controller (UPFC)–Principle of operation-modes of operation– applications– modelling of UPFC for power flow studies. Co-Ordination Of Facts Controllers: FACTs Controller interactions – SVC–SVC interaction - co- ordination of multiple controllers using linear control techniques – Quantitative treatment of control Co-ordination.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

Book:

1. Mohan Mathur, R.,Rajiv. K.Varma, "Thyristor–Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc.
2. A.T. John, "Flexible AC Transmission System", Institution of Electrical and Electronic Engineers (IEEE), 1999.
3. Narain G. Hingorani, Laszio. Gyugyl, "Understanding FACTS Concepts and Technology of Flexible AC Transmission System", Standard Publishers,Delhi 2001.

MAGAZINE:

1. Power Plant Design Magazine, IEEE.
2. Power and Energy Magazine, IEEE.
3. Renewable Power Generation, IET.

JOURNALS:

1. Electrical Power Systems Research, Elsevier.
2. Power Delivery (PD), IEEE Transactions.
3. Power and Energy Society, IEEE Transactions.

Name of the Module: Electrophysiology
Module Code: EE 705A
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Introduction to nervous system and neuro anatomy.
2. Understanding the electrical properties of neuron and various models with concepts of circuit theory applied.
3. Study of various Electrophysiological methods.

Learning Outcomes:

1. Students will be adequately trained to work with neurotransmitters.
2. Students will be made familiar with the processes of electroencephalography and various methods of measuring neuron potential.

Students will be substantially prepared to take up prospective research assignments

Subject Matter:

Unit I: Introduction to the nervous system: Neuro anatomy, Resting cell potential (structure, protein, gradient, potential), Action potential (myelination, propagation), Synapses and neurotransmitters (receptors, packaging, recycling), Ion basis for conduction;

Unit II: Analog to electrical system: Circuit theory, Electrical properties of neurons, Cable equation, Hodgkin- Huxley Model, Core-conductor theory, local circuit theory;

Unit III: Electro physiological methods: Ionic basis for conduction, Basic instrumentation (recording electrode, oscilloscope), Voltage-and current clamping vitro, Single channel patch clamp, Stimuli and recording, Electro encephalography and cortical potential, local synaptic decoupling and modelling.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)
Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

MAGAZINE:

1. Intelligent Systems, IEEE Magazine.

JOURNALS:

1. Bio-medical Research, Elsevier.

Name of the Module: Photovoltaic Device and System
Module Code: EE 706A
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Study of solar resource and calculation of solar insolation taking care of geographical factors affecting them with sun tracking diagram.
2. Study of fabrication and manufacturing of photovoltaic cells and panels with an understanding of the operation characteristics.
3. Mathematical modeling of a solar PV cell. Estimation of a standalone solar plant. And introduction to solar codes according to NEC, IEEE Standard 1547.

Learning Outcomes:

1. Students will be adequately trained to work as operation engineers in solar power plants.
2. Students will be skilled for doing simulations related to photovoltaic energy.
3. Students will be imparted the knowledge of mechanical design and estimating cost of such plants and also meeting the load demand with relevant battery bank.

Subject Matter:

Unit I:
The Solar Resource: solar spectrum, sun position, sun path diagrams, solar and clock times, clear sky insolation on a collecting surface, solar radiation measurements, resource of solar data. Photovoltaic Materials and Electrical Characteristics (Chap 8): semiconductor physics, generic PV cell circuit model, modules and arrays, I-V curves, impact of temperature, shading impacts, crystalline silicon technologies, thin-film PV.

Unit II:
Grid-Connected PV Systems (Chap 9): I-V Curves of simple loads and batteries, interfacing with the utility, system sizing, economic considerations.

Unit III:
Stand-Alone PV Systems (Chap9): load estimation, batteries and their properties, array and battery sizing, hybrid-PV systems, case study of PV-powered water pumping.

Unit IV:
Mechanical Considerations: material properties, mechanical system requirements, design and installation guidelines, forces acting on PV arrays, array mounting systems design mechanical load and stress. Codes and standards related to PV Systems: National Electric Code (NEC) and IEEE Standard 1547.

Books:

1. Applied Photovoltaic (Wenham, Green, Watt and Corkish) (Earthscan).
2. Crystalline Silicon Solar Cells (Goetzberger, Knobloch and Voss) (Wiley).
3. Thin Film Solar Cells (Y. Hamakawa) (Springer).

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%
(Teacher is to divide components for T/R/P)
Examination Pattern

1. Theoretical Examination : Written

2. Practical Examination: Conducting experiments and viva-voce.

MAGAZINE:

1. Power Plant Design Magazine, IEEE.
2. Power and Energy Magazine, IEEE.
3. Renewable Power Generation, IET.

JOURNALS:

1. Electrical Power Systems Research, Elsevier.
2. Power Delivery (PD), IEEE Transactions.
3. Renewable Energy and alternative sources, IEEE Transactions

Name of the Module: Microprocessor Based Instrumentation
Module Code: EE 701B
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Introduction to microprocessor architectures and its pin diagram.
2. Study of assembly language programming of microprocessors (8085).
3. Also study of 8086, 80486 and Pentium processors.

Learning Outcomes:

1. Students will be adequately trained to work in embedded systems utilizing microprocessors. Students will be able to address various problems of monitoring, operation, control and decision making aspects of engineering designs with help of microprocessors

Subject Matter:

Unit I: Introduction to8085: Architecture and operation, pin out diagram. Assembly language programming for8085microprocessor instruction classification, instruction set study in details, addressing modes, writing assembly language programs, stacks subroutines, floating point routines.

Unit II: Instruction set timing diagrams, a minimum configuration for 8085. Interfacing memories EPROM and RAM with 8085with exhaustive and partial decoding techniques. Interrupt structure of 8085, internal interrupt circuit, and hardware and software interrupts, serial data transfer.

Unit III: Following structure programmable peripheral devices are to be studied in details as regards block diagram, software for their interfacing with8085:8255, 8253, 8279, 8251.

Unit IV: Bus interfacing standards-RS232, IEEE488. Interfacing application: Interfacing seven segment displays keyboard, A to D and D to A converter. Microprocessor based data acquisition and control system: Temperature control system, Flow control system etc. Introduction to 8086, 80486, and Pentium processors.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

Books:

1. K.L. Short, “Microprocessor and programming logic”, Second Edition, Prentice-Hall India Pvt. Ltd.
2. R.S. Gaonkar, “Microprocessor Architecture, Programming and application with 8085/8085A”, Fourth Edition, Willey Eastern Ltd.
3. U.V. Kulkarni and T.R. Sontakke, “The 8085 A Basics: Programming and Interfacing”, Sadusudha Prakashan, Nanded.
4. Intel Mcs, “8085usersmanual”IntelCorporation.
5. B.Ram “Fundamentals of microprocessor and Microcomputer”, Dhanpat Rai and Sons, New Delhi.

MAGAZINES:

1. Electrical Business Magazine, (Online edition of Electrical Industry Magazine)
2. Instrumentation and Measurement Magazine, IEEE.

JOURNALS:

1. Instrumentation and Measurement, IEEE Transactions.
2. Science, Measurement and Technology, IET Journal.
3. Measurements, Elsevier Journal.

Name of the Module: Power Quality Issues and Remedials
Module Code: EE 702B
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Introduction to custom power and study of factors governing power quality.
2. Study of power factor compensation techniques with power electronic devices and active harmonic filtering.
3. Introduction to wiring and grounding methods and particular standards related to them.

Learning Outcomes:

1. Students will be adequately trained to work for improvement and betterment of power quality.
2. Students will be skilled theoretically and practically for monitoring of power quality and improvement.
3. Students will be substantially prepared to take up prospective research assignments.

Subject Matter:

Unit I:

Power Quality –overview of power quality phenomena -Basic terminologies–Power Quality Issues–Causes for reduction in Power Quality—Power Quality Standards and indices

Unit II:

Voltage sags-Causes of voltage sags – magnitude & duration of voltage sags – effect on drives and peripherals – monitoring & mitigation of voltage sags. Interruptions- Origin of Long & Short interruptions– influence on various equipment's –monitoring & mitigation of interruptions. Harmonics-important harmonic introducing devices-SMPS-Three phase power converters-arcing devices- storable devices-harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

Unit III:

Power Factor Improvement –Passive Compensation- Passive Filtering- Harmonic resonance-Impedance Scan Analysis - Active Power Factor Corrected Single Phase Front End-Control Methods for Single Phase APFC-Three Phase APFC and Control Techniques-PFC Based on Bilateral Single Phase and Three Phase Converter-static var compensators-SVC and STATCOM

Unit IV:

Active Harmonic Filtering- Shunt Injection Filter for single phase, three-phase three-wire and three-phase four-wire systems-d-q domain control of three phase shunt active filters-UPS-constant voltage transformers- series active power filtering techniques for harmonic cancellation and isolation. Dynamic Voltage Restorers for sag swell and flicker problems. Grounding and wiring-introduction-NEC grounding requirements-reasons for grounding-typical grounding and wiring problems-solutions to grounding and wiring problems

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

Books:

1. Pogei C.Dugan, Mark F. Mc Granghan, Suryasantoso, H. Wayne Beaty, Electrical power system quality, Second edition ,McGraw Hill Pub.
2. G.T. Heydt, Electric Power Quality, Starsina Circle Publications, 1991
3. J. Arrillaga, Power System Quality Assessment, John Wiley, 2000
4. J. Arrillaga, B.C.Smith, N.R. Watson & A. R. Wood, Power system Harmonic Analysis, Wiley, 1997
5.Wilson E Kazibwe, Musoke H Sendaula, Eclectic Power quality control techniques, Van Nostrand Reinhold, New York, 1993

MAGAZINES:

1. IEEE Spectrum.
2. E & T Magazine, IET, U.K.
3. Power and Energy Magazine, IEEE.

JOURNALS:

1. Power and Energy Society, (PES) IEEE Transactions.
2. Electrical Power Systems Research, Elsevier.
3. Electrical Power Systems Research, Taylor and Francis.

Name of the Module: Power Semiconductor Devices and ICs
Module Code: EE 703B
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Study of physical properties of semiconductors and effects, basic operations and applications.
2. Understanding of fabrication of ICs at Muller and Kamins level.
3. Hands on experience in BJT technology with introduction to structural trade off and optimal performance.

Learning Outcomes:

1. Knowledge of power semiconductor devices and their use in various control devices and signal conditioning equipment.
2. Students will be able to design converters for specific purpose and select semiconductor devices relevant to the working requirements.
3. Students will be substantially prepared to take up research assignment in relevant topics.

Unit: I.
Physics and Properties of Semiconductors: crystal structure, energy bands, statistics, Fermi level, carrier concentration at thermal equilibrium, carrier transport phenomena, Hall effect, recombination, optical and thermal properties, basic properties for semiconductor operation. Device Processing Technology: oxidation, diffusion, ion-implantation, deposition, lithography, etching and interconnect.

Unit: II
p-n Junction: depletion region, diffusion, generation-recombination, current-voltage characteristics, junction breakdown, charge storage and transient behaviour. Integrated-Circuit Technology: understanding at the level of Muller and Kamins of integrated-circuit fabrication processes.

Unit: III
Bipolar transistor: transistor action and dependence on device structure, charge control switching model, Ebers-Moll Model, current-voltage characteristics, non-ideal and limiting effect sat extremes of bias. State-of-the-Art Bipolar Transistor Technology: poly- si emitters, narrow base, structural trade off sin optimizing performance.

Unit: IV
Metal-Semiconductor Contacts: equilibrium, idealized metal semiconductor junctions, non-rectifying (ohmic) contacts, Schottky diodes, tunneling. Metal- Oxide- Silicon System: MOS structure, capacitance, oxide and interface charge (charging of traps, tunnelling through oxide). MOS Field- Effect Transistor: threshold voltage, derivation of current-voltage characteristics, dependence on device structure. State-of-the-Art MOS Technology: small- geometry effects, mobility degradation due to channel and oxide fields, velocity saturation, hot- electron effects, device wear out mechanisms.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

Books:

1. R.S. Muller and T.I. Kamins, Device Electronics for Integrated Circuits, Wiley, 1986 OR Semiconductor Device Fundamentals by R. F. Pierret, Addison-Wesley,1996.
2. Chapters 3,4, 5, and 9ofS.Wolf, The Submicron MOSFET, volume 3 of Silicon Processing for the VLSI Era, Lattice Press,1995.
3. Chapters1,5,9, and 10 of J.P. Mc Kelvey, Solid-State Semiconductor Physics, Krieger Publishing,1993.

MAGAZINES:

1. Power Electronics Letters, IEEE.
2. Power Electronics Magazine, IET.

JOURNALS:

1. Power Electronics, IEEE Transactions.
2. Electrical and Electronics Engineering, Elsevier.
3. The Journal of Institute of Electrical and Electronics Engineer, Japan.

Name of the Module: Sustainable Energy Systems
Module Code: EE 704B
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objectives:

1. Introduction to the general information regarding Non-conventional energy sources.
2. Study of various power flow solution algorithms and their use in AC/DC Power System analysis.
3. Study of symmetrical and asymmetrical faults.
4. Stability analysis and use of digital computer in power system solutions.

Learning Outcomes:

1. Students will be adequately trained to work with MATLAB for modeling of power flow problems.
2. Students will be skilled to work as Power System Engineers and to do fault analysis of the system with help of software like MATLAB, PSSE, DiG-Silent, etc.
3. Students will be substantially prepared to take up relevant research works.

Unit I:
GENERAL: Primary and commercial energy resources- study of availability, energy consumption pattern and growth rate in India, Non-conventional energy sources. availability, Economics and efficiency.
SOLAR PHOTOVOLTAICS: Silicon PN junction, PV circuit properties and laods, PV fed drives.

Unit II:
WIND ENERGY: Energy from the wind-General theory of wind mills-types of wind mills-performance ofwindmachines-windpower-efficiency-windgeneratorcharacteristics.
Unit III:
TIDAL ENERGY AND GEO THERMAL: Energy from tides and waves- working principles of tidal plants -tidal power generations. Geo thermal energy-principle of working of geo thermal power plants.
Unit IV:
BIO-ENERGY: Energy from Bio- mass- Biogas plants- various types- Industrial wastes-Municipal waste- Burning-plants- Energy from the Agricultural wastes- Applications.

Books:

1. John W. Turdell, Anthony W. Wein "Renewable energy resources" CLBS, 19872. Rai, G.D. 'Non conventional Energy Sources', Khanna publishers, 1993. Rai,G.D.,' SolarEnergy Utilisation', M/S. Khanna publishers, 4th edition,1991.12.
2. Ronald Shaw,' Wave energy:(Ade sign challenge)'Ellis Horwood Limited Publishers, Istedition,1982.
3. Daniel Hunt. V.,' Wind power-A hand book of WECS systems' ,Van Nostrand Co.,NewYork,1981.

MAGAZINES:
1. Power Systems Magazine, IEEE Magazine.
2. IEEE Spectrum.
3. E & T Magazine, IET.

JOURNALS:
1. Power and Energy Society (PES), IEEE Transactions
2. Electrical Power System Research, Elsevier.

Name of the Module: Theory of forecasting
Module Code: EE 705B
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

1. Process Planning

Types of Production - Standardization, Simplification - Production design and selection - Process planning,selectionandanalysis-Processplanning,selectionandanalysis- Steps involved in manual experience based planning and computer aided process planning-Retrieval, generative-Selection of processes analysis-Break even analysis.

2. Estimating and Costing

Importance and aims of Cost estimation-Functions of estimation-Costing-Importance and aims of Costing -Difference between costing and estimation -Importance of realistic estimates -Estimation procedure.

3. Element of Cost

Introduction -Material Cost-Determination of Material Cost Labour Cost-Determination of Direct Labour Cost-Expenses- Cost of Product(Ladder of cost)-Illustrative examples. Analysis of overhead expenses- Factory expenses- Depreciation- Causes of depreciation- Methods of depreciation- Administrative expenses-Selling and Distributing expenses-Allocation of overhead expenses.

4. Product Cost Estimation

Estimation in forging shop-Losses in forging-Forging cost-Illustrative examples. Estimation in welding shop-Gas cutting-Electric welding-illustrative examples.
Estimation in foundry shop-Estimation of pattern cost and casting cost-Illustrative examples.

5. Estimation of Machining Time

Estimation of machining time for Lathe operations-Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations-Illustrative examples.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

1. Theoretical Examination : Written
2. Practical Examination: Conducting experiments and viva-voce.

Text Books:

1. M. Adithanand B.S.Pabla,"Estimating and Costing", KonarkPublishersPvt.Ltd., 1989.
2. A.K. Chitaleand R. C.Gupta," Product Design and Manufacturing ",Prentice Hall Pvt.Ltd.,1997.
3. Nanua Singh," System approach to Computer Integrated Design and Manufacturing", John Wiley & Sons, Inc., 1996

4. Joseph G. Monks, "Operations Management, Theory & Problems", McGraw Hill Book Company, 1982.
5. G.B.S. Narang and V. Kumar, "Production and Costing", Khanna Publishers, 1995.
6. T.R. Banga and S.C. Sharma, "Estimating and Costing", Khanna Publishers, 1986.

Name of the Module: Re-engineering
Module Code: EE 706B
Semester: 7th
Credit Value: 4[P=2, T=0, L=3]
Module Leader:

Objective:

To provide a greater understanding of effective solutions to change problems that need to combine technological, organizational and people-orientated strategies by adopting a process based approach to change management. To introduce the contingencies that affect management and the most effective measures for dealing with them. To introduce strategic IS/IT planning and how it must relate to business strategy. To demonstrate the use and validity of organizational development models through current real-life case studies.

Business process reengineering:
An overview. Concepts and techniques. Changing business processes: the importance of technology as a
Driver for organisation. BPRE&TQM Benchmarking, ISO standards. Implementation of BPRE-business process management, principles, Business models, barriers. Change management Change and the manager: change and the human resource: the cultural web and the past: the cultural Attributes of change. The importance of communication and the resistance to change Building the culture for successful strategy implementation; the influence IT will have on the internal Appearance of organisations in the future. The concept of the learning organisation and its influence on systems development: restructuring the organisation.

Teaching/Learning/Practice Pattern
Teaching: 40%
Learning: 10%
Practice : 50%

(Teacher is to divide components for T/R/P)

Examination Pattern

1. Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.