SHRI RAMDEOBABBA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR - 440013

An Autonomous College affiliated to Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2017-21

B. E. (ELECTRICAL ENGINEERING)
About the department

The Department of Electrical Engineering was established in year 1984 with a sanctioned intake of 60 students. The National Board of Accreditation has accredited the department thrice in succession in the year 2001, 2006 & 2012. Presently, the Electrical Engineering Department has post graduate program (M. Tech. in Power Electronics and Power Systems) with sanctioned intake of 18, started from 2011. Department is a Recognized Research Centre, approved by RTM Nagpur University for Master of Engineering (M.E.- By Research) and Doctoral program. Department has twelve well-equipped laboratories.

Department has Two Professors, Nine Associate Professors and Twelve Assistant Professors on the roll. Department has well qualified and experienced faculty with industrial background. Presently, five faculty members are Ph.D., three have submitted their thesis and Sixteen pursuing Ph.D. They are normally invited by other institutes and industry to deliver guest lectures. Some of these industries are Ordnance factory ambazari and Hindalco Industries, Mouda. They have undertaken many consultancy projects and have been granted patent by government of India.

The department has conducive environment for the academic and overall development of the students. The Electrical Engineering Students Association (EESA) is a platform for promoting the curricular, co-curricular and extracurricular students activities. Department students actively participate in sports and represent the college at various levels. Students are keenly interested in contributing for social cause and join the National Service Scheme (NSS) activities. Department organizes Seminars, Guest lectures and Training programs, Product exhibitions for the students. Students get opportunity to enhance their technical skill by participating in the training program like PLC, SCADA and Microcontroller Applications.

To introduce the graduating students to the latest developments in the industry, the department organizes product exhibition “Empower”. Reputed companies namely ABB Limited, ARCTIC Infra Tech Solutions Ltd., Larsen and Toubro Switchgear Ltd, HOKKI Inc. Japan, GRANDSTREAM INDIA Cohesive Technologies (P) Ltd, Grundfos Pumps India Private Ltd, Hager Electro Private Limited, KIEL Industries Limited, Powerica Ltd. (Cummins Division), WIPRO Lighting, Texas Instruments, Bergen Associates, Schneider Electrical, HP India, Biosys (India) Pvt Ltd, Rockwell Automation participated in the exhibition with the wide range of products to display.

The department has excellent placement record. Students are placed in core electrical as well IT companies. Companies visiting the campus for the placement include: Reliance Energy, L&T, Mahindra & Mahindra, Kirloskar Oil Engines, BILTs, TCS, Tech-Mahindra, Syntel, Mindtree, Raymond Limited, Shapoorji Pallonji, Infosys, EMCO PVT Ltd and many more.

On academic front, the department results are consistently good with students seeking merit positions on the University level. The department has active Entrepreneur Development Cell to develop the entrepreneurial skills among the students. The department highly encourages the industry interaction. Students go for industry training during the vacation.

Department Vision: Department of Electrical Engineering endeavors to be one of the best departments in India having expertise to mould the students to cater the needs of society in the field of technology, leadership, administration, ethical and social values.

Department Mission: To provide dynamic and scholarly environment for students to achieve excellence in core electrical and multidisciplinary fields by synergic efforts of all stake holders of the Electrical Engineering Department and inculcate the ethical and social values.
Programme Educational Objectives

PEO1: Our graduates will work on design, operation and practice in electrical fields by addressing intricacies of engineering and technology applications.

PEO2: Our graduates will work in multidisciplinary fields and adapt to new technologies, new work environments, pursue additional skills and knowledge leading to professional development.

PEO3: Our graduates will progress in their career by demonstrating in practice the technical and communication skills with an understanding of ethical and social responsibilities.

Programme Outcomes

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals to the solution of engineering problems.

PO2. Problem analysis: Identify, formulate, review literature, and analyze complex engineering problems using first principles of mathematics, natural sciences and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public safety, societal and environmental considerations.

PO4. Conduct problem investigations: Use research-based knowledge including experimentation, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Select, and apply appropriate techniques, resources, and modern engineering and IT tools for analyzing the engineering activities with an understanding of the limitations.

PO6. The engineer, industry and society: Apply contextual knowledge to assess industrial, societal and safety related issues and understand consequent relevance to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities such as, being able to understand and write effective reports, make effective presentations and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team in multidisciplinary environment.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes

PSO1. Analyze and design electrical networks, machines, control systems, power systems, power converters and evaluate the performance.

PSO2. Understand and develop electrical systems considering energy efficiency, power scenario, environmental issues and industry applications.
### Scheme of Examination of Bachelor of Engineering (Electrical Engineering) Semester Pattern

#### III Semester, B.E. (Electrical Engineering)

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Credits</th>
<th>Maximum Marks</th>
<th>Exam Duration</th>
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<tr>
<td>1</td>
<td>MAT201</td>
<td>Engineering Mathematics-III</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>40 60 100</td>
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<td>2</td>
<td>EET201</td>
<td>Elements of Electromagnetic Theory</td>
<td>4</td>
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<td>3</td>
<td>EET202</td>
<td>Network Analysis</td>
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<td>4</td>
<td>EEP207</td>
<td>Network Analysis Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>25 25 50</td>
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<tr>
<td>5</td>
<td>CST212</td>
<td>Introduction to Computer Concepts</td>
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<td>1</td>
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<td>Electronic Devices &amp; Circuits</td>
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<td>ENP206</td>
<td>Electronic Devices &amp; Circuits Lab</td>
<td>0</td>
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<tr>
<td>9</td>
<td>CHT201</td>
<td>Environmental studies I</td>
<td>2</td>
<td>0</td>
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#### IV Semester, B.E. (Electrical Engineering)

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<th>Sr. No</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>L</th>
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<th>P</th>
<th>Credits</th>
<th>Maximum Marks</th>
<th>Exam Duration</th>
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<tr>
<td>1</td>
<td>MAT242</td>
<td>Electrical Engineering Mathematics</td>
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<td>Principles of Economics and Management</td>
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<td>Digital and Linear Electronic Circuits</td>
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<td>4</td>
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<td>Digital and Linear Electronic Circuits Lab</td>
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<tr>
<td>5</td>
<td>EET201</td>
<td>Electrical Machines-I</td>
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<td>Electrical Measurement and Measuring Instruments</td>
<td>4</td>
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<td>0</td>
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### Scheme of Examination of Bachelor of Engineering (Electrical Engineering) Semester Pattern

#### V Semester, B.E. (Electrical Engineering)

<table>
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<tr>
<th>Sr. No</th>
<th>Subject Code</th>
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<th>P</th>
<th>Credits</th>
<th>Maximum Marks</th>
<th>Exam Duration</th>
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<tr>
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<td>EET301</td>
<td>Power Station Practice</td>
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<td>EET302</td>
<td>Electrical Machines-II</td>
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<td>3</td>
<td>EEP302</td>
<td>Electrical Machines-II Lab</td>
<td>0</td>
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<td>4</td>
<td>EET303</td>
<td>Electrical Power Systems-I</td>
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<tr>
<td>5</td>
<td>EET304</td>
<td>Elective I</td>
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<td>Electrical Engineering Workshop</td>
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<tr>
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<td>Industrial Visit and Case Study</td>
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<td>EET316</td>
<td>Microprocessor &amp; Interfacing</td>
<td>0</td>
<td>0</td>
<td>2</td>
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<tr>
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<td>Microprocessor &amp; Interfacing Lab</td>
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<td>0</td>
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<tr>
<td>10</td>
<td>EET317</td>
<td>Self Study</td>
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### Course Code

- **Elective-I**
  - EET304-1: Electrical Machine Design
  - EET304-2: Entrepreneurship Development
  - EET304-3: Energy Management and Audit
  - EET304-4: Design of Data Acquisition & Logic controller

#### VI Semester, B.E. (Electrical Engineering)

<table>
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<tr>
<th>Sr. No</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>L</th>
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<th>P</th>
<th>Credits</th>
<th>Maximum Marks</th>
<th>Exam Duration</th>
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<tr>
<td>1</td>
<td>EET307</td>
<td>Control System Engineering</td>
<td>4</td>
<td>1</td>
<td>0</td>
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<tr>
<td>2</td>
<td>EEP307</td>
<td>Control System Engineering Lab</td>
<td>0</td>
<td>0</td>
<td>2</td>
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<tr>
<td>3</td>
<td>EET308</td>
<td>Electrical Drives &amp; Their Control</td>
<td>3</td>
<td>1</td>
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<tr>
<td>4</td>
<td>EET309</td>
<td>Power Electronics</td>
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<td>EEP309</td>
<td>Power Electronics Lab</td>
<td>0</td>
<td>0</td>
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<td>Instrumentation</td>
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<tr>
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<td>EET313</td>
<td>Open Elective</td>
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<tr>
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<td>Computer Aided Electrical Engineering Drawing</td>
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<tr>
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<td>EEP312</td>
<td>Mini project</td>
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</table>
Course Code: MAT101  
Course: Engineering Mathematics-I  
L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week  
Total Credits: 09

Course Objective
Course objective of this course is to provide understanding the concepts of Mathematics and its application to Engineering. This course introduces the student to Differential Calculus for one and several variable, Differential Equations and Infinite Series.

Course Outcomes
On successful completion of the course, student shall be able to
1. Solve Engineering problems using the concept of Differential Calculus.
2. Get analytical solution of Ordinary Differential Equations in Engineering.
3. Test convergence of Infinite series.

Syllabus

**Unit - I:**  
Ordinary Differential Calculus: Successive differentiation, Taylor’s and Maclaurin’s series for function of one variable, indeterminate forms, curvature, radius of curvature and circle of curvature.

**Unit - II:**  
Partial Differentiation: Functions of several variables, first and higher order derivative, Euler’s Theorem, Chain rule and Total differential coefficient, Jacobians. Taylor’s and Maclaurin’s series for function of two variables, Maxima and minima for function of two variables, Lagrange’s method of undetermined multipliers.

**Unit - III:**  
Infinite Series: Convergence, divergence and oscillation of series, General properties, Tests of convergence, Alternating series.

**Unit - IV:**  
First Order Differential Equation: First order first degree differential equations: Linear, reducible to linear, exact and reducible to exact differential equations; Non-linear differential equations.

**Unit - V:**  
Higher Order Differential Equation: Higher order differential equations with constant coefficient, method of variation of parameters, Cauchy’s and Legendre’s homogeneous differential equations, simultaneous differential equations, differential equation of the type $d^2y/dx^2 = f(x)$ and $d^2y/dx^2 = f(y)$.

**Unit - VI:**  
Text Books:
3. Advanced Engineering Mathematics, 2 ed, Jain, Iyenger, Narosa publication

Reference Books:
2. Schaum’s Outline of Differential Equations, Richard Bronson, TMH, 3ed, New Delhi
3. Engineering Mathematics by Srimanta, Paul

Syllabus of Group 1 - Semester I and Group 2 – Semester II, Bachelor of Engineering

Course Code : PHT101     Course : Engineering Physics
L: 4 Hrs, T: 1 Hr, P : 0 Hr., Per week   Total Credits : 09

Course Objectives :
1. To develop the ability to apply concepts in elementary physics to understanding of engineering applications;
2. To introduce more advanced physics concepts, which form the basis of modern engineering;
3. To provide a sound foundation in mathematical formulation of concepts learnt and their applications;
4. To elaborate the general nature of concepts learnt and of possibility of their cross-disciplinary application;
5. To develop skills for numerical problem solving in areas covered

Course Outcomes :
At the end of the course the students
1. will be able to recognize and analyze phenomena of interference, diffraction and polarization of light waves;
2. will understand principles of laser action and basic working of many types of laser devices;
3. will understand geometrical theory of optical fibre communication and the phenomena of attenuation and dispersion of electrical signals in the fibre;
4. will understand fundamental notions in quantum mechanics such as wave particle duality, de Broglie matter waves, Heisenberg uncertainty relations, wave function of system, quantum confinement, quantization of energy and quantum tunneling of potential barriers;
5. will understand concepts like Fermi energy and density of states, understand calculation of carrier density and electrical conductivity in intrinsic and semiconductors and understand the behaviour of pn-junction;
6. will understand broad principles of electromagnetic electron lenses, cyclotron, mass spectrograph and working of the CRO;
7. will understand the reasons for novel properties at nano-scale, be familiar with elements of some of the methods of synthesis and characterization and some of the properties of such materials;
8. will be able to understand and perform numerical calculations in areas of optics, lasers, optical fibres, quantum physics, semiconductors, charged particle devices and nano physics at the level defined above for these.

Unit-I:
Optics:
Interference in thin films, division of amplitude and wavefront, wedge-shaped films, Newton’s rings, antireflection coatings; Diffraction, single slit, double slit. Different types of polarization of light, Malus’ law, production of plane polarized light, birefringence, wave plates.
Unit-II:
Quantum Physics:
Wave-particle duality, wave packets, Heisenberg uncertainty relations; Wave function, probability Schrodinger’s equation, time dependent equation and its separation; Infinite potential and finite potential wells, phenomenon of tunneling.

Unit-III:
LASERs and Optical Fibres:
Interaction of matter and radiation, LASER, spontaneous and stimulated emission, population inversion; Common types of lasers and their applications; Optical fibres, structure, types, propagation in a fibre, modes of propagation, signal attenuation, signal distortion.

Unit-IV:
Mass Spectrograph and Particle Accelerators:
Principles of electron optics, cathode ray tube, cathode ray oscilloscope, mass spectrographs, particle accelerators.

Unit-V:
Semiconductors:
Band structure of solids, band diagrams of insulators, semiconductors and conductors, Fermi level in conductors and semiconductors, carrier concentration, conductivity, effective mass; Junction diode and its band diagram, depletion region and barrier potential, diode rectifier equation.

Unit-VI:
Nanophysics:
What is Nanotechnology? Fullerenes and nanoparticles; Outline of methods of preparation; Elements of electron microscopy; Scanning probe microscopy, Outline of properties – physical, thermal, optical, electrical, magnetic; Quantum size-effects; CNTs; Applications.

Text Books:

Reference Books:
1. Electronic Engineering Materials and Devices: J. Allison, TMH.
SHRI RAMDEOBABA COLLEGE OF ENGINEERING & MANAGEMENT, NAGPUR

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EET101
Course : Electrical Engineering
L:3 Hrs., T:1 Hrs., P:0 Hrs., Per week
Total Credits : 07

Course Outcomes:

Upon completion of this course, the students shall be able to,

1. Apply the basic laws of electric and magnetic circuits to obtain the unknown quantities.
2. Represent and interpret the sinusoidal electrical quantities mathematically as well as graphically in the form of waveformsphasors and analyze the 1-phase/3-phase AC circuits to determine the unknown quantities.
3. Determine the power losses/efficiency and voltage drop/voltage regulation of a 1-phase transformer at full load condition and demonstrate the knowledge related with its need, construction, principle, types and applications.
4. Describe the construction, principle, applications and performance characteristics of DC machines and Induction motors.
5. Demonstrate the concept of electrical power generation, transmission, distribution and the understanding about conventional/renewable energy sources.
6. Demonstrate the understanding about necessity of electrical earthing, safety & protecting devices, electrical energy utilization, illumination sources and their selection.

Unit-I:

Magnetic Circuits: Concept of MMF, Flux, reluctance, analogy with electric circuits, B-H curve, simple numerical on series magnetic circuits.

Unit-II:


Unit-III:
Introduction to Electrical Power System:
Introduction to Power Generation (Thermal, Hydro, Nuclear, Wind and Solar) with block schematic representation only. Single line diagram for Generation, Transmission & Distribution through different voltage levels. Low voltage radial distribution system (Over head & underground, single phase and three phase).

Text Books:
2. Electrical Technology: B. L. Thareja, S. Chand Publications.

Reference Books:

Programme Scheme & Syllabi for B. E. (Electrical Engineering)

Necessity of equipment earthing, Fuses (Rewirable and HRC), MCB, ELCB. Basic operation of UPS and Inverters (Block schematic representation).

Unit-IV:
Single phase Transformer:
Principle of operation, Construction, Transformer ratings, No load and On load operation with leakage reactance, losses, efficiency, Definition & formula for voltage regulation, OC/SC test, equivalent circuit referred to primary side of transformer.

Unit-V:
Rotating Electric Machines:
DC Machines: DC Generator-Principle of working, construction (without details of armature winding), classification of DC generators. DC Motors-Back EMF, necessity of starters, speed and torque equations, characteristics of motors, speed control of DC motors (without numerical). Application of DC motors.
Three Phase Induction Motors: Working principles, types and construction of three phase Induction Motor, synchronous speed, torque, slip, torque slip characteristics, applications of three phase Induction motor.
Single Phase Induction Motors: operating principle of capacitor start and run single phase induction motor and its applications.

Unit-VI:
Utilization of Electrical Energy:
Illumination: Definition of luminous flux, luminous intensity, Candle power, illumination, Luminance, Luminous efficiency (lumens/watt) of different types of lamps, working principle of Fluorescent/Sodium Vapour/ Mercury vapor & CFL Lamps. Simple numerical to determine number of lamps to attain a given average lux level in an area.

Electric Heating: Advantages of Electrically produced heat, types and applications of Electric heating equipment, transfer of heat (conduction, convection, radiation); Resistance ovens, Induction heating (Core & coreless type), Dielectric heating. (Note. Numerical excluded)

Tariff: One part (KWH based) tariff with simple numerical; to calculate the domestic electricity charges.

Text Books:
2. Electrical Technology: B. L. Thareja, S. Chand Publications.
Course Code: EEP101        Course: Electrical Engineering Lab
L:0 Hr., T:0Hrs., P:2 Hrs., Per week      Total Credits : 02

Course Outcomes:
Upon completion of this course, the students shall be able to,
1. Connect the electric circuits based on the syllabus of theory subject EET101 and test the performance by way of observation, calculations and conclusion.
2. Demonstrate the concept and significance of power factor and how it can be improved.
3. Conduct an electrical energy survey of connected load at residential premises and demonstrate the understanding of energy tariff by calculating the energy bill in accordance with the norms of State Electricity Distribution Company.

List of Experiments:
1. To verify Kirchoff’s voltage and current law using D.C. source.
2. To study the R-L-C series circuit with AC source.
3. To study R-L-C parallel circuit with AC source.
4. To perform direct load test on 1-phase transformer for finding regulation and efficiency.
5. To perform open circuit and short circuit tests on 1-phase transformer.
6. To study 3-phase star delta connections and verify different relations of voltage, current and power.
7. To study the speed control techniques for DC shunt motor.
8. To study the importance of power factor and improvement of power factor using static capacitors.
9. To analyze energy bill of residential category and prepare energy sheet.

Course Code: CST101        Course: Computer Programming
L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week    Total Credits: 4

Course Outcomes:
On successful completion of the course, students will be able to
1. Understand basics of computer, software, number systems, flowchart and algorithms.
2. Design and code well-structured C programs.
3. Write program on the basis of decision control structures and loop control structures.
4. Perform sorting and various other operations on 1-D and 2-D array.
5. Perform operations on structures, functions and pointers.

Syllabus
Unit-I:

Unit-II:
C Programming Language: Keyword, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case.

Unit-III:
Loop Control Structure: goto, while, for, do while, break, continue. Storage classes, Enumerated Data types, Renaming Data types with typedef(), Type Casting, Bitwise Operators.

Unit-IV:
Array: Introduction, array Declaration, Single and multidimensional array. Pointers: Introduction, Definition and use of pointer, Pointer arithmetic, pointer operators, pointer and array, pointer to pointer

Unit-V:
Structures and Union: Declaring and using structure, Structure initialization, Structure within structure, array of structure, pointer to structure.

Unit-VI:
Function Programming: Introduction, User Defined and Library Function, Parameter passing, Return value, Recursion, pointer and function

Text Books:

Reference Books:
1. Let Us C:9thed: Yashwant Kanetkar, BPB Publication
2. Programming with C: Byron Gottfried, Schaums Outline Series.
Course Code: CSP 101        Course: Computer Programming Lab
L: 0 Hrs., T: 0 Hrs., P:2 Hrs. Per week                           Total Credits: 2

Course Outcomes:
1. Implement programs based on if-else, switch and loop structure.
2. Implement programs based on 1-D and 2-D numeric and character arrays.
3. Perform operation on structure and pointer.
4. Design programs based on functions.

CSP101 practicals based on above CST 101 syllabus

Course Code : HUT101      Course: Communication Skills
L:2 Hrs., T:0 Hrs., P:0 Hrs., Per week     Total Credits:4

Course Outcomes:
1. Students have better reading comprehension, pronunciation, and functional English grammar.
2. Students are able to write letters and resumes
3. Students are able to organize their thoughts for effective presentation and writing.
4. Students are able to learn skills to present themselves well in an interview, and handle a Group Discussion

Syllabus
Unit-I:
Communication:
What is Communication, the Media of Communication, Channels of Communication, Barriers to Effective Communication, Role of Communication Skills in Society.

Unit-II:
Reading Comprehension:
The Process of Reading, Reading Strategies Central idea, Tone and Intention, Comprehension Passages for practice.

Unit-III:
Professional Speaking:
Components of an effective talk, Idea of space and time in public speaking, Tone of voice, Body language, Timing and duration of speech, Audio-Visual Aids in speech. Presentation Skills, Group Discussion and Job Interviews

Unit IV:
Orientation to Literary and Scholarly Articles:
Preferably two fictional and two non-fictional texts (Selected by the teachers and the Head). The art of writing articles on social, cultural, scientific and technical issues (Paragraph Writing), Exercises.

Unit V:
Business Correspondence:
Types and Formats of Business letters, Routine Business Letters (Inquiry, Order, Instruction, Complaint, Adjustment), Sales Letters, Resumes and Job applications, Business Memos, Emails.
Unit VI:
Grammar:
Synonym and Antonym, Give one word for, Voice, Narration and Comparison of Adjectives and Adverbs, Transformation of sentences and Common Errors, Idioms and Phrases, Note Making, Précis writing.

Text Book:

Reference Books:

Sr. No Name of the Practical Activities Taken Medium of Practical
1 Speaking Skills 1. Introduction to effective ways of speaking PPT Based, JAM/Self-introduction
2. Oral presentations Extempore / Debate / JAM/Self-introduction
2 Presentation Skills 1. Preparing visual aids/PPTs on given topics PPT Based, Activity Based
3 Group Discussion-Orientation 1. GD types PPT Based, Activity Based
2. GD techniques/rules - videos Open Source CDs
3. General/familiar topics for discussion Activity based
4 Group Discussion-Practice session 1. Divide in group of 6 PPT Based, Activity Based
2. Classification of topics
3. Feedback
5 Group Discussion-Mock 1. Divide in group of 6 Activity Based
2. Mock GDs - types Activity Based
3. Feedback
6 Interview Techniques-Orientation 1. Various types of interviews PPT Based, Activity Based
2. Types of interviews
3. Self-analysis
4. KYC sheet
5. Self-introduction
7 Interview Techniques Practice Sessions 1. Video Open Source CDs
2. Non-verbal communication Activity Based
3. Types of interview questions
8 Interview Techniques-Mock Interviews Optional Practicals 1. Mock Interviews (One to One) Teacher can decide any other Practical apart from the ones mentioned below
2. Activitiy Based
11 Listening Skills 1. Listening Barriers PPT Based, Activity Based
10 Non Verbal Communication 1. Kinesics in com/interviews Open Source CDs
2. Activities/Role play PPT Based
11 Use Figurative Language 1. Intro phrases/ Idioms/proverbs/ pronunciation PPT Based, Activity Based
Course Code: PEP101  
Course: Sports/Yoga  
L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week  
Total Credits: 00

Course Outcomes

On successful completion of the course, students will be able to
1. Understand fundamental skills and basic rules of games.
2. Gain health related physical fitness.
3. Develop body-mind coordination through games and yogasans.

BRIEF OBJECTIVES OF SPORTS/YOGA PRACTICAL CLASSES

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education department at RCOEM will conduct sports/yoga classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be to develop team spirit, social skills as well as identify and develop leadership qualities in students through various sports group activities. Training of students to understand the rules of various national and international games would also be an important objective. Sport activities would also be conducted with the objective to provide recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate fitness of students so as to recommend and conduct specific Yoga and Sport activities.

PROGRAMME OUTLINE

1. Sports
   1. Introduction to sports i.e. volleyball, cricket, football, basketball, badminton, T.T., Athletics.
   2. Health and safety issues related to sports; Knowledge, recognition and ability to deal with injuries and illnesses associated with sports.
   3. Awareness about sports skills, techniques and tactics.
   4. Rules, regulations and scoring systems of different games (Indoor & Outdoor).
   5. Trials of students to participate in inter-collegiate/University level games.

2. Yoga: Includes asanas like sitting, standing and lying, Suryanamaskar, Pranayam.

3. Physical fitness test: this would include speed, Cardiovascular Endurance, strength, skill & flexibility.

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Course Code: MAT102  
Course: Engineering Mathematics-II  
L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week  
Total Credits: 09

Course Objective

The objective of this course is to expose student to understand the basic importance of Integral Calculus and Vector calculus. The student will become familiar with fitting of curves and regression analysis.

Course Outcomes

On successful completion of the course, student shall be able to
1. Understand and use the concepts of Integral Calculus for Engineering problems.
2. Apply technique of Vector differentiation and integration to various Engineering problems.
3. Know basic statistical techniques required for Engineering.

Syllabus

Unit-I: Integral Calculus I: Beta and Gamma functions, Differentiation of definite integrals, Mean value and root mean square values.

Unit-II: Integral Calculus II: Tracing of curves (Cartesian, polar and parametric curves), rectification of simple curve, quadrature, volumes and surface of solids of revolutions (Cartesian, polar and parametric forms), Theorem of Pappus and Guldin.

Unit-III: Multiple Integrals and their Applications: Elementary double integrals, change of variable (simple transformation), change of order of integration (Cartesian and polar), application to mass, area, volume and centre of gravity (Cartesian and polar forms), elementary triple integrals.

Unit-IV: Vector Calculus I: Scalar point function, Vector point function, vector differentiation, gradient, divergence and curl, directional derivatives with their physical interpretations, solenoidal and irrotational motions, Scalar potential function.

Unit-V: Vector Calculus II: Vector integration: Line integrals, work done, conservative fields, surface integrals and volume integrals, Stokes’s theorem, Gauss divergence theorem, Green’s theorem and their simple applications.

Unit VI: Statistics: Fitting of straight line, y = a + bx, parabola y = a + bx + cx^2 and the exponential curves by method of least squares, Coefficient of linear correlation, lines of regression, rank correlation, multiple regression and regression plane of the type z = a + bx + cy, coefficient determination.

Text Books:

Reference Books:
SHRI RAMDEOBABA COLLEGE OF ENGINEERING & MANAGEMENT, NAGPUR

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course No. CHT101  Course: Engineering Chemistry
L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week  Total Credits: 09

Course Outcomes of Engineering Chemistry:
Upon successful completion of the course, the student shall be:
1. Able to understand the basic scientific principles underlying the troubles caused by impurities present in water and treatment to remove the same.
2. Understand the applications of different nanomaterials with their synthetic routes.
3. Able to characterize the fuels and analyze their combustion mechanism.
4. Able to understand the effect of constituents on quantity of cement manufactured with their setting and hardening reactions.
5. Able to understand principles of lubrication along with chemical properties of lubricants.
6. Knowledge of proper engineering materials having better corrosion resistance and sustainability and implement the effective measures to minimize the corrosion wherever possible.

Syllabus
Water Treatment:

Water Treatment for Domestic Water:
Domestic water treatment: Brief discussion and Chemistry involved in the process of sedimentation, coagulation, filtration and sterilization by UV, Ozone, Chlorination including Break point chlorination. Desalination of water using reverse osmosis and electro dialysis.

Numericals Based on Water Softening: Numericals based on (1) lime-soda (2) zeolite / ion-exchange water treatment processes.

Cement:
Process parameters involved in the manufacturing of portland cement, manufacture of portland cement, microscopic constituents of cement and their effects on strength; setting and hardening of cement.

Types and uses of cement: Pozzolonic; Rapid hardening, Low heat and High alumina cements. Additives and admixtures used in cement: Accelerators, Retarders, Air entrainment agents, Water repellants.

Chemical approach to Nanomaterials:
General introduction to nanotechnology, timeline and milestone, overview of different nanomaterials available, potential use of nanomaterials in electronics, sensors, medical applications, catalysis, environment and cosmetics.

Physical chemistry related to nanoparticles such as colloids and clusters: conductivity and enhanced catalytic activity compared to the same materials in the macroscopic state. Synthesis of nanomaterials: 'Top-Down'-photolithography and 'Bottom-Up'-sol-gel method.

Carbon nanotubes: Single-walled and multi-walled carbon nanotubes, their structures, properties and applications.

Potential risks of nanomaterials: Health and environmental impact.

Fuels and combustion:
Introduction, Calorific value, Higher and Lower calorific value, flame temperature and flame intensity, determination of calorific value by Bomb calorimeter and Boy's calorimeter, numericals based on the determination of calorific value by Bomb and Boy's Calorimeter.

Solid Fuels:
Types of coals, proximate and ultimate analysis of coal, its significance, Carbonization of Coal.

Liquid and Gaseous Fuels:
Liquid fuels: mining & fractional distillation of crude petroleum, use of gasoline in internal combustion engine, octane number, cetane number, flash point of combustible liquid fuel, knocking. Fisher-Tropsch's process for manufacture of synthetic gasoline, thermal and catalytic cracking: fixed bed and fluid bed catalytic cracking; aviation gasoline.

Gaseous fuels:
CNG and Significance of flue gas analysis by Orsat apparatus.

Numericals based on Combustion Calculations:
Numericals based on combustion calculations for solid fuels. Numericals based on combustion calculations for liquid and gaseous fuels.

Friction, Wear and Lubricants:

Corrosion:
Electrochemistry and Theories of Corrosion:
Introduction to corrosion, Cause and Consequences of corrosion, Measurement of corrosion rate, Galvanic series, Dry and Wet corrosion, Pilling-Bedworth rule, factors affecting the rate of corrosion.

Types of corrosion and Preventive Methods; Different types of corrosion (Pitting, Stress, Intergranular and...
Galvanic), protection against corrosion, design and selection of engineering materials, cathodic and anodic protection, Brief discussion about Protective Coatings: Metallic, Inorganic, Organic coatings, Corrosion inhibitors.

Text Books:
3. TextBook of Environmental Chemistry and Pollution Control, S. S. Dara; S. Chand and Company Ltd., New Delhi.

Reference Books:

Syllabus of Group 1 - Semester 1 and Group 2 - Semester II, Bachelor of Engineering
Course Code : CHP101
Course: Engineering Chemistry Lab
L:0 Hr., T:0 Hrs., P:3 Hrs., Per week
Total Credits : 03

Course Outcomes of Engineering Chemistry Lab
After successful completion of the course, the student will be able to
1. Be conversant with various chemical processes involved in qualitative as well as quantitative analysis of different materials, water pertaining to various impurities and to record the information in the scientific way.
2. Understand applicability of different physico-chemical properties of fluids such as viscosity and flash point for various industrial machineries.

Text Books:

Reference Books:
Syllabus of Group 1 - Semester II and Group 2 - Semester I, Bachelor of Engineering

Course Code: CET101   Course: Engineering Mechanics
L:3 Hr., T:1 Hrs., P:0 Hrs., Per week  Total Credits : 07

Course Outcomes
After Completion of the course in Engineering Mechanics, the student should be able to
1. Define and Describe various parameters related to static and dynamic behaviour of the rigid bodies.
2. Understand and describe physical phenomenon with the help of various theories.
3. Explain and analyse various physical phenomenon with the help of diagrams.
4. Describe and analyse the engineering problems with the acquired knowledge of engineering mechanics

Syllabus

Unit-I:
Fundamental of Engineering Mechanics:

Unit-II:
Equilibrium of Force System :
Equilibrium of concurrent force system, Equilibrium of non-concurrent force system Friction: Law’s of friction, simple application, wedge friction, belt friction.

Unit-III:
3-D Force system & Analysis of trusses :
Moment of a force about a point and about an axis, resultant of spatial concurrent & Non concurrent force system, wrench, equilibrium of concurrent and non-concurrent force system. Analysis of simple trusses (Joint & Section Method)

Unit-IV:
Centroids and moment of inertia :
Centroids locating by first principle, centroid of composite areas, Second moment and product of inertia of plane areas. Moment of Inertia of composite areas. Transfer theorems for moment of Inertia and Product of Inertia.

Virtual work method
Virtual work principle, application of virtual work principle.

Unit-V
Kinematics & Kinetics of Particles :
Rectilinear motion of a particle with variable acceleration, Projectile motion, normal and tangential components of acceleration, kinetics of particle and several interconnected particles. D’Alembert’s principle, problems on connected system of particles.

Unit-VI:
Collision of elastic bodies:
Principle of conservation of momentum, Impulse momentum equation, work energy equation, coefficient of restitution, impact of elastic bodies.

Text Books:

Reference Books:
Course Code: CEP101     Course: Engineering Mechanics Lab
L:0 Hr., T:0Hrs., P:2 Hrs., Per week    Total Credits: 02

Course Outcome
After Completion of the course in Engineering Mechanics Lab; the student should be able to:
1. Define and explain different terminologies of simple lifting machines.
2. Understand and perform practicals on equilibrium of concurrent and non-concurrent force systems.
3. Describe various terminologies related to friction and mass moment of inertia.
4. Explain graphical solutions of equilibrium conditions in engineering mechanics.
5. Analyse the experimental data collected based on practicals and discuss the results.

Minimum of Eight Practical will be performed based on the theory
List of Experiment
Experiments On "Simple Lifting Machines"
1. Law of machine for Differential Axle and Wheel
2. Law of machine for Single Purchase Crab
3. Law of machine for Double Purchase Crab

Experiments On "Equilibrium of force systems"
4. Jib Crane (Equilibrium of concurrent Forces)
5. Simple Beam (Equilibrium of Non-concurrent Forces)
6. Shear Leg Apparatus (Equilibrium of 3-D concurrent forces)

Experiments On "Friction & Inertia"
7. Inclined Plane (Coefficient of friction using Inclined Plane)
8. Belt Friction (Coefficient of friction using coil friction set-up)
9. Fly-Wheel (Mass moment of Inertia of fly-wheel)

Graphical Methods in Engineering Mechanics
10. Resultant of concurrent force systems
11. Resultant of Non-concurrent force system
12. Reactions for simply supported beams
13. Forces in members of simple Trusses
14. Moment of Inertia (Mohr’s Circle)

Syllabus of Group 1 - Semester II and Group 2 - Semester I, Bachelor of Engineering
Course Code: MET101    Course: Engineering Drawing
L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week    Total Credits: 06

Course Outcomes: The expected learning outcome is that, the students shall be able to:
1. Draw & interpret technical drawings.
2. Convert 2-D drawing to 3-D drawing & vice-versa.
3. Represent the various positions of planes & solids in different orientations.
4. Develop the solid surface for sheet metal working.

Syllabus (Only First Angle Method of Projection)
UNIT 1
Scales - Plain Scale, Diagonal Scale, Vernier Scale
Engineering Curves; Ellipse: Directrix Focus, Concentric Circles & Rectangle Method.
Parabola: Directrix Focus, Rectangle Method, Tangent Method.
Hyperbola: Directrix Focus & Asymptote Method.

UNIT 2
Theory of Projections - Concept of Projection, First & Third angle projection methods.
Orthographic Projections: Conversion of given 3 dimensional View to 2 dimensional representation.

UNIT 3
Projections of Lines: Oblique Lines, Traces, Applications of lines.

UNIT 4
Projections of Planes - Polygonal Lamina, Circular Lamina.
Projections of Solids - Cube, Prism, Pyramid, Tetrahedron, Cylinder, Cone.

UNIT 5
Sections of Solids & Development of Lateral Surfaces - Cube, Prism, Pyramid, Tetrahedron, Cylinder, Cone.

UNIT 6
Isometric Projections: Isometric Scale, Conversion of given 2 dimensional views to Isometric Projection/View.

Books:

References:
1. Engineering Drawing by R.K. Dhawan, S. Chand Publications
Syllabus of Group 1- Semester II & Group 2- Semester I, Bachelor of Engineering

Course Code: MEP101      Course: Engineering Drawing Lab
L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week      Total Credits: 03

Course Outcome:
The expected learning outcome is that, the students shall be able to:
1. Draw & interpret technical drawings.
2. Plan the sheet layout for the given drawing.
3. Convert 2-D drawing to 3-D drawing & vice-versa.
4. Represent the various positions of planes & solids in different orientations.
5. Develop the solid surface for sheet metal working.
6. Use & demonstrate drafting package.

List of Sheets: (50% of the sheets to be drawn in Auto CAD)
Sheet No.1: Engineering Scales & Curves
Sheet No.2: Orthographic Projections
Sheet No.3: Projection of Lines
Sheet No.4: Application of Lines
Sheet No.5: Projection of Planes
Sheet No.6: Projection of Solids
Sheet No.7: Section & Development of Solids
Sheet No.8: Isometric Projections

Books:

References:
1. Engineering Drawing by R.K. Dhawan, S. Chand Publications

Syllabus of Group 1- Semester II and Group 2-Semester I, Bachelor of Engineering

Course Code: HUT102     Course:-Social Skills
L: 2 Hrs., T:0Hrs., P:0Hrs., Per week    Total Credits:4

Course Outcomes:
On successful completion of the course, students will be able to:
1. Learn the basic concepts of personnel management or manpower planning and the process of recruitment and selection that they will go through as engineers.
2. Learn leadership skills, industrial relations, work organizations, and impact of industry on society.
3. Learn about the political systems and institutions working in India, laws and legislations affecting industry and the application of political principles like democracy in industry.
4. Learn the importance and application of Economics in Engineering.
5. Learn about culture/civilization and develop cross cultural capacity.
6. Learn about Personal, Professional and social ethics.

Syllabus
Unit-I:
Industrial Sociology:-
• Meaning and scope of Industrial Sociology
• Work Organization and its types.
• Concept of Leadership: Meaning, changing roles and its types.
• Concept of Power and Authority: Meaning, Importance, sources and Delegation
• Industrial Culture in India: Effects of Industrialization and Urbanization on Indian Society.

Unit-II:
Industrial Psychology:-
• Meaning and scope of Industrial Psychology
• Recruitment, Selection and Training
• Industrial fatigue
• Motivation, Theories of motivation: Maslow’s Need Priority Theory, Macgregor’s X And Y Theory, McClelland’s Needs Theory
• Dealing with Self: Stress, health, and coping; interpersonal relationships; gender roles; environmental adjustments.

Unit-III:
Political Orientation:-
• Indian Constitution, features and federal structure.
• Fundamental rights
• Directive principles of state policy
• Industrial Democracy.
• Role of Bureaucracy in Modern Democratic states.
Unit-IV:
Economics:-
- Development of Indian Economy
- Infrastructure in the Indian Economy: Energy, power, transport system, road transport system, Rail-Road co-ordination, water transport, Civil aviation, communication system, urban infrastructure, science and technology, private investment in infrastructure.
- Role of Public and Private sector in Indian Economy.
- Challenges before Indian Economy in 21st Century.
  Poverty, Unemployment, Corruption, Regional Imbalance, Growth of educational sector.

Unit-V:
Culture and Civilization:-
- Concept of Culture and Civilization.
- Study of engineering skills with special reference to Egyptian and Indus Valley Civilization.
- Role of Engineers as agent of change with specific reference to change in Indian Society during 20th and 21st century.
- Multiculturalism: Meaning, scope and significance especially in Indian context.

Unit-VI:
Ethics and social responsibility:-
- Personal and professional ethics
- Corporate social responsibility
- Social capital, social audit.
- Role of entrepreneurship in nation building.
- Developing scientific and humanitarian outlook for the welfare of nation and society.

Text Books:
1. A new look into Social Sciences by Sheikh and Shabbir

Reference Books:
3. Dr. V.H. Asudani: An Easy Approach To Social Science, (3rd edition, 2008), Astha Publication, Nagpur
5. Social & Human Skills by Dr. Vinod Asudani and Dr. Monika Seth.
Syllabus of Semester III, B.E. Electrical Engineering
Course Code : MAT203      Course : Engineering Mathematics-III
L: 3 Hrs., T: 1 Hrs. P:0 Hrs., Per week     Total Credits : 7

Course Objectives
The objective of this course is to expose students to understand the basic concepts of Laplace transform, Fourier series and Fourier transforms. It also focuses on Matrices, Partial Differential Equations and Function of a Complex Variable.

Course Outcomes
On successful completion of the course, student shall be able to
2. Understand Matrices to solve system of equations.
3. Make use of complex variables to evaluate Contour Integrations.

UNIT I

UNIT II
Functions of a Complex Variable: Function of a complex variable, Analytic functions, Analytic functions, Cauchy-Riemann conditions, Conjugate functions, singularities, Cauchy’s integral theorem and integral formula, Taylor’s and Laurent’s theorem, Residue theorem, contour integration.

UNIT III
Fourier Series: Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions, Practical Harmonics Analysis.

UNIT IV

UNIT V
Partial Differential equations: Partial differential equation of first order first degree i.e. Lagrange’s form. Linear homogeneous PDE of n° order with constant coefficient, method of separation of variables, Application of partial differential equations.

UNIT VI
Matrices: Rank of matrix, consistency of system of equations, linear dependence, linear and orthogonal transformations. Characteristics equations, eigen values and eigen vectors. Reduction to diagonal form, Cayley Hamilton theorem, Sylvester’s theorem, determination of largest eigen values and eigen vector by iteration method.

Text Book :

Reference Books :
Course Code: EET201
Course: Elements of Electromagnetics
L: 4Hrs., T: 1 Hrs., P: 0 Hrs., Per week
Total Credits : 9

Course Outcomes
Upon the completion of this course, the students will be able to:

CO 1: Understand the vector analysis, vector and scalars conversion for different co-ordinate system like conversion of Cartesian to Cylindrical, Spherical co-ordinate system and vice versa.

CO 2: Understand scalar and vector magnetic and electric field and how to calculate force on steady and moving charge.

CO 3: Apply Coulombs law, Gauss law, Divergence theorem to electric field intensity i.e. field of ‘n’ point charges, volume charge, line charge etc.

CO 4: Find potential difference and potential of point charge.

CO 5: Apply effective analysis tool like Poissons and Laplace equations to current, current density, dielectrics and capacitances, metallic conductors.

CO 6: Understand the nature of dielectric materials like in parallel plate capacitance, two wire line capacitance.

CO 7: Understand steady magnetic field and magnetic forces, also nature of magnetic material. Also how to apply Biot-Savart’s law, Ampere’s Circuital Law, Strokes theorem to magnetic circuit.

CO 8: Understand the role of Maxwell’s equation and boundary conditions.

CO 9: Understand basics electromagnetic waves.

Unit 1: Vector Analysis
Idea of Vector & Scalars, Vector Algebra, Vector addition, vector subtraction, Dot product, Scalar product in Cartesian co-ordinates system, conversion of variables from Cartesian to cylindrical of Cartesian to spherical and vice versa.

Unit 2: Coulomb’s law, Electrical field intensity and electric flux density
Coulomb’s law, electric field intensity, field often, point charges, field due to continuous volume charge distribution, field of line charge, field of sheet charges concept of flux density.

Unit 3: Gauss’s law, Energy and Potential of charge system
Gauss’s law, Application of Gauss’s law, divergence theorem, definition of potential difference and potential, potential of a point charges, potential field of system of charge, potential gradient, Energy density in Electrostatic field.

Unit 4: Conductors, Dielectric and Capacitance and Poisson’s and Laplace’s Equations
Current and current density, continuity of current, metallic conductors, conductor properties and Boundary conditions, Nature of Dielectric materials capacitance and capacitances, Capacitance of parallel plate capacitor, Capacitance of two wire line, Poissons and Laplace equations.

Unit 5: The Steady Magnetic Field and Magnetic Forces
Biot Savarts law, Ampere’s Circuital Law, Strokes theorem, Magnetic flux density, Scalar and Vector Magnetic potentials, force on moving charge, force between differential current elements, nature of Magnetically material, Magnetization and permeability, Magnetic circuits, potential energy, and forces on magnetic materials, Inductance and mutual inductances.

Unit 6
Maxwell’s equations and boundary conditions, Elementary idea of Electromagnetic waves,

Text Book:

Reference Book:
Electromagnetic, Joseph A. Administer
Syllabus of Semester III, B.E. Electrical Engineering

Course Code: EET207      Course: Network Analysis
L: 4Hrs., T: 1 Hrs. P: 0 Hrs., Per week    Total Credits: 9

Course Outcomes
After the completion of the course, students will be able to:

CO 1: Apply the concept of equilibrium to generate the mathematical model of network, & determine the unknown quantities using different network theorems.

CO 2: Analyze a given signal by applying Fourier Series Expansion and determine the steady state response to non-sinusoidal inputs.

CO 3: Find out the initial & final conditions and analyze the network in frequency domain with different input signals using Laplace Transform.

CO 4: Understand the transient behavior of the given system using pole-zero concept.

CO 5: Determine the parameters of Two-port network and analyze the power flow in Three-phase unbalanced system.

Unit-1:
Nodal and mesh basis equilibrium equations, matrix approach for complicated network, containing voltage, current sources and reactances, source transformations.

Unit-2:
Network Theorems, Superposition, Reciprocity, Thevenin’s Norton’s maximum power transfer, compensation, Tellegen’s theorem as applied to A.C. circuits.

Unit-3:
Trigonometric and exponential Fourier series, Discrete spectra and Symmetry of waveforms, steady state response of a Network to non-sinusoidal periodic inputs, Fourier transforms and continuous spectra.

Unit-4:
Laplace transform and properties, partial fractions, singularity functions, waveforms, synthesis, Analysis of RL, RC, RLC network with and without initial conditions with Laplace transforms evaluation of initial condition.

Unit-5:
Transient behavior, concept of complex frequency, Driving points and transfer functions, poles, zeros of admittance function, their properties, sinusoidal response from Pole-Zero locations, convolution theorem and integral solution.

Unit-6:
Two port Network parameters and inter-connections study of series and parallel resonance in A.C. circuits, three phase unbalanced circuit and power calculations.

Text Books:
1. Network Analysis by Van Valkenburg.
2. Linear Network Theory by Kelkar and Pandit.
3. Circuits and Networks by A. Sudhakar and S. P. Shyam Mohan

Reference Books:
1. Network and System D. P. Roy Choudhary
3. Electrical Circuits Dal Toro Prontice Hall.
Course Code: CST212  Course: Introduction To Computer Concepts
L: 3Hrs., T: 1 Hrs., P: 0 Hrs., Per week  Total Credits : 7

Course Outcomes
Upon the completion of this course, students will be able to:
CO 1: Understand the concepts of operating system and its functions.
CO 2: Understand database management system and architecture along with basic concepts in computer networks.
CO 3: Differentiate between modular and object oriented programming and implement in the form of classes and objects.
CO 4: Understand basic concepts of internet programming languages.

UNIT 1:
OPERATING SYSTEMS:
Introduction to Operating Systems, functions of OS, types of Operating Systems, Concept of Process and threads.
DOS: DOS Concepts, Booting concepts, DOS commands, Batch file, AUTOEXEC & CONFIG files.

UNIT 2:
DATABASES:
Database System Concepts and Architecture, Relational Data Model, ER Model
Introduction to ORACLE: SQL-the relational database standard, DDL, DML, TCL commands, PL/SQL programming.

UNIT 3:
COMPUTER NETWORKS:
Basic Concepts in Computer Networks: OSI & TCP/IP Architecture, Transmission Media, Network hardware (Repeater, Router, Hub, Gateway, Nic), Network layer in the internet, IP protocol, IP address, client–server interaction

UNIT 4:
OBJECTS ORIENTED PROGRAMMING:
C++: Features of object oriented programming languages, data encapsulation, inheritance, polymorphism, Abstraction, Concept of a class, instantiating a class, Access control of members of a class, static and non-static members, overloading a method.

UNIT 5:
JAVA:
Creation of classes, characteristics, methods, overriding, overloading, packages

UNIT 6:
INTERNET BASICS:
Basic Concepts of Internets: Overview of Internet, history, HTTP protocol basics, HTTP request & response, HTML, Javascript, XML, difference between static websites and dynamic websites, CSS (cryptography techniques, worms and viruses, firewalls, security threats, digital signature and certificates)

Text Books:
1. Programming in C++: Balaguruswamy
2. JAVA 2 Programming Black Book: Steven Holzner, Wiley India.

Reference Books:
1. UNIX Commands: Sumitaba Das
3. SL & PL/SQL for Oracle 10g black book: Dr. P.S. Despande, Dreamtech press.
Syllabus of Semester III, B.E. Electrical Engineering

Course Code: ENT206   Course: Electronics Devices & Circuits
L: 4Hrs., T: 1 Hrs., P: 0 Hrs., Per week                       Total Credits : 9

Course Outcomes
Upon the completion of this course, students will be able to:

CO 1: Understand the working of all the electronic semiconductor devices.
CO 2: Demonstrate their theoretical knowledge by doing practical.
CO 3: Design any electronic circuit followed by breadboard testing to check its functionality.
CO 4: Apply the knowledge of Electronics devices and circuits for making projects.

Unit 1:
Semiconductor Diodes and Power Supplies:
Intrinsic and extrinsic semiconductors theory of PN junction, diode junction, capacitance, zener diode, vector diode, Tunnel diode, Power supplies, Half wave and full wave Rectifiers, Voltage doublers, filters, ripple factor, Zener and Emitter follower type series voltage regulators.

Unit 2:
Junction Transistors:
Theory of operation, static characteristics, break down voltage, current voltage, power Limitations, Biasing of BJT, different biasing arrangements, stability factor, Thermal runaway, power transistors.

Unit 3:
BJT Analysis:
Small signal analysis of CE, CB, CC amplifiers and comparison, High frequency analysis, calculation of frequency response, gain bandwidth product.

Unit 4:
Power Amplifiers:
Classification A,B, AB, C classes, efficiency, Push-pull configuration (A,B,AB), complimentary symmetry, Distortions and cross over distortion.

Unit 5:
Positive and Negative Feedback Amplifiers:
Feedback amplifiers, classification, Practical circuits applications, advantages, Stability, Oscillators, Barkha us encriterion RC, LC and Crystal Oscillators.

Unit 6:
FET and its Analysis:
Field effect transistor and 'MOSFET', Principle of operation and characteristic, biasing arrangement, small signal analysis of CG, CS, High frequency Analysis.

Text Books:
1. Integrated Electronics: Millman  Halkias, Parikh, McGraw Hill.

Reference Books:
2. An introduction to semiconductor Devices: Donald Nemen ,TMH.
Syllabus of Semester III, B.E. Electrical Engineering

Course Code: CHT201 Course: Environmental Studies I
L: 2Hrs, T: 0 Hrs, P: 0 Hrs, Per week Total Credits: 0

Course Outcomes
After the completion of this course, students will be able to:

CO1: Develop a breadth of the interdisciplinary and method logical knowledge in the environmental fields that enables them to facilitate the definition & solution of environmental problems.

CO2: Understand modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.

CO3: Realize the need to change the way in which we view our own environment, using practical approach based on observation and self learning.

CO4: Understand need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it. By studying environmental science, students may develop a breadth of the interdisciplinary and methodological knowledge in the environmental fields that enables them to facilitate the definition and solution of environmental problems.

CO5: Identify and analyze environmental problems as well as the risks associated with these problems and understand what it is to be a steward in the environment, studying how to live their lives in a more sustainable manner.

Unit 1:
Multi disciplinary Nature of Environmental Studies: Definition, scope and importance; Need for public awareness.

Unit 2:
Natural Resources Renewable and Non-renewable Resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. (d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. (e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. (f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.
### Course Objective
The objective of this course is to expose students to understand the basic concepts of Mathematical modeling and Time response analysis. It also focuses on Z-transform, Numerical Method and Fuzzy sets.

### Course Outcomes
On successful completion of the course, student shall be able to:

- **CO1** Form mathematical model corresponding to engineering problem, convert it into block diagram, find its transfer function, solve it and analyze its time response.
- **CO2** Understand and use Z-transform to solve difference equations. Understand and use concepts in Fuzzy sets and relations.
- **CO3** Use Numerical techniques to solve system equations and differential equations.

### UNIT I: Mathematical Modeling
Mathematical modeling of physical system like Mechanical system (basic translational and rotational system), Electrical system (basic RLC series and parallel circuits). Concept of transfer functions. Transfer function of elementary RLC circuit, elementary block diagram of closed loop system. Laplace transform of impulse, step, ramp and parabolic signals. Time response of first order and general second order system for unit step, unit impulse, and ramp input signal. Concept of characteristic equation, Determination of time constants.

### UNIT II: Root locus techniques

### UNIT III: Z transforms
Formation and solutions of Difference equations, Definition and properties, One sided Z-transform: Definition and properties, z-transforms pairs, inverse Z-transform, correlation of Laplace transform to Z-transform. Properties of Z-Transforms, z-transfer function, Convolution of two sequences, poles and zeros. Solution of difference equations.

### UNIT IV: Fuzzy sets
Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, union, intersection and combination of fuzzy sets, fuzzy operations, crisp and fuzzy relations.

### UNIT V: Numerical solution of algebraic and transcendental equations

### UNIT VI: Numerical methods for Differential Equations

### Text Books
1. Control systems Engineering: J Nagrath and M Gopal
2. Fuzzy Engineering: Bart Kasko
3. Principles of control systems: Xavier and Babu, S Chand, New Delhi

### Reference Books
1. Introductory method of numerical analysis: 4th ed: S. S. Sastry, PHI, New Delhi
2. Advanced Engineering Mathematics: 2nd ed: Jain, Iyengar, Narosa publication
SHRI RAMDEOBABA COLLEGE OF ENGINEERING & MANAGEMENT, NAGPUR

Syllabus of Semester IV, B.E. Electrical Engineering

Course Code: HUT202  Course: Principles of Economics & Management
L: 3Hrs., T: 1 Hrs., P: 0 Hrs., Per week  Total Credits: 7

Course Outcomes

After the completion of the course the student will be able to:

CO 1: Get acquainted with the basics of economics.
CO 2: Develop the understanding of macro economics.
CO 3: Have hands-on experience of macro economics.
CO 4: Acquainted with the basics of management.
CO 5: Develop the understanding of marketing management.
CO 6: Learn the working of financial management.

Unit 1: Introduction to Economics
- Meaning and Scope

Unit 2: Micro-Economics
- Law of Diminishing Marginal Utility
- Concept of Demand
- Law of Demand
- Elasticity of Demand
- Concept of Supply
- Law of Supply
- Elasticity of supply
- Indifference Curve
- Types of Market (Perfect and Imperfect Competition)

Unit 3: Macro-Economics
- Concepts of Inflation and Deflation;
- Business cycles;
- Banks: Types, Functions of Central Bank and Commercial banks;
- Monetary and Fiscal Policies;
- Direct and indirect taxes;
- Liberalization, Privatization and Globalization

Unit 4: Concepts of Management:
- Definition, nature and scope of Management
- Functions of Management - Planning and Controlling

Unit 5: Marketing Management:
- Meaning and nature of Marketing Management
- Marketing Mix
- Market segmentation
- Advertisement and sales promotions
- Channels of distribution.

Unit 6: Financial Management
- Meaning, nature and scope of financial management
- Profit and loss account,
- Balance sheet,
- Budgets,
- Ratio analysis,
- Depreciation and its methods.

Text Books:
1. K.K. Dewett; Modern Economic Theory; (43rd edition); S. Chand and Co. Ltd; New Delhi.

Reference Books:
2. Rudradutt and K.P.M. Sundaram; Indian Economy (45th revised edition); S. Chand and Co. Ltd.; New Delhi.
Course Outcomes

After the completion of the course, student will be able to:

CO 1: Use basic components to design digital circuits.
CO 2: Design different combinational circuits for various applications.
CO 3: Design various sequential circuits for different applications.
CO 4: Design and verify digital systems using combinational and sequential circuits.
CO 5: Understand the fundamental background in differential amplifier which is necessary for understanding the working principle and characteristics of the Operational amplifier.
CO 6: Understand the basic Operational amplifier circuits with different feedback.

Unit 1:
Analog V/s Digital systems, Digital Codes and conversions, Boolean algebra, Logic problems.

Unit 2:
Logic gates, Karnaugh Map, Decoders, Encoders, Multiplexers, Demultiplexers.

Unit 3:
Sequential circuits – Latches, Flip Flop, Conversion of one Flip Flop to another, Arithmetic Circuits - Adders and Subtractors, Memory Organization.

Unit 4:
Differential amplifier, DC and AC analysis, cascaded differential amplifier stages, Opamp Configuration inverting and non-inverting.

Unit 5:

Text Books:
3. Op-Amps and Linear ICs: Fiore J. M, Thomson Delmar Learning

Reference Books:
2. Digital Electronics: Ryan, Tata Mc Grav Hill.
4. Analog Filter Design: M. E. Van Valkenburg, PHI
5. Op-Amp and Linear Integrated Circuits, Ramakant A. Gaikwad.
Syllabus of Semester IV, B.E. Electrical Engineering

Course Code: EET 203  
Course: Electrical Machines-I  
L: 4Hrs., T: 1 Hrs., P: 0 Hrs., Per week  
Total Credits: 9

Course Outcomes

Upon the completion of this course students will be able to:

CO 1: Construction features and operation of single phase and three phase transformer to determine the equivalent circuit parameters per calculation of power efficiency and percentage regulation at different loads.

CO 2: Various transformer connection, polarity test and phasor groups, parallel operation and load sharing, and concept of daily load cycle to calculate all day efficiency.

CO 3: Construction, operation characteristics speed control of dc motor and calculate its losses and efficiency.

CO 4: Construction operation and characteristics of three phase induction motors, and its testing to calculation of equivalent circuit parameters.

CO 5: Starting and speed control of three phase induction motor and find power losses to calculate efficiency.

CO 6: Construction and principal of operation of double cage induction motor, induction generator, and single phase induction motors.

Unit 1: 1 phase & 3 Phase Transformer:

Unit 2:
Daily Load Cycle and All day efficiency of transformer, Polarity test, various connections with vector groups, Three phase to two phase conversion, parallel operation of three phase transformer, methods of cooling, temperature rise test, maintenance of transformer.

Unit 3:
D. C. Motors:
Basic principle & operation of DC motors (separately excited, shunt and series), Types of excitation, Characteristics of shunt, series, speed control of DC motor (separately excited, shunt & series), Losses & Efficiency

TEXT BOOKS:
1. Electrical Machines: Dr. P.S. Bimbhra
2. Electrical Machines: Ashfaq Hussain
3. A Text Book of Electrical Technology: B. L. Theraja (Vol. II)

REFERENCE BOOKS:
1. Performance & Design of A.C. Machine: M. G. Say
2. Electrical Machines: I.S. Nagrath & Dr. D.P. Kothari
3. Laboratory Courses in Electrical Engineering: Tarnekar, Kharbanda, Bodkhe & Naik
Syllabus of Semester IV, B.E. Electrical Engineering

Course Code: EET208 Course: Electrical Measurements & Measuring Instruments
L: 4 Hrs., T: 1 Hrs., P: 0 Hrs. Per week Total Credits: 9

Course Outcomes:
On completion of this course, the students will be able to

CO 1: Understand classification of different types of instrument and errors in it.
CO 2: Measure different types of resistances using DC bridges
CO 3: Analyse and measure the Inductance, Capacitance & frequency by using bridges.
CO 4: Understand various types of analog and digital instruments and its application.
CO 5: Understand the principle and construction of Instrument Transformer for measurement of high voltage and current.

UNIT-1:
Classification of Measuring Instruments, comparison of analog and digital instruments, absolute and secondary instruments, indicating type, recording type and integrating type instruments, loading effect of instruments.

UNIT-2:

UNIT 3:
General theory of AC bridges, Measurement of Inductance: study of Maxwell, Hay’s, Owen’s, Measurement of Capacitance: De Sauty’s, Wien and Schering Bridges, detectors for AC bridges.

UNIT-4:
Ammeter, Voltmeter, Principles of moving coil, moving iron and dynamometer type instruments, extension of range using series and shunts.

UNIT-5:
Measurement of power in single phase and three phase circuit by using dynamometer type instrument. Digital Measurement - True RMS measurement, measurement of frequency, measurement of power, measurement of Energy.

UNIT-6:
General theory of extension of range using CT and PT, errors in instrument transformers, applications of instrument transformers.

Text Books:

Reference Book:
Syllabus of Semester IV, B.E. Electrical Engineering

Course Code: CHT202   Course: Environmental Studies - II
L:2Hrs.,T: 0 Hrs. P:0Hrs., Per week   Total Credits : 0

Course Outcomes
After the completion of the course, student will be able to:

CO 1: Understand the modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.

CO 2: Realize the need to change the way in which we view our own environment, using practical approach based on observation and self-learning.

CO 3: Recognize the need to create a concern for our environment that will trigger pro-environmental action; including simple activities, we can do in our daily life to protect it.

CO 4: Identify and analyze environmental problems as well as the risks associated with these problems and understand what it is to be a steward in the environment, studying how to live their lives in a more sustainable manner.

Unit I
Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, and Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes; Role of an individual in prevention of pollution, Pollution case studies; Disaster management: floods, earthquake, cyclone and landslides.

Unit II
Social Issues and the Environment: From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation of people; its problems and concerns, Case Studies; Environmental ethics: Issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case Studies; Wasteland reclamation; Consumerism and waste products; Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation; Public awareness.

Field work
Visit to a local area to document environmental assets (river/forest/grassland/hill/mountain); Visit to a local polluted site (Urban/Rural/Industrial/Agricultural); Study of common plants, insects, birds; Study of simple ecosystems (pond, river, hill slopes, etc).

Text Books:

Reference Books:
1. Text Book of Environmental Chemistry and Pollution Control: S. S. Dara; S. Chand and Company Ltd., New Delhi.
V Semester

SYLLABUS OF SEMESTER V, B.E. ELECTRICAL ENGINEERING

Course Code: EET301  Course: Power Station Practice
L: 3 Hrs., T: 1 Hrs., P: 0 Hrs. Per week  Total Credits: 7

UNIT I: Sources of Electrical Energy: Coal, oil and natural gas, water power, nuclear fission and fusion. Recent development in power generation.

UNIT II: Thermal Stations: Choice of site, size and number of units, general layout, major equipment, essential and non-essential auxiliaries, electric supply to auxiliaries, cost of generation, effect of different factor on costs. Treatment of water, Tests on coal, Automatic control of different of different system. Advantages and disadvantages.

UNIT III: Hydro station: Hydrology, stream flow, flow duration curve, power duration curve, mass curve reservoir capacity, type of hydro plants and their field of use, pumped storages plants and their utility, surge tanks, governing characteristics of turbine and hydro generators. Advantages and disadvantage, Automatic and remote control, advantages and disadvantages.

UNIT IV: Nuclear station: Principle of Nuclear energy, materials, types of nuclear reactors, breeder reactors, location, material for moderator and control rods, cost economics

UNIT V: Voltage control of A.C. generators: Methods of stabilizing exciter voltage, Automatic Voltage regulator action. Tariff different consideration of Flat & two part economical choice.

UNIT VI: Non conventional techniques of energy production:
   b. Electrical power generation and other miscellaneous applications of solar energy.
   c. Wind energy – Introduction, Basic principles of wind energy conversion, Wind Delta, energy estimation, site selection, Basic component of Wind energy conversion system, Wind turbines and their analysis, Wind Electrical generation, stand alone, and grid connected wind-electrical power systems, various applications of wind energy.

Text Books:
1. Electrical Power Stations: Car.
2. Generation of Electrical Energy: Dr. B. R. Gupta
3. Power plant Engineering: P. C. Sharma

Reference Books:
1. Electrical Power Station Control: H.P. Young.
2. Elements of Power Station Design: M.V. Deshpande.
Syllabus of Semester V, B.E. Electrical Engineering

Course Code: EET302       Course: Electrical Machines-II
L: 4 Hrs. T: 1 Hrs. P:0 Hrs. Per week     Total Credits: 9

Course Outcomes
Upon the completion of this course, students will be able to:

CO 1: Understand the constructional features of synchronous machines, induced EMF equation & Harmonics.

CO 2: Understand the steady state operation of cylindrical rotor & salient pole synchronous generator at different power factors.

CO 3: The steady state operation of cylindrical rotor and salient pole synchronous motor.

CO 4: Analyze the operation of synchronous machine connected to infinite bus and synchronization & parallel operation of generator, power angle characteristic (P-δ curve), V and inverted V curve, Losses and efficiency.

CO 5: Understand the transient analysis under sudden Three phase short circuit condition and methods to obtain various reactances.

CO 6: Understand the construction and principle of operation of various special purpose motors.

Unit-1:
Three Phase Synchronous Generators: Introductions, constructional features of cylindrical and salient pole rotor, machines introduction to armature winding and field windings, MMF of armature and field windings induced EMF equation and harmonics.

Unit-2:

Unit-3:
Synchronous Motor: Principle of operation of synchronous motor, steady state operation of cylindrical rotor and salient pole synchronous motor, phasor equations and phasor diagram,

Unit-4:
Performance of synchronous Machines: Synchronous Machines On Infinite Bus, synchronization of alternator with infinite bus, parallel operation and load sharing, power angle characteristic (P-δ curve), steady state stability limit and role of damper windings. V curve and inverted V curves for synchronous motors and generators., losses and efficiency.

Unit-5:

Unit-6:
Introduction To Special Machines: Reluctance motor, hysteresis motor, permanent magnet motor, Repulsion motor.

Text Books:
1. Electrical Machines: Ashfaq Hussain.
2. Electrical Machinery: Nagrah and Kothari.

Reference Book:
Electrical Technology Vol. II: B. L. Thareja and et. al.
Syllabus of Semester V, B.E. Electrical Engineering

Course Code: EET303  Course: Electrical Power System-I
L: 3Hrs., T: 1 Hrs P: 0 Hrs. Per week  Total Credits: 7

Course Outcomes :
Upon the completion of this course, students will be able to:

CO 1: Find the per unit values for various power system components.
CO 2: Calculate different parameters of overhead line and underground cable.
CO 3: Understand and analyze different types of transmission lines.
CO 4: Understand different distribution schemes and types of cables.
CO 5: Understand power flow in transmission line, load sharing between alternators and types of insulators.
CO 6: Understand the load flow problems and calculation of Y_bus matrix.

Unit 1:
Structure of electrical power system, brief exposition of generation, transmission and distribution aspects, use of high voltage, idea about substation (indoor and outdoor), concept of real, reactive and complex power system, load and their characteristics, voltage and frequency dependence of loads, overhead v/s underground transmission, per unit system, representation of power system elements and per unit impedance diagram.

Unit 2:
Concept of GMD & GMR, calculation of the inductance and capacitance of overhead transmission lines with symmetrical and unsymmetrical spacing, effect of earth on capacitance, transposition of line, bundle conductor, double circuit three phase lines.

Unit 3: Elementary distribution schemes:
Types of cables, capacitance of single phase and three-phase cable, grading of cable, DC Cables, power factor and heating of cables.
Types of distribution system, comparison, feeders and distributors, numerical on AC and DC distribution system.

Unit 4:
Representation of transmission lines, ABCD parameters of transmission lines, Voltage regulation and efficiency of power transmission lines, Power flow equations and circle diagrams.

Course Outcomes :
Upon the completion of this course, students will be able to:

CO 1: Find the per unit values for various power system components.
CO 2: Calculate different parameters of overhead line and underground cable.
CO 3: Understand and analyze different types of transmission lines.
CO 4: Understand different distribution schemes and types of cables.
CO 5: Understand power flow in transmission line, load sharing between alternators and types of insulators.
CO 6: Understand the load flow problems and calculation of Y_bus matrix.

Unit 5:
Interconnection of system elements to form two bus system, Illustration of active and reactive power transmission, Introduction to load flow studies in multibus system (Methods of solution not expected), Introduction of frequency and voltage as system state indicators.

Unit 6:
Elementary concepts of real and reactive power control, Steady state performance of turbine governors, load sharing between generators, preliminary concepts of automatic voltage regulators for turbogenerators, Insulation of overhead lines, insulator string, efficiency, types of insulators.

Text Books:

Reference Books:
2. Power System Analysis: Wadhwa C. L.
Course Code: EET 304-1  Course: Elective – I Electrical Machine Design
L: 3Hrs., T: 1 Hrs. P:0 Hrs. Per week  Total Credits: 7

Course Outcomes
Upon the completion of this course, students will be able to:

CO1. Select proper materials for making different parts of electrical machines and compute the final temperature attained by machines during heating & cooling processes.

CO2. Design different components of transformers and estimate the performance characteristics from the design.

CO3. Design different components of induction motor and estimate the performance characteristics from design.

CO4. Design an electromagnet.

Unit :1
Review of materials used in construction of electrical machines: Classification of insulating materials depending upon permissible temperature rise, properties of transformer oil, standard specifications, CMR and short time of machines, heating and cooling characteristics.

Unit: 2
Design of magnetic circuit: Magnetization characteristics. Design of electromagnets, magnetic pull or force, ampere-turn requirement, temperature rise, Design of inductor, small chokes.

Unit: 3:
Transformer Design: Specific loading equation for voltage per turn for power and distribution transformers, output equation.

Unit: 4:
Principles of electric and magnetic circuit design. Estimation of performance characteristics from the design data.

Unit: 5
Induction Motor: main dimension, output equation, loading constants estimation of axial lengths, air gap diameter, winding design.

Unit : 6
Air gap lengths, rotor of IM, cage rotor and wound rotor design. Calculation of no load current and other performance from characteristics for design data.

Text Books:
1. Performance and design of A.C. Machines: M.G.Say.

Reference Books
Course Outcomes

Upon the completion of this course students will be able to understand,

CO 1: Qualities and Functions of an Entrepreneur.
CO 2: Government policy towards Entrepreneur.
CO 3: Small business environment of an Entrepreneur
CO 4: Knowledge centre and assistance available to an Entrepreneur
CO 5: How to organize and setup an Entrepreneur business model
CO 6: Project report, finance and marketing models for a new Entrepreneur.
CO 7: Problems encountered by a new Entrepreneur
   a. Finance
   b. Labour
   c. Purchase
   d. Manufacturing
   e. Marketing
   f. Branding
   g. Government Taxes and duties.

UNIT :1
Entrepreneurial traits types and significance. Definitions characteristics of Entrepreneur type’s. Qualities and functions entrepreneurship role and importance of entrepreneur economic growth. Competing theories entrepreneurship. Entrepreneurial Development Programmed in India History Program in India History Support. Objective stages of performances. Planning and EDP Objectives.

UNIT :2

UNIT :3
Establishing Entrepreneurial System. Search for business idea. Sources of ideas, processing. Input requirements. Sources and criteria of farcing, fixed and working capital assessment Technical assistance. Marketing assistance, sickness of units and remedial assistance Preparation of feasibility reports and legal formalities and documentation.

UNIT :4
Small Business in Indian Environment - Economic, Social, Political Cultural and Legal Policies Governing Small Scale Units. Industrial Policies and Strategies relating to small scale sector; Technological know-how and Appropriate Technology; Quality Circles and productivity, and linkage between Small and Big Business.

UNIT :5
Organizational Structure and other Characteristics of Small -Firms . Special Problems m the Management of small Business in various Functional Areas like Finance. Marketing, Production and Personnel Sickness in the small Scale Sector. Modernization of Small and Village Industries; Training Programmers and consultancy Senders; Institution Assisting Export Promotion of Small Business m India; Export Promotion Councils Global perspective of Small Business in selected countries.

UNIT :6
Problems of Industrialization in underdeveloped countries with special reference to India .Industrial policy, Regulations and control of Industries in India, Mechanics of setting of new enterprises -size and location, optimum units its meaning and determinants size of industrial units in India. Theory of industrial location factors determining the industrial location. Regional distribution of industrial activity in India; Recent trends in the localization of industrial activity in India, Regional planning of industrial activity in India; Feasibility studies technical, marketing and financial. Managerial problems of new Enterprises production purchasing. Financing labour and marketing problems. Facilities provided by different Institutions and Agencies in India. Financing facilities for new enterprise. Marketing and other facilities.

Text Books:

Reference Books:
1. Chary – Business Gurus speaks: Macmillan
Course Outcomes

Upon the completion of this course, students will be able to,

CO 1 : Understand the basics of energy with material and energy balance.
CO 2 : Understand the role of ESCO and analyze the different financial options of investment.
CO 3 : Understand details about Electrical Energy consumption, its uses, and its efficiency.
CO 4 : Evaluate the performance of Compressed Air System and Heating, Ventilation & Air Conditioning (HVAC).
CO 5 : Find out the energy saving opportunities in Pumps, Pumping System and Cooling Towers.
CO 6 : Correlate the energy and its effect on environment.

Unit I:

Unit II:

Unit III:

Unit IV:
Compressed Air System and (HVAC): Types of air compressors, reciprocating vs screw, compressor efficiency, efficient compressor operation, Heating, ventilation, air conditioning and Refrigeration System: Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pressure drop calculation.

Text Books:

Reference Books:
2. Energy Efficient Buildings, Majumder Milli, TERI.
Curriculum of Semester V, B.E. Electrical Engineering

Course Code: EET 304-4  Course: Elective – I: Design of Data Acquisition and Logic Controllers

L: 3 Hrs., T: 1 Hr. P: 0 Hrs. Per week  Total Credits: 7

Course Outcomes
Upon the completion of this course, students will be able to understand,

CO1. Concept and advantages of PLC
CO2. Standards, which guide the programming of a PLC and communication protocols.
CO3. Concepts and design of DCS and SCADA systems
CO4. Interface of PLC, DCS and SCADA with protocols
CO5. Report generation from SCADA and DCS systems
CO6. Concept of MMI and user interface panel design.
CO7. Wireless communication of DCS, SCADA and PLC systems.

Unit 1: Programmable Logic Controllers: Automation: Basic Concepts and Need, Types of Processes and Automation Strategies, Requirements of Batch and Sequential control Design of Relay Logics with electrical accessories, Sequencing, Interlocking and latching concepts, PLC working along with Hardware details, Programming of PLC as per IEC61131-3, Ladder Diagram and Functional Block diagram programming, HMI Programming along with alarms and displays.

Unit 2: Introduction to DCS, DCS Introduction, functions, advantages and limitations, DCS components and architecture, Specifications of DCS, Engineering and design details, SCADA-DCS Interface.

Unit 3: Configuration software as per IEC-61131-3 standard, Types of Editors used for configuration software, Functionalities of the Important “Function Blocks”, Ladder programming.

Unit 4: SCADA (Supervisory Control & Data Acquisition System), SCADA features, SCADA architecture, Alarms, Events, Trends, Graphic generation, Report generation, Communication protocols, Interface with PLC and DCS.

Unit 5: MMI / HMI programming, Working principle & types of HMI, WinCE based HMI.


Text Book:
1. Programmable Logic Controllers and Industrial Automation: An Introduction by Madhuchhanda Mitra
   Penram International Publishing (India) Pvt Ltd.

Text Book:
1. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing.
Syllabus of Semester VI, B.E. Electrical Engineering

Course Code: EET307        Course : Control System Engineering
L: 4 Hrs., T: 1 Hrs. P:0 Hrs. Per week      Total Credits: 9

Course Outcomes
Upon the completion of this course, the students will be able to:

CO 1: Convert physical models into physical systems and then formulating the appropriate mathematical model and converting mathematical models into the block diagrams/ signal flow graphs and then find the transfer function of the system

CO 2: Understand various time response specifications, perform time response analysis and understand techniques of compensation for improving the system response.

CO 3: Apply various methods to investigate stability of a given system.

CO 4: Understand the concept of root locus, Bode plots, Nyquist plots for design and analysis of a system

CO 5: Understand the concept of modern control system theory for design and analysis of a system.

UNIT 1:
Introduction, Block Diagrams and Signal Flow Graphs
Introduction to need for automation and automatic control. Use of feedback, broad spectrum of system application. Mathematical modeling (Electrical and Electro mechanical), transfer functions, block diagram, signal flow graphs, application to elementary systems, simplifications. Effect of feedback on parameter variations, disturbance signal, servomechanism and regulators. Control system components, electrical, electro mechanical, their functional analysis and input output representation.

UNIT 2:
Time Response Analysis
Time response of system, first order and second order system, standard inputs, concept of gain and time constants. Steady state errors, type of control system, approximate methods for higher order system. Types of Controllers.

UNIT 3:
Stability
Stability of control systems, condition of stability, characteristics equation, Routh Hurwitz criterion, special cases for determining stability, relative stability.

UNIT 4:
Root Locus
Root location and effect on time response, elementary idea of root locus, Construction of root locus effect of addition of pole and zero in proximity of imaginary axis.

UNIT 5:
Frequency Response
Frequency response method of analyzing linear system, Nyquist and bode plot, stability and accuracy analysis from frequency response, open loop and close loop frequency response, Nyquist criterion, effect of variation of gain and addition of pole and zero on response plot, stability margin in frequency response. Introduction to basic Lag-Lead Compensator.

UNIT 6:
State Space Analysis
State variable method of analysis, characteristics of system state. Choice of state variables, representation of vector matrix differential equation, standard form, relation between transfer function and state variables.

Text Books:
1. Automatic Control System: B.C.Kuo (P.H.I.)
2. Control System Analysis: Nagrath & Gopal
3. Linear System Design: D’azzo and Houpis (M.H.)

Reference Book:
Modern Control Theory: M. Gopal.
Course Outcomes
Upon the completion of this course, the students will be able to,

- CO 1: Examine factors governing selection of Electric Motors like speed torque characteristics under starting, running, and braking for particular application in a common electric drive system.
- CO 2: Select motor rating, Flywheel of common drive motors for continuous and intermittent periodic duties.
- CO 3: Analyze control circuit of ac/dc contactors and relays for automatic starting and braking of ac/dc motors.
- CO 4: Analyze the performance and suitability of motors used in ac/dc traction, their performance characteristic, control and braking.
- CO 5: Apply digital control of electric motor, plc programming in electrical drives.

Unit 1:
Factors Governing Selection of Electric Motors, Types of Drives and Types of Load, Starting of electric motors, Speed control of Electric motors. Definition classification and speed torque characteristics of common drive motors and their characteristics under starting, running, Electric Braking. Types of enclosures.

Unit 2:
Selection of Motor: Insulating materials, Temperature rise in Electrical machines, Duty cycles, Power capacity for continuous and intermittent periodic duties, Load equalization and flywheel effect. Brief idea about drives commonly used in industries.

Unit 3:
Control devices for industrial motors, AC and DC contactors and relays: Lock out contactors, magnetic structure, operation, arc interruption, contactor rating, H.V. contactors. Control circuits for automatic starting and braking of DC motor and three phase induction motor. Control panel design for MCC.

Unit 4:
Different systems of Traction. Train movement and energy consumption. Traction Motors: Motors used in AC/DC traction, their performance and desirable characteristics, requirements and suitability of motor for traction duty.

Unit 5:

Unit 6:
PLC, its programming and its applications in electrical drives. Digital control of Electric motor, Block diagram arrangement, comparison with other methods of control.

Textbooks:
1. Utilization of Electric power and Electric Traction: J. B. Gupta
2. Modern Electrical Traction: H. Pratap

Reference Books:
1. A course in Electric Power Soni, Gupta and Bhatnagar.
3. Magnetic Control of Industrial Motors: Heumann
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Syllabus of Semester VI, B.E. Electrical Engineering

Course Code: EET309  Course : Power Electronics
L: 4 Hrs., T: 1 Hrs. P:0 Hrs. Per week
Total Credits: 9

Course Outcomes
Upon the completion of this course, students will be able to,
CO 1: Understand construction, working, static V-I & dynamic characteristics, ratings, specifications of basic power electronic switches with necessity of series & parallel connections of SCRs and triggering mechanism.

CO 2: Understand the working of different types of AC-DC converters with their performance parameters, output waveforms and applicability depending on nature of load.

CO 3: Select and compare power electronic switches depending upon requirement and nature of power electronic controller with design of protection parameters for the circuit.

CO 4: Understand the working of different types of DC-DC & DC-AC converters with their performance parameters, output waveforms, applicability depending on nature of load and PWM techniques.

Unit 1 : Thyristors : Static V-I characteristics of SCR, TRIAC and DIAC, gate characteristics of SCR, SCR turn ON and turn OFF process, Transient characteristics of SCR during turn ON and turn OFF, ratings and specifications of SCR, series and parallel connections of SCRs, TRIAC and its applications, Unijunction transistors, Gate triggering circuits.


Unit 3 : Single phase and three phase half controlled converters with highly inductive load, Performance parameters of converters, Cycloconverters (Single Phase).

Unit 4 : Static controllable switches : VI Characteristic and working of MOSFET, Gate turn off thyristor(GTO) and insulated gate bipolar transistor(IGBT), Protection of SCR, gate circuit protection, over voltage and over current protection, snubber circuit design.

Unit 5 : D.C. Choppers : Commutation of SCRs, various techniques, Principles of step down chopper, step up chopper, classification of choppers, choppers using SCRs, Multiphase choppers, Practical application of Choppers.

Unit 6 :- Inverters: Classification of Inverters, Basic series resonant inverter, half bridge and full bridge series resonant inverters. Single phase and three phase bridge inverters, causes of generation of harmonics and reduction techniques using PWM method.

Text Books:
1. Power Electronics Circuits Devices & Application: M. H. Rashid
2. Thyristor & their Application: G. K. Dubey & Joshi &Doralba
3. Industrial Power Electronics: Deodatta Shingare.

Reference Books:
1. Power Electronics ; M.D. singh & Khanchandani
2. Power Electronics ; P.S. Bimbhra
Course Code: EET310
Course: Instrumentation
L: 3 Hrs., T: 1 Hrs. P:0 Hrs. Per week
Total Credits: 7

Course Outcome:
Upon the completion of this course, the students will be able to

CO 1: Understand various transducers for motion measurement.

CO 2: Understand various Temperature transducers and their applications.

CO 3: Understand the techniques used for measurement of pressure, flow, pH, volume of gas and liquid

CO 4: Understand analog to digital conversion and Signal transmission.

CO 5: Familiarize with data acquisition systems (DAS) and SCADA systems.

Unit 1: Motion Measurement: Relative and absolute motion measurement, measurement of velocity and acceleration, electrical transducers for motion measurement. LVDT, piezo electric transducers, variable inductance transducers, measurement of shaft torque and power.

Unit 2: Temperature measurement: Law of thermo-electric circuits, thermocouples, cold junction compensation, thermistor, radiation thermometry, broadband narrow band radiation methods. Two color pyrometers, optical pyrometers, temperature compensation of temperature sensors, heat flux sensors.


Unit 4: Method of Analog to Digital Conversion: Errors in A to D conversion, Transmission of signals in analog and digital forms. 4-20 ma, RS232, RS485.

Unit 5: Conversion of various transducer signals into electrical signals

Unit 6: Data Acquisition Systems, SCADA

Text Books
2. Electronics Instrumentation and Measurement Technique: W.D. Cooper in Prentice hall.

Reference Books
Unit 6:
Application development and Automation for industry verticals: Application development and automation for following industries – Power, Water and Waste Water Treatment, Food and Beverages, Cement, Pharmaceuticals, Automobile and Building Automation.

Text Books:
2. Programmable Logic Controllers: Principles and Applications: Webb and Reis, PHI.

Reference Book:
Introduction to Programmable Logic Controllers: Garry Dunning, Thomson Learning.
Special types of industrial motor: Traction motor, Electric drive for Cranes.  
(Mathematical treatment and numerical not expected)

Unit 4. Power Electronic Control of Electric Motors:
Power semiconductor switches (SCR, MOSFET and IGBT): basic construction and static characteristics.  
Types of controllers, 1-phase Half and full wave uncontrolled/controlled AC to DC converters, 3-ph AC to DC  
bridge type converter, 1-ph and 3-ph bridge type inverter, Sinusoidal pulse width modulation.  
(Mathematical treatment and numerical not expected)

Unit 5. Industrial Motor Control, Selection of Electric Motor and Energy Conservation Aspects:
Control diagrams, starting methods, inching and jogging, reversing the direction of rotation, plugging, reduced  
oltage starting methods, classes of motor duty, General guidelines for selection of motors, selection of motor  
power rating, measures for energy conservation in electric motors, use of variable speed (frequency) drives.

Unit 6. Common types of Industrial load and specific application drives:
Fan load, pump load, turbo compressors, drives for textile mills, steel rolling mills and machine tools.

Textbooks:

Reference books:
Unit VI: Energy, Environment and Climate change: Energy and environment, air pollution, climate change

Text Books:

Reference Books:
1. Handbook on Energy Audits and Management: Amit Kumar Tyagi:, TERI
2. Energy Efficient Buildings: Majumder Milli, TERI

UNIT I: Symmetrical Components:
Symmetrical Component transformation, Three phase power in unbalanced circuit in terms of symmetrical component, Sequence impedances of Generator, Transformer, Transmission line and Passive loads, Phase shift in Star/delta three phase transformer (Yd1, Yd11 connection).

UNIT II: Symmetrical Fault:
Symmetrical fault analysis without and with pre-fault load currents, selection of circuit Breakers ratings, current limiting reactors.

UNIT III: Unsymmetrical Faults:

UNIT IV: Stability of Power System:
Steady state, dynamic and transient stability definition. Dynamics of synchronous machine, swing equation, swing equation for machines swinging coherently and Non-Coherently, power angle equation, Steady state stability studies.

UNIT V: Economic operation of Power system:
Introduction, Distribution of load between units within the plant, Optimum generation scheduling with and without considering transmission losses, Representation of transmission loss using loss formula co-efficient, Derivation of loss formula co-efficient, simulation of co-ordination equation on digital computer. Preliminary concept of load dispatch centre.
UNIT VI: Neutral Grounding and Compensation:
1. Grounding of Neutral in power system.
2. Shunt & series compensation - Generalized equation, shunt reactor, compensation of very long line with intermediate switching station, series capacitor compensation at line centre, shunt reactors at both ends and series capacitor in middle of line, Elementary idea of sub-synchronous resonance problem and counter measures.

Text Books:
3. Electrical Power Systems, C.LWadhaw, New Age International

Reference Books:
1. Extra High Voltage A.C – Transmission Engineering, R.D. Begamudre, New Age International

Syllabus of Semester VII, B.E. Electrical Engineering
Course Code: EET402
Course: High Voltage Engineering
L: 4Hrs; T: 1 Hrs; P: 0 Hrs Per week
Total Credits: 9

Course Outcomes
Upon the completion of this course, student will be able to understand
CO1: The breakdown mechanisms in insulation.
CO2: The over voltage phenomenon in power system and their protection.
CO3: The generation & measurement techniques of high voltage for testing purpose.
CO4: The non destructive and high voltage testing of electrical equipments.

UNIT 1: Breakdown mechanism in Dielectrics:

UNIT 2: Lightning and Switching over voltages:
Lightning mechanism, types of lightning strokes, parameter and characteristics of lightning strokes, protection of power system against lightning over voltages, types of lightning arresters, surge absorbers; types of switching over voltages and their causes, protection against switching over voltages; Insulation coordination, BIL and SIL.

UNIT 3: Travelling waves:
Travelling waves on transmission lines, reflection and transmission of waves, behavior of travelling waves at transition points-typical cases, Bewley's lattice diagram.

UNIT 4: Generation of high voltage and currents:
Generation of high D.C. voltage by rectifier, voltage doublers and multiplier circuit, Van-de-Graff generator; generation of high AC voltage by cascade transformers, resonant transformer; generation of high frequency AC high voltage; impulse waveform, generation of impulse voltage, tripping and control of impulse generator; generation of switching surges; generation of impulse current.

UNIT 5: Measurement of high voltage and current:
Measurement of high AC and DC voltages by micro ammeter, generating voltmeters, resistance and capacitance potential divider, series impedance voltmeter, CVT, magnetic type potential transformers, electrostatic voltmethe, peak reading AC voltmeters, sphere gap arrangement; measurement of impulse voltage by potential dividers and peak reading voltmeters; measurement of high AC, DC and impulse currents:
UNIT 6: Non-destructive and high voltage testing of electrical apparatus:
Non-destructive testing: Significance of non-destructive testing, measurement of DC resistivity, measurement of dielectric constant and loss-factor, partial discharge phenomenon and measurement, discharge detection in power cables.
High voltage testing: Testing of insulators, bushings, isolators, circuit breakers, cables, transformers, lightning arresters and power capacitors.

Text Books:
2. High Voltage Engineering, C. L. Wadhawa, New Age international (P) Ltd Publisher.
3. High Voltage Engineering, M.P. Chaurasiya, Khanna Publisher.

Reference Book:

Course Outcomes
On completion of this course, the students will be able to,
CO1: Calculate the power handling capacity and surface voltage gradient of EHVAC transmission system.
CO2: Understand the concept of AC to DC conversion and power flow control in HVDC transmission system.
CO3: Discuss the necessity of various components in the HVDC transmission system substation.
CO4: Discuss about the substation protection and insulation co-ordination schemes used in HVDC transmission system.

Unit 1:
Power Handling capacities of EHV AC transmission lines, Introduction to voltage gradient on EHV conductors, Electric field of point charge, sphere gap, line-charge, single and three phase lines, and bundled conductors, Maxwell’s potential coefficients, Mangoldt Formula.

Unit 2:
Corona types, critical disruptive voltage, factors affecting corona, methods for reducing corona power loss, corona current wave form, charge voltage diagram, audible noise and radio interference. Electrostatic and electromagnetic fields of EHV lines, Electric shock and Threshold current, Capacitance of long object, calculation of electrostatic field of A.C. Lines (3-ph. Single and double circuit lines only), Effect of high electrostatic field, measurement of electrostatic field, induced voltages in insulated ground wires, electromagnetic interference.

Unit 3:
Comparison of EHV AC and HVDC transmission systems, HVDC converter: Rectifier and Inverter, Kinds of DC link, Power flow control in HVDC system, Constant current, constant voltage, constant ignition and excitation angle control, control characteristics.

Unit 4:
Parallel operation of AC and DC links (Synchronous and Asynchronous links),
Earth electrode and earth returns: Introduction objectives, location and configuration, resistance of electrodes, means of reducing earth electrode resistance, troubles caused by earth current and remedies. Multi-terminal HVDC system: Introduction, 2 pole transmission, MTDC system with series and parallel connected convertors, advantages and parallel connected convertors, advantages and applications, configurations and types.
Unit 5:
Harmonic Filters: Introduction, Filters, surge capacitors and Damping circuits, shunt filters, series filters, AC filters, design of AC filters and tuned filters, double frequency and damped filters, cost considerations. DC Harmonic filters.
Reactive power compensation: Reactive power requirements of HVDC convertors, substations, effect of Delay angle and extinction angle on reactive power.

Unit 6:
HVDC circuit breakers: Introduction, construction, principle, switching energy, interruption of DC current, application of MRTB, Types of HVDC C.B., capability and characteristics of HVDC circuit breakers. Introduction to HVDC substation protection against short-circuits and over-voltages, Difference between insulation coordination of AC and DC systems, Surge- Arresters protection scheme, Insulation coordination and protection margin.

Text Books:

Reference Book :
Extra High Voltage Engineering, Rakosh Das Gupta.
Unit IV: Designing of Lighting Systems:
Lux level requirements for various applications, classification of light fittings and luminaires, factors affecting the design of indoor lighting installations, total lumen method of calculation, Lighting design for indoor applications, Outdoor lighting system design for street lighting and flood lighting.

Unit V: Electrolytic Processes:
Fundamental principles, laws of electrolysis, Extraction & Refining of metals, Electro-deposition, Electro plating, Anodizing, manufacture of chemicals, Power supply for electrolytic processes.

Unit VI:

Text Books:

Reference Book:

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PROGRAMME SCHEME & SYLLABI for B. E. (ELECTRICAL ENGINEERING)

Syllabus of Semester VII, B.E. Electrical Engineering
Course Code: EET403-3
Course: Elective - II; Advanced Control System
L: 3 Hrs T: 1 Hrs P:0 Hrs. Per week
Total Credits: 7

Course Outcomes
Upon the completion of this course, student will be able to:

CO1: Analyze continuous time system using state space technique and investigate controllability and observability of the system.

CO2: Use Optimal Control theory to solve variety of control system problems.

CO3: Able to differentiate between Analog and Digital PID Controller.

CO4: Analyze Digital Control System & investigate its stability.

CO5: Understand nonlinear systems and evaluate the stability of nonlinear systems.

UNIT I:
Design by state variable feedback: Review of state variable representation. Solution of state equation. Controllability and Observability. Design of SVF

UNIT II:

UNIT III:
Controller Tuning: Review of analog PID controller, PID tuning methods in process control (Ziegler-Nichols tuning method) ,digital PID controllers.

UNIT IV:

UNIT V:
UNIT VI:
Introduction to Non Linear Control System (NLCS):
Types of non-linearities, characteristics of NLCS,
Describing function method for analysis, Stability analysis, Limit cycle and its stability. Difference between
describing function and phase plane method for analysis of NLCS.

Text Books:
1. Control System Analysis, Nagrath & Gopal.
2. Linear System Analysis, D’Azzo & Houpis.
3. Modern Control Engineering, Ogata.

Reference Books:
2. Digital Control and State Variable Methods, M. Gopal.
UNIT V:
Brushless DC motor, stepper motor, switched reluctance motor drives and eddy current drives. Introduction to solar and battery powered drives.

UNIT VI:
Traction drives, Conventional D.C. and A.C. traction drives, semiconductors converter controlled Drives, 25KV AC Traction using semiconductor converter controlled DC Motor. DC Traction using semiconductor, chopper controlled DC motors, Poly Phase AC motors for traction drives

TEXT BOOKS:
3. Electric drives concepts and applications, V. Subramanan.

REFERENCE BOOKS:
1. Electrical Drives, Jon Boldea, N.A. Nasar
2. Electrical Drives Control, R. Krishnan

Syllabus of Semester VII, B.E. Electrical Engineering
Course Code: EET405    Course: Switch Gear and Protection
L:4Hrs T: 1 Hrs P:0 Hrs. Per week  Total Credits: 9

Course Outcomes:
On completion of this course the student will able to,
CO1: Describe the principle and operation of relays and protective relaying.
CO2: Select and apply protective relays for protection of overhead lines and busbars.
CO3: Select and apply protective relays for protection of power transformers
CO4: Select and apply protective relays for protection of alternators and motors
CO5: Describe the methods of arc interruption, principle of operation of circuit breakers and their applications.

Unit 1:- General Philosophy of Protective Relaying:
Faults & their classification, Protective Zones, Primary Protection, Back up protection, Remote and Local Back up, Selectivity, characteristics of CT & PTs for protection.

Unit2 :- Medium Voltage Line Protection:
Over current relaying, directional over current relays, limitations of overcurrent relaying.

Unit3:- High Voltage Line Protection:
Distance relays, carrier distance schemes, Unit carrier schemes.

Unit4 :- Equipment Protection:
Principles of differential relaying, protection of generator, transformers and busbars by differential relaying and other relays.
Protection of Induction Motors against overloads, short circuits, thermal relays, miniature circuit breakers.

Unit5 :- Introduction to Static Relays:
Comparison of static and electro mechanical relays, two input amplitude and phase comparators and their duality, Generation of various distance relay characteristics using above comparators. Introduction to numerical relays.

Unit6 :- Switchgear:
Circuit breakers, Arc interruption theory, recovery and re-striking voltages, RRRV, breaking of inductive and capacitive currents, C.B. ratings, different media of arc interruption, overview of oil circuit breakers, construction and operation of Air blast, SF6 and vacuum breakers.

Text Books:
1. Art & Science of Protective Relaying, Mason.

Reference Books:
2. Power System Protection and Switchgear B. Ram, D.N. Vishwakarma, TMG.
Syllabus of Semester VIII, B.E. Electrical Engineering
Course Code: EET407     Course: Electrical Installation Design & Practices
L: 3Hrs. T: 1 Hrs P: 0 Hrs. Per week   Total Credits: 7

Course Outcomes
Upon the completion of this course, the students will be able to:

CO 1: Assess the electrical load and select the conductors suitable to carry the load currents.
CO 2: Calculate short circuit currents at different locations and select proper switchgear.
CO 3: Design and select suitable components of starters for induction motors, understand its operation and select capacitors for reactive power management.
CO 4: Design and understand procedures for installation, testing and commissioning practices for various components of transformer substation suitable for 11 and 33 kV installations.
CO 5: Design the electrical systems for residential, commercial and industrial establishments.

Unit 1:
Electrical load assessment: Concept of electrical load, categories of load, types of loads, connected load, demand factor, Maximum demand, diversity factor, load factor, power factor, TOD Tariff, Industrial Electric Bills, regression Analysis for Load Forecasting.
Cables, conductors & bus-bars:
Construction, selection, installation, testing of LT/HT cables, overload & short circuit ratings, rating factors; Overhead line conductors.

Unit 2:
Symmetrical Short Circuit Calculations:
Determining symmetrical short circuit currents at various locations for selecting proper circuit breaker rating & determining value of series reactors for limiting short circuit current. Overcurrent protection with two phase fault & one ground fault relays.
Switching & protection devices: Types, specifications; selections of isolators, switches, switch fuse units, MCB, MCCB, ACB, VCB, SF6 breakers, dropout/ horn gap fuses, AB switches, contactors for voltages up to 33 kV. Various types of protective releases for above circuit breakers.

Unit 3:
Electric supply to Induction Motors in industries: Types of motors, SLD and working of DOL/ Star-Delta/ Autotransformer starters; types, specifications, selection of power contactors, Overload relays, short circuit protective devices.
Reactive power management in industries:
Reactive power compensation in industries using static capacitors, use of Power Triangle, Calculating payback period for reduced system currents.

Unit 4:
Transformers: Specifications, ratings, selection, installation, testing & commissioning.
Substations: 11kV & 33 kV, indoor/outdoor substations, plan/ elevations.

Unit 5:
Design of Industrial Electrical Installations: Preparing load list, assessing various factors associated with loads, selection of transformer, design of PCC & MCC, selection of all the associated electrical apparatus, busbars, cables, switchgear, protective devices, earthing system, testing, commissioning.

Illumination:
Design definitions, polar curves, and simple calculations, working principles of fluorescent, sodium vapor and mercury vapor lamps.

Unit 6:
Earthing (IS 3043): Necessity of earthing, concept of system & equipment earthing, definitions of various terms, types of earthing, earth tester and measurement of earth resistance.
IE Rules:
Important IE Rules applicable to residential, commercial & industrial installations.
Note : The scope of this subject shall cover installations up to 33 kV.

Text Books:
1. Electric Power Distribution, A. S. Pabla
2. Design of Electrical Installations, V. K. Jain, Amitabh Bajaj

Reference Book:
1. Indian Electricity Rules, Latest Edition
2. IS 3043, Code of Practice for Earthing.
3. Manufacturers’ Catalogues & technical write-ups on their websites.
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Syllabus of Semester VIII, B.E. Electrical Engineering

Course Code: EET408          Course: Computer Applications in Power Systems
L: 4Hrs.  T: 1 Hrs P: 0 Hrs. Per week       Total Credits: 9

Course Outcomes

Upon the completion of this course, students will be able to,

CO 1: Describe the Graph Theory and Form Single phase Incidence and Network Matrices.

CO 2: Form Bus Impedance and Bus Admittance Matrices using Algorithm and steps for simulating the construction of Network by adding one element at a time.

CO 3: Describe three phase representation of networks, transformation Matrix, symmetrical components along with formation of Incidence matrices and to form only three phase Bus Incidence Matrix using algorithm.

CO 4: Determine power flows and system voltages during normal and emergency conditions, draw flow charts and elementary programming for Numerical solution to linear and non linear algebraic equations.

CO 5: Analyze symmetrical / unsymmetrical faults for a chosen power system Network at any location Construct flow charts and write elementary programming for achieving this task.

CO 6: Obtain the solution of swing equation / differential equations employed in Transient stability studies.

UNIT I:
Incidence and Network Matrices: Graph Theory, Incidence Matrices, Primitive network, formation of network matrices by Singular transformations.

UNIT II:
Algorithm for formation of Bus Impedance and Bus Admittance matrix for system without mutual coupling.

UNIT III:

UNIT IV:

UNIT V:

UNIT VI:
Transient Stability Studies:

Text Books:
3. Elements of power system analysis, William D. Stevenson.

Reference Book :
Computer Analysis of Power system, R.N. Dhar
Syllabus of Semester VIII, B.E. Electrical Engineering

Course Code: EET409-1                                    Course: Elective - III; Embedded Systems
L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week                      Total Credits: 7

Course Outcomes:

On completion of this course, students will be able to,

CO1: Differentiate between different architecture, language and instruction set of different processors.

CO2: Apply the knowledge for interfacing with devices/ports.

CO3: Use different software tools for real time operating system.

Unit – I Introduction to Embedded System

Introduction to functional building blocks of embedded systems – Register, memory devices, ports, timer, interrupt controllers using circuit block diagram representation for each categories.

Unit – II RISC Processor Architecture & Instruction Set

Structural units in a processor; selection of processor & memory devices; shared memory; DMA; interfacing processor, memory and I/O units; memory management – Cache mapping techniques, dynamic allocation - Fragmentation.

CASE STUDY: Required Memory devices for an Automatic Washing machine, Chocolate vending machine and for a Digital Camera and Voice recorder.

Unit – III Peripheral & Network Components

I/O devices; timer & counting devices; serial communication using I2C, CAN, USB buses; parallel communication using ISA, PCI, PCIX buses, arm bus; interfacing with devices/ports, device drivers in a system – Introduction.

Unit - IV Embedded Software Architecture

I/O instruction – Transfer rate, latency; interrupt driven I/O - Non-maskable interrupts; software interrupts, writing interrupt service routine in C & assembly languages; preventing interrupt overflow; disability interrupts. Multi threaded programming – Context switching, premature & non-premature multitasking, semaphores.

Scheduling – Thread states, pending threads, context switching, round robin scheduling, priority based scheduling, assigning priorities, deadlock, watch dog timers.

Unit - V Real Time Operating System (RTOS)

Introduction to basic concepts of RTOS, RTOS – Interrupt handling, task scheduling; embedded system design issues in system development process – Action plan, use of target system, emulator, use of software tools.

Text Books


Reference Books


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Syllabus of Semester VIII, B.E. Electrical Engineering

Course Code: EET409-2                                    Course: Elective - III; Power Quality
L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week                      Total Credits: 7

Course Outcomes:

On completion of this course, the students will be able to,

CO 1: Identify the various power quality events like short and long duration variations, Waveform distortion, Unbalance, Transients, Power factor etc.

CO 2: Discuss about the sources causing the power quality issues.

CO 3: Suggest suitable mitigation strategies for some of the power quality issues.

CO 4: Discuss about the equipments for measurement of power quality events.

Unit 1

Introduction to Electric Power Quality, Power Quality standards, Different Power Quality terms and definitions.

Unit 2

Voltage Sag and Interruptions, Sources of Voltage sag and interruptions, type and characteristics of voltage sag and interruptions, Factors affecting characteristics of voltage sag and interruptions, behavior of different equipments during voltage sag, concept of area of vulnerability, CBEMA and ITI Curves.

Unit 3

Voltage Swell and transient overvoltage, sources of overvoltage like capacitor switching, load switching, lighting etc, various causes of voltage flicker and their effects. Short term and long term flickers, various means to reduce flickers, Transient over voltages, sources, impulsive transients, switching transients, Effect of surge impedance and line termination, control of transient voltages.

Unit 4

Harmonic distortions, voltage and current harmonics, THD, sources of harmonics, ill effects of harmonics, interharmonics, harmonics filters, IEEE 519-1992 definitions, reactive power under harmonics, K-rated transformer.

Unit 5

Voltage Unbalance, Impact on equipment performance, other power quality related issues like EMI, noise, notching, DC offset, Typical wiring and grounding problems causing poor power quality, solution to wiring and grounding problems.
Unit 6

Text Books:
3. Power Quality by C.Sankaran, CRC Press

Reference Books / Reading Material :
1. IEEE std 519-1992/ IEEE std 1159 IEEE recommended practices and requirements for harmonics control in electrical power system.
Syllabus of Semester VIII, B.E. Electrical Engineering

Course Code: EET410-1    Course: Elective - IV; Flexible AC Transmission Systems
L: 3 Hrs.    T: 1 Hr.    P: 0 Hrs. Per week    Total Credits: 7

Course Outcome
Upon the completion of this course, students will be able to

CO 1: Understand the effect of reactive power flow on performance of transmission line and types of FACTS controllers.
CO 2: Understand the application of converter for FACTS devices.
CO 3: Understand the application of FACTS controller.

UNIT I:
FACTS Concept & general system consideration: Transmission inter connection, flow of power in an AC system, Factor affecting the loading capability, Power flow & dynamic stability consideration of transmission inter connection. Importance of controllable parameters, FACTS controller.

UNIT II:
Voltage sourced & current sourced converters: Basic concept of voltage sourced converters, single phase full wave bridge converter operation, single phase leg operation, square wave voltage harmonics for single phase bridge, three phase full wave bridge converter, sequence of valve conduction process in each phase leg, transformer connection for 12 pulse operation, three level voltage sourced converter, pulse width modulation converter, generalize technique of harmonic elimination & voltage control, basic concepts of current sourced converter, Thyristor based converters (with gate turn on), current source converter with turn off devices. Current source versus voltage source converter.

UNIT III:
Static Shunt Compensators: SVC and STATCOM,
Objectives of shunt Compensation, Methods of Controllable Var Generation, Static Var Compensators SVC and STATCOM, Comparison between STATCOM and SVC, Static VAR System

UNIT IV:
Static Series Compensators: GCSC, TSSC, TCSC and SSSC
Objectives of series Compensation, Variable Impedance, Type Series Compensators, Switching Converter Type, Series Compensators, External (System) Control for Series Reactive Compensators.

UNIT V:
Static Voltage and Phase Angle Regulators: TCVR and TCPAR
Objectives of Voltage and Phase Angle Regulators, Approaches to Thyristor-Controlled Voltage and Phase Angle Regulators (TCVR and TCPARS) Switching Converter – Based Voltage and Phase Angle Regulators, Hybrid Phase Angle Regulators.

UNIT VI:
Combine Compensators (UPFC, IPFC) and Special Purpose FACTS Controllers
The Unified Power Flow Controller (UPFC), Interline Power Flow Controllers Generalized and Multifunctional FACTS Controllers, Sub synchronous Resonance, NGH-SSR Damping Scheme, Thyristor-Controlled Braking Resistor (TCBR)

Text Book:
Understanding FACTS, Naryan G. Hingorani and Laszlo Gyigyi (Standard Publishers).

Reference Books:
1. Flexible AC Transmission System (FACTS) ’Yong Hua Song and Johns (IEEE Publishers).
Course Code: EET410-2  
Course: Elective - IV Digital Signal Processing  
L: 3 Hrs.  T: 1 Hrs.  P: 0 Hrs.  Per week  
Total Credits: 7  

Course Outcomes:  
Upon the completion of the course, student will be able to:  
CO1: Differentiate between different types of signals and systems.  
CO2: Find the Fourier transform of a given discrete signal.  
CO3: Apply the z transform to a given system.  
CO4: Represent and design IIR & FIR filters.  
CO5: Find the DFT and FFT of a given signal.  

Unit 1:  
Discrete time signals & systems: Linearity, causality, stability, static dynamic, Time Invariance Time variance, classification of discrete time systems, convolution, cross correlation, Autocorrelation, sampling theorem & sampling process, Reconstruction of sampling data. 

Unit 2:  
Frequency domain representation of discrete time signals and systems, Fourier transform of discrete time signals, properties of discrete time Fourier transform. 

Unit 3:  
The Z-transform: Definition, Properties of the region of convergence for the Z-transform, Z-transform properties, Inverse Z-transform using contour integration, complex convolution theorem, unilateral Z-transform. 

Unit 4:  
Transform analysis of LTI system & structures for discrete-time system: Frequency response of LTI system, relationship between magnitude & phase, all pass system, minimum phase system, linear system with generalized linear phase. Block diagram representation & signal flow graph representation of linear constant Coefficient difference equations, basic structures for IIR systems, transposed forms, basic network structures for FIR systems, lattice structures. 

Unit 5:  
Filter design techniques: Design of discrete time IIR filters from continuous time filters. Frequency transformations of low pass IIR filters. Design of FIR filters by windowing technique and Frequency sampling method. 

Text Books:  

Reference Books:  
Digital signal processing Theory &Applications, 3” Edition Prows and Manolakis, PHI Ltd.
Course Outcomes:
Upon the completion of the course, student will be able to:

CO1: Understand category and utility of substation on the basics of different parameter

CO2: Classify the substation and the basics of different parameter and understand the important of different components in substation.

CO3: Design by basic substation layout and the substation placement of the basic of inputs.

CO4: Understand system procedure of different equipment in substation weight approximate intimation.

Unit-I: Electrical substation – General concept as referred to function, layout, voltage levels, types of substations, features and necessity, Concept of EHV-AC and HVDC substation. Single line diagram.

Unit-II: Introduction to EHV substation equipments like Bus bars, circuit breakers, power transformers CT & PTs, Isolators and earth switches, lightening arrestors.

Unit-III: Classification of substation on basis of configuration, Indoor and Outdoor, Application. General specifications of substation. Bus bar system, bays and layout of EHV substation.

Unit-IV: Principle of substation design, Terms and definitions, Stresses on equipments, all clearances, maintenance zones, all type of substation structures, Dimensions of structures, preparation of layout drawing using Autocad or other tools.

Unit-V: Design concepts of substation bus bar system, material for bus bar, current carrying Capacity, Insulation requirements, clearance. Different insulators used in substation, Design aspects of substation earthing system.

Unit-VI: Auxiliary supplies required in substation, Basic concept of protection, control and automation in EHV substations, concept of power line carrier communication, planning for installation, commissioning and testing of all equipments in EHV substation, Estimation of substation and agencies for providing the finance for erecting substation, technical and commercial feasibility.

Text Book:
Electrical Substation Engineering and Practice, S. R. Rao, Khanna Publisher.

References:
1. Electrical Transmission & Distribution Ref. book by Westinghouse, USA.
2. Technical literature, Papers, Installation Manuals, ABB, Siemens, etc.
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