### Course Structure & Syllabus

**For EE**

<table>
<thead>
<tr>
<th>Education</th>
<th>Research</th>
<th>Service to Society</th>
</tr>
</thead>
</table>
| In GOD’s own land, a fusion of scholastic students, innovative & motivated researchers & teachers and fast | P.O.- Yupia, Dist.–Papumpare, Arunachal Pradesh, Pin–791112  
Phone No:0360-2284801/2001582  
Fax No:0360-2284972  
Email– nitarunachal@gmail.com | Stepping Stone and Sky reaching ladder to success. |
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”.

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

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<tr>
<th>Semester</th>
<th>Credit Course</th>
<th>I- Course</th>
<th>Audit Course</th>
<th>Add-on course</th>
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### Syllabus for B.Tech in Electrical Engineering

**Examination System:**

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<tr>
<th>Semester</th>
<th>Conventional</th>
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| 1<sup>st</sup> | 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. | |
| 2<sup>nd</sup> | 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  
Programming in C | |
| 3<sup>rd</sup> | 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 | |
| 4<sup>th</sup> | 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 | |
| 5<sup>th</sup> | Embedded Systems  
Power Electronics – II  
Power System Reliability  
Power System – II  
Probability and Stochastic processes  
Industrial Management. | Machine Design - I | |
| 6<sup>th</sup> | Engineering Ethics & IPR.  
Disaster Management.  
Electric Drives  
Computer Aided Electrical System Design  
| 7<sup>th</sup> | 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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Total: 17 P, 1 T, 17 L, 28 Credit

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### 7th Semester

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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
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 of transposes, Symmetric and Skew symmetric matrices and their properties. Determinant of a square matrix, Minors and Cofactors, 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:
Syllabus for B.Tech in Electrical Engineering

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

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 analytic 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:

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).
5. Plus magazine (University of Cambridge).

H. Journals:
3. The Journal of Indian academy of 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 property. Introduction 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 Lavoisier and Laplace, Hess's law of constant heat summation, Kirchoff's law. Second law thermodynamics; Joule Thomson and throttling processes; evaluation of entropy: characteristics and expression, entropy change in irreversible process, entropy change for irreversible isothermal expression of an ideal gas. 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.


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:
UNIT IV:


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:
   3. Levine ” Physical Chemistry” McGraw-Hill Education.
   15. Maity and Maity, ” Engineering Chemistry”, U & N Dhar Publisher.

H. Magazine:
   1. Chemical science.
   2. Chemistry Today.
3. Chemistry For You.

1. **Journals:**
   1. *Journal of Organic Chemistry, ACS*
   2. *Journal of Physical Chemistry, ACS*
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.

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:

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
5. Proceedings of the National Academy of Sciences
6. Chemical Physics Letters
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 designed 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:
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:
Syllabus for B.Tech in Electrical Engineering

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:

G. Magazines:
1. National Geographic Chennel, http://science.nationalgeographic.co.in/science/earth

H. Journals:
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 designed to meet 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.
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:

H. Magazine
2. Design to Part Magazine.

I. Journals

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:
Name of the Module: Workshop Practice-I
A. Objectives:
The course is designed to meet 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:

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 up to 3 mm thick.
3. Lap joint by Gas Welding (up to 3 mm thick).
4. Manual Metal Arc Welding practice (up to 5 mm 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:
Syllabus for B.Tech in Electrical Engineering

4. Hazra and choudhary “Workshop Technology” Vol. 1, 2, Media Promoters
5. 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.

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, impedance 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.
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:

H. Magazines:
1. IEEE Industrial Electronics
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 designed to meet with the objectives of:  
1. to increase the students ability to improve and utilize the skills necessary to be competent interpersonal communicators,  
2. to increase the students’ 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:  

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
5. Rajeevan, Dutt, Sastkumar, A course in Listening and Speaking I & II with CD, CUP, New Delhi, 2007.
7. Software: Orell Digital Language Lab Software.
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.
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 designed to meet 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:  

Name of the Module: Engineering Mathematics-II  
Module Code: MAS 201  
Semester: 2nd
A. Objectives:
The course is designed to meet 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 objects in space,
2. making students 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.


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:

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).
5. +Plus magazine (University of Cambridge).

H. Journals:
3. The Journal of Indian Academy of 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 designed to meet the objectives of:
1. ability to utilize scalar and vector analytical techniques for analyzing 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:

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

E. Examination Pattern:
1. Theoretical Examination

F. Books
3. Timo& Young, “Elements of Strength of Materials” D Van Nostrand Company

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
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 constant.  
**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) \[ f(x) = 2 + 4 + 6 + 8 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \]
   b) \[ f(x) = 1! + 2! + 3! + 4! + \ldots \ldots \ldots \]
   c) \[ f(x) = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots \ldots \ldots \]
   d) \[ f(x) = 1 + x + x^2 + x^3 + x^4 + \ldots \ldots \ldots \]
7. Write a program to display the following patterns using nested for loops.
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G. Books

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:
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:  
Effect of noise on people, rating systems, commUNITy noise sources and criteria, traffic noise prediction, noise control. Noise standards, measurement and control.  

UNIT II:  
Water resources, characteristics of water, water pollutants, oxygen demanding wastes, surface water quality, groundwater quality, water treatment systems, biomedical wastes treatment technologies and disposal options.  

UNIT III:  

UNIT IV:  
Air quality standards, emission standards, emission standards, criteria pollutants, air pollution and meteorology, atmospheric dispersion, emission controls. Air pollution and pollutants, criteria pollutants, Acid
deposition, Global climate change – greenhous gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

D. Books:
2. Arcadio P. Sincero & Gergoria A. Sincero, "Environmental Engineering" Prentice Hall India
4. Currinham & Saigo, “Environmental Science”, TMH,

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 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 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: concept of displacement current, Maxwell’s field equations, Maxwell's wave equation and its solution for free 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
8. S. N. Ghoshal, “Atomic Physics” S. Chand

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
5. *Proceedings of the National Academy of Sciences*
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:**

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**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 at least 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) Single line definition of multiple input AND & OR gate.
   ii) What is the primary difference between NOT gate from AND & OR gate.
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) \( f_1(A,B,C,D) = m_0 + m_1 + m_2 + m_3 + m_6 + m_{10} + m_{13} + m_{15} \)
   ii) \( f_2(A,B,C,D) = m_0 + m_1 + m_2 + m_3 + m_7 + m_{10} + m_{13} \)
   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 programme 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.
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:

H. Magazines:

I. Journals:
1. International Journal of Electronics Devices and Circuits.

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:  

G. Magazine:  
1. Science and Technology Magazine  
2. Historiography of contemporary Science and Technology  

H. Journal:  
1. Historiography in Graduate Technology  
2. Innovation, Technology or History
3. *Historiography of the Sciences*
Module Code: CE 202  
Semester: 2nd  
Credit Value: 2 2 \(P=3, T=0, L=0\)  
Module Leader:

A. Objectives:  
The course is designed to meet 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 mortar  
Concrete: 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:  
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:
4. Hazra and choudhary “Workshop Technology” Vol. 1, 2, Media Promoters
5. VirenderNarula “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: 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**

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**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:**


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.

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**D. List of Practical:**
1. Transient response in R-L and R-C Network: Spice, Simulation/hardware.
3. Determination of Impedance (Z) and Admittance(Y) parameters of two port network.
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
   3. Engineering circuit analysis with PSPICE and probe-Roger
   5. A.Chakravarty: Networks, Filters & Transmission Lines
   6. D. Chattopadhyay and P.C. Rakshit: Electrica I Circuits
   7. A.V. Oppenheim and A.S.Wilsky: Signals & Systems, PHI
   8. R.V.Jalgaonkar.: Network Analysis & Synthesis. EPH.

H. Magazines:
   1. Electrical Today Magazine.
   2. Electrical India Magazine.

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 designed to meet 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 like 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:

UNIT - IV:

D. List of Practical:
1. Design, implementation and measurement with graphical analysis of input and output of clipping and clamping 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:
4. Manis Mukherjee, “Foundation of Electronics Devices” Prentice Hall of India, New Delhi, 2nd Edition
7. R L Smith, Electronics: Circuits & Devices, John Wiley & Sons Ltd

H. Magazines:
1. Planet Analog
2. IEEE Spectrum
3. Electronics for you
4. Electropages

I. Journals:
1. 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 designed 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 acquainted 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:
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:
Polarisability 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%
Syllabus for B.Tech in Electrical Engineering

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:

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 Hawthorne 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.  

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:
Syllabus for B.Tech in Electrical Engineering

Theoretical Examination : 50
Class test : 30
Assignment : 20

F. Books:

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, correlogram, 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.


D. Books:
2. Simon Haykins, “Introduction to Analog and Digital Communications”, Wiley India.

E. Magazines:
2. Electronics Business Magazine.
3. IEE ASSP Magazine

F. Journals:
1. IEEE journal on selected Areas in communication.
2. Springer
3. IEEE Spectrum
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:

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:

UNIT-IV:

D. List of Experiments:
1. Using Kelvin’s Bridge for measurement of low resistance.
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.
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:
   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.
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

UNIT-II

UNIT-III

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
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:

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

Module Leader:

A. Objectives:
The course is designed 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 statements and solve problems.
7. Students will have a basic understanding of information technology and its use in Mathematical contexts.

C. Subject Matter:

Unit I:

Unit II:

Unit III:
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 Automorphisms, Homomorphism and Normal Subgroups, Rings, Integral Domains, and Fields.

D. Teaching/ Learning/ Practice Pattern:
Teaching: 70%
Learning: 30%
Practice: 0%

E. Examination Pattern:
1. Theoretical Examination:

F. Books:

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. SIAM Journal on Discrete Mathematics.
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 designed to meet the objectives of:
1. students will be able to involve 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 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.
Entrepreneur Carrier: Different Stages, Entrepreneur Development Programmers (EDPs).

UNIT III:
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:

D. Teaching/ Learning/ Practice Pattern:
Teaching: 70%
Learning: 30%
Practice: 0%
E. Examination Pattern:
1. Theoretical Examination

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

G. Magazines:

H. Journals:
1. International Journal of Entrepreneurship
2. International Journal of Innovation Management
3. Journal of Small business and Entrepreneurship
5. Journal of Management Research
A. Objectives:
The course is designed 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.

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:

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
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
   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

UNIT-III

UNIT-IV

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.
7. Load characteristic of universal motor, operating and and ac supply Comparison of performance.
8. Experimental determination of performance characteristics of two phase servomotor.

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:

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.
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.
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.
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:

J. Magazines:
   1. Power Electronics Letters, IEEE.
   2. Power Electronics Magazine, IET.

H. Journals:
   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

G. Magazines:
3. Electrical India Magazine, (Online Magazine)
4. Power and Energy Magazine, IEEE.

H. Journals:
3. Power Engineer Magazine, IET.
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 designed 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:

UNIT II:
I/O Interface: 8255 PPI 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:

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_1 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:
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
5. AT&T Bell Laboratory Technical Journal
6. Electronics Letter
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:

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:

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 of step response & impulse response for type-0, type-1 & type-2 systems with unity feedback using MATLAB & PSPICE.
4. Determination of Root Locus, 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 PLPD, 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.

\[
\frac{\omega_n^2}{s^2 + 2\xi \omega_n s + \omega_n^2}
\]

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:**
   2. Das Gupta S: *Control System Theory; Khanna Pub.*
8. Gopal: Modern Control System Theory, New Age International.

H. Magazines:
1. Industrial Electronics Magazine, IEEE.
2. Control and Automation Magazine, IEEE.
4. Control and Automation Magazine, IET.

I. Journals:
1. Intelligent Systems, IEEE Transactions.

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

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

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:
   2. A course in Electrical Engineering Material---Seth & Gupta

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:
G. Magazine:

H. Journals:
   1. *Group and Organization Management*
   2. *Journal of Organizational Behaviour*
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

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 hours 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.
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:
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:
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  

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, interpole, 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:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Hours per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>3 hours</td>
</tr>
<tr>
<td>Tutorial and Computer based simulation</td>
<td>1 hour</td>
</tr>
<tr>
<td>Laboratory practical</td>
<td>0 hours</td>
</tr>
<tr>
<td>Self study</td>
<td>6 hours</td>
</tr>
</tbody>
</table>

F. Books:
5. Design and testing of electrical machine – M.V. Deshpande - PHI learning pvt ltd.

I. Magazines:
1. Electrical Today.
2. Electrical Machines and Drives.
3. Industrial Electronics.

J. Journals:
2. Power system 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  

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.
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.

H. Journals:
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:

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:

D. Books:
1. Embedded Systems - Raj Kamal, TMH.
4. *An Embedded Software Primer* - David E. Simon, Pearson Education.

**E. Magazines:**
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 designed to meet 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. providing 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 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 χ². Expectation and Variance (t and χ² 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:

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)
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:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>3 hours per week</td>
</tr>
<tr>
<td>Tutorial and Computer based simulation session</td>
<td>0 hour per week</td>
</tr>
<tr>
<td>Laboratory practical</td>
<td>2 hours per week</td>
</tr>
<tr>
<td>Self-study</td>
<td>6 hours per week</td>
</tr>
</tbody>
</table>

F. Books:

G. Journals
1. Power Electronics Letter, IEEE.
2. IEEE Transactions on Power Electronics, IEEE.
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

UNIT – II

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.

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.
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  

UNIT-III  

UNIT-IV  

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. Books:
   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.
   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 designed 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  

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

Unit IV  

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:

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:  

UNIT II:  

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
   3. MHA, GOI-UNDP, Disaster Management in India, 2009
   4. NDMA, 'Incident Response Guidelines', 2009

G. Magazines:

H. Journals:
   2. International Journal of Disaster management.
   3. IDRIM Journal.
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 designed 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


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.
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:

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Lecture</td>
<td>: 3 hours per week</td>
</tr>
<tr>
<td>Tutorial and Computer based simulation session</td>
<td>: 0 hour per week</td>
</tr>
<tr>
<td>Laboratory practical</td>
<td>: 2 hours per week</td>
</tr>
<tr>
<td>Self-study</td>
<td>: 6 hours per week</td>
</tr>
</tbody>
</table>

F. Books:

G. JOURNALS AND MAGAZINE:
1. Power Electronics Letter, IEEE.
2. IEEE Transactions on Power Electronics, IEEE.
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
5. Newton Raphson method of 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:

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

I. Journals:
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
INDUCTIVE MOTORS
SYNCHRONOUS MACHINES

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

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.

E. Teaching Approach:

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours per week</th>
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<tbody>
<tr>
<td>Lecture</td>
<td>3</td>
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<td>Tutorial and Computer based simulation session</td>
<td>0</td>
</tr>
<tr>
<td>Laboratory practical</td>
<td>0</td>
</tr>
<tr>
<td>Self-study</td>
<td>6</td>
</tr>
</tbody>
</table>

F. Books:

G. Magazines:
1. Electricity Today T & D Magazine

H. Journals:
1. The Journal of the Institute of Electrical and Electronics Engineers, Japan.
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:

<table>
<thead>
<tr>
<th>Teaching</th>
<th>50%</th>
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</thead>
<tbody>
<tr>
<td>Learning/ case presentation</td>
<td>30%</td>
</tr>
<tr>
<td>Assignment</td>
<td>10%</td>
</tr>
<tr>
<td>Attendance</td>
<td>10%</td>
</tr>
</tbody>
</table>

D. Examination pattern:

| Theoretical Examination | 50 |
| Class test | 30 |
| Assignment | 20 |

E. Books:

F. Magazines:

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

UNIT II

UNIT-III

UNIT-IV

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:
4. Power System Analysis by J.J. Grainger and W.D. Steverson, MGH.

G. Magazines:
2. E & T Magazine, IET, U.K.
3. Power and Energy Magazine, IEEE.

H. Journals:
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**


**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.
4. Determination of flashover voltage of pin type and string type insulators.
6. Generation of HV Impulse waveforms and analysis using Digital Storage CRO. (Positive and Negative waveforms).

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:

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.
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

UNIT III:
DIESEL AND GAS TURBINE POWER PLANT

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:

H. Magazine:
1. Power Plant Design Magazine, IEEE.
2. Power and Energy Magazine, IEEE.
3. Renewable Power Generation, IET.

I. Journals:
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

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:
7. Switchgear and Protection--M.V. Despande

H. Magazines:
1. Power Apparatus and System Magazine (PAS), IEEE.
2. Electrical Insulation Magazine, IEEE.

I. Journals:
1. Power Delivery (PD) Journal, IEEE.
2. Electrical Power Applications, IET.
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

UNIT – III

UNIT – IV
Electrolytic Processes: Electro deposition, Anodizing, electro polishing, cleaning and pickling, Electro-metallurgy. Power supplies Refrigeration and air conditioning: Air-

D. Books:

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.
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 designed 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 of 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-I:  
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:  

Unit-IV:  
Data Collection Tools and Data Processing- Questionnaires and Observation Forms; Questionnaire Design Process;  

Unit-V:  

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:
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.


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%

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

Examination Pattern

Theoretical Examination : Written
Practical Examination: Conducting experiments and viva-voce.
MAGAZINE:
2. Electricity Today (T & D) Magazine.

JOURNALS:
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

Unit-II

Unit-III

Unit-IV
- 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:


MAGAZINES:
1. IEEE Xplore
2. Electricity Today T & D Magazine

JOURNALS:
1. The journal of the institute of electrical and electronics engineers, Japan.
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, Musculo-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, (Ganstrers), 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 Chemicial 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:

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 Edward 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.
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:

Unit II:

Unit III:

Unit IV:

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:

MAGAZINE:
1. Power Plant Design Magazine, IEEE.
2. Power and Energy Magazine, IEEE.
3. Renewable Power Generation, IET.

JOURNALS:
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:
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.  

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:  

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 (Chap 9): 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:
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 to 8085: Architecture and operation, pin out diagram. Assembly language programming
for 8085microprocessor 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 8085 with 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 with 8085: 8255, 8253, 8279, 8251.

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:
   Eastern Ltd.
   Nanded.
MAGAZINES:
1. Electrical Business Magazine, (Online edition of Electrical Industry Magazine)
2. Instrumentation and Measurement Magazine, IEEE.

JOURNALS:
1. Instrumentation and Measurement, IEEE Transactions.
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:

Unit II:

Unit III:

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:

MAGAZINES:
2. E & T Magazine, IET, U.K.
3. Power and Energy Magazine, IEEE.

JOURNALS:
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

Unit III

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

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Syllabus for B.Tech in Electrical Engineering

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

Books:


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

JOURNALS:
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 load, PV fed drives.

Unit II:

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:

Books:


MAGAZINES:
2. IEE Spectrum.
3. E & T Magazine, IET.
JOURNALS:
1. Power and Energy Society (PES), IEEE Transactions
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, selection and analysis- Process planning, selection and analysis- 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  

4. Product Cost Estimation  
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  
Theoretical Examination: Written  
Practical Examination: Conducting experiments and viva-voce.  

Text Books:  
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:

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

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