

COURSE OBJECTIVES:

1. To educate Matrix Algebra Technique and curvature Theory
2. To impart knowledge of Techniques in solving Ordinary Differential Equations and to apply in solving Modern Engineering Problems
3. To acquaint the students about functions of several variables and also to familiarize the students in infinite series and their convergence

UNIT I EIGEN VALUE PROBLEMS**9 Hours**

Characteristic equation - Eigen values and Eigen vectors of a real matrix – Properties - Cayley– Hamilton theorem- Diagonalization of Matrices - Reduction of a quadratic form to a canonical form by orthogonal transformation – Application of Matrices in Structural Engineering and image processing

UNIT II ORDINARY DIFFERENTIAL EQUATIONS**9 Hours**

Higher order linear differential equations with constant coefficients – Cauchy’s and Legendre’s linear equations – Method of variation of parameters in solution of ordinary differential equations.

UNIT III DIFFERENTIATION AND GEOMETRICAL APPLICATIONS**9 Hours**

Derivative of special functions (Trigonometry, Exponential, Logarithmic), Derivative by rule (Product, Quotient, Chain rule), Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature- Evolutes and involutes.

UNIT IV MULTIVARIABLE CALCULUS**9 Hours**

Functions of two variables and solutions (Partial derivatives and Euler’s theorem)– Taylor’s series - Maxima and Minima – Application of Partial Derivatives to find the optimum requirement using Lagrangian multipliers.

UNIT V SEQUENCES AND SERIES**9 Hours**

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test, Integral test and D’Alembert’s ratio test – Alternating series – Leibnitz’s test – Application of Sequences in real life.

TOTAL: 45 + 15 HOURS**FURTHER READING:**

1. Modeling and solutions using Newton’s Law of Cooling of Bodies
2. Differentiation of implicit Functions, Jacobians and Properties

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

- CO1: Analyze the characteristics of a linear system with Eigen value and Eigen Vectors
- CO2: Recognize and solve Higher order Ordinary Differential Equations
- CO3: Solve Derivative of special functions and apply it in solving Geometrical problems
- CO4: Apply Partial Derivatives in finding Maxima and Minima of a function
- CO5: Test the convergence of any series

REFERENCES:

1. Veerarajan R., “Engineering Mathematics”, updated second edition for semester I and II,(2017)
2. Grewal. B.S, “Higher Engineering Mathematics”, 44th Edition, Khanna Publications, Delhi, (2014).
3. Bali N. P and Manish Goyal, “Text book of Engineering Mathematics”, Sixth edition, Laxmi Publications(p) Ltd.,(2014).
4. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, (2012).
5. P.Kandasamy, K. Gunavathy and K. Thilagavathy, Engineering Mathematics ,Volume II, S. Chand & Co ., New Delhi, (2009)
6. Erwin Kreyszig, Advanced Engineering Mathematics,9th Edition, Wiley International edition, (2006)
7. Ramana B.V, “Higher Engineering Mathematics”,Tata McGrawHill Publishing, New Delhi, (2007).
8. M K Venkataraman, Engineering mathematics, Volume I, 2nd ed., National Publishing Co.(2003)
9. nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html
10. www.learnerstv.com/Free-maths-video lectures - Itv348-page1.htm

1701PH101

APPLIED PHYSICS FOR ENGINEERS
(Common to all B.E. / B.Tech Degree Programmes)

L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To impart knowledge in properties of matter, crystallography and ultrasonics.
2. To understand the applications of lasers and fiber optics.
3. To implement the principles of quantum physics in the respective engineering fields.

UNIT I PROPERTIES OF MATTER

9 Hours

Elasticity: elastic and plastic materials – Hooke's law – elastic behavior of a material – stress – strain diagram – factors affecting elasticity. Three moduli of elasticity – Poisson's ratio – torsional pendulum – twisting couple on a cylinder. Young's modulus – uniform bending – non-uniform bending. Viscosity: coefficient of viscosity – streamline and turbulent flow – experimental determination of viscosity of a liquid – Poiseuille's method.

UNIT II APPLIED OPTICS

9 Hours

Interference: air wedge – theory – uses – testing of flat surfaces – thickness of a thin wire. Laser: introduction – principle of laser – characteristics of laser light – types: CO₂ laser – semiconductor laser (homojunction). Fiber optics: principle of light transmission through fiber – expression for acceptance angle and numerical aperture – types of optical fibers (refractive index profile and modes) – fiber optic communication system (block diagram & description).

UNIT III ULTRASONICS

9 Hours

Ultrasonics: introduction – properties of ultrasonic waves – generation of ultrasonic waves – magnetostriction - piezo electric methods – detection of ultrasonic waves – Determination of velocity of ultrasonic waves (acoustic grating). Applications of ultrasonic waves: pulse echo method, SONAR – measurement of velocity of blood flow – modes of operation (A scan, B Scan & C Scan).

UNIT IV SOLID STATE PHYSICS

9 Hours

Crystal Physics: lattice – unit cell – crystal systems – Bravais lattices – Miller indices – "d" spacing in cubic lattice – calculation of number of atoms per unit cell, atomic radius, coordination number and determination of packing density for SC, BCC, FCC and HCP structures – X-ray diffraction: Laue's method – powder crystal method.

UNIT V QUANTUM MECHANICS

9 Hours

Quantum Physics: development of quantum theory – de Broglie wavelength – Schrodinger's wave equation – time dependent and time independent wave equations – physical significance. Application: particle in a box (1D) – degenerate and non-degenerate states. Electron Microscopy-SEM, TEM - principle and working – problem solving.

TOTAL: 45 HOURS

FURTHER READING:

Neutrino's – expanding universe

COURSE OUTCOMES:

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

- CO1: Realize the concept of properties of matter and apply the same for practical applications.
- CO2: Identify the suitable laser source for fiber optic communication applications.
- CO3: Determine the velocity of ultrasonic waves and apply the same for day today applications.
- CO4: Classify the different types of crystal structures and analyze their properties.
- CO5: Comprehend the efficacy of quantum equations in modern areas.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012
- 3.Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd, 2013.
7. <http://nptel.ac.in/>

1701EN101

TECHNICAL ENGLISH
(Common to all B.E / B.Tech Degree Programmes)

L T P C
3 0 0 3

COURSE OBJECTIVES:

- 1.To develop the ability to read and comprehend technical texts in the field of Engineering
- 2.To develop vocabulary building through the study of word construction
3. To develop ability to write formal definitions of technical terms and expression.
4. To recognize various grammatical structures that will aid the student improve his/her theoretical knowledge.

UNIT I

9 Hours

Articles-Preposition-Subject-Verb-Object-Adjective-Adverb-Conjunction-Nouns- Usages of Have, has, had- Simple Present-Simple Past-Simple Future-Self introduction-Framing Questions

UNIT II

9 Hours

Present Continuous-Past Continuous-Future Continuous-Describing a place, person or thing-Framing negative questions-Gerund-Listening to Articles, speeches and audios

UNIT III

9 Hours

Present perfect-past perfect-future perfect-writing short paragraph-sentence pattern- Infinitive-Tag questions- Reading newspaper cutting

UNIT IV

9 Hours

Present perfect continuous –Past perfect continuous-Future perfect continuous-writing an Essay in 100 words-Types of sentences-Prefix-suffix-word formation-Dialogue writing.

UNIT V

9 Hours

Active voice-passive voice-impersonal passive voice –Synonyms and Antonyms-phrasal verbs- Punctuation- Common Errors-Letter writing.

TOTAL: 45 HOURS

FURTHER READING:

Letters from a Father to His Daughter- Jawaharlal Nehru

COURSE OUTCOMES:

On the successful completion of the course, Students will be able to

- CO1: Read and comprehend technical texts in the field of Engineering
- CO2: Acquire vocabulary building and write effectively in technical writing
- CO3: Write formal definitions of technical terms and expression in both verbal and written form.
- CO4: Understand grammatical structures and use flawless English in the professional documents

REFERENCES:

1. Meenakshi Raman, Sangeetha Sharma, “*Technical Communication : English Skills for Engineers*” Oxford University Press: New Delhi, 2016.
2. Rizvi Ashrav.M, “*Effective Technical Communication*” Tata McGraw Hill: New Delhi, 2017
3. Herbert, A.J, “*Structure of Technical English*”, London English Language Society.
<https://archive.org/details/in.ernet.dli.2015.136456>
4. J.D. O'Connor, Better *English Pronunciation* Paperback, 2nd edition, 162 pages, Published September 16th 2013 by Cambridge University Press,October 23rd 1967
5. Nehru, Jawaharlal. *Letters from a Father to His Daughter*, Puffin Books, 2004
6. *Technical English* by faculty of English –published by EGS Pillay press 2017

1701CH104

APPLIED CHEMISTRY
(Common to B.E. – ECE & EEE Programmes)

L T P C
3 0 0 3

COURSE OBJECTIVES:

1. Recall the terminologies of electrochemistry and explain the function of batteries and fuel cells
2. Choose appropriate instrumentation technique for interpreting analytical data.
3. Understand the fundamentals of corrosion, its types and polymers with its applications with its electrochemical reactions

UNIT I ELECTROCHEMISTRY

9 Hours

Cell terminology-Electrochemical cells- Electrolytic cells- Cell reactions- Daniel cell-Difference between electrolytic cells and electrochemical cells. Reversible cells and irreversible cells -types- EMF series and its applications - Nernst equation (derivation and problems).Single electrode potential - Hydrogen electrode - Calomel electrode - Glass electrode - pH measurement using glass electrode.

UNIT II CORROSION AND ITS CONTROL

9 Hours

Corrosion – types-chemical, electrochemical corrosion (galvanic, differential aeration) - Factors influencing corrosion -corrosion control – material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Protective coatings: Electroplating of gold and electroless plating of nickel. Paints - Constituents and Functions.

UNIT III NONCONVENTIONAL ENERGY RESOURCES AND STORAGE DEVICES

9 Hours

Introduction- nuclear energy- nuclear fission, nuclear fusion- nuclear chain reactions- breeder reactor- Nuclear Reactor-solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery nickel- cadmium battery- lithium battery- fuel cell H₂ -O₂ fuel cell- applications

UNIT IV POLYMER AND ITS APPLICATION

9 Hours

Introduction: Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Addition (Free Radical Mechanism) condensation and copolymerization. Fabrication of Plastics. Application –Conducting polymer.

UNIT V INSTRUMENTAL TECHNIQUES OF CHEMICAL ANALYSIS

9 Hours

Laws of photochemistry - Grothus–Draper law, Stark–Einstein law and Lambert-Beer Law. Electromagnetic spectrum - UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only) - Applications. Colorimetry- principles, instrumentation (Block diagram only) estimation of iron. Flame photometry – principles, instrumentation (Block diagram only) estimation of sodium.

TOTAL: 45 HOURS

FURTHER READING:

1. Alloys-ferrous and nonferrous alloys
2. Cambridge structural database (protein data bank)-noting data bank
3. Unique properties of nano material- introduction to quantum materials, quantum dots, supramolecular materials and molecular crystal engineering – molecular machines and devices- Logic gate using electronics material for molecular electronic.

COURSE OUTCOMES:

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

- CO1: Construct an electrochemical cell and measure its potential
- CO2: Identify the components and processes in batteries and infer the selection criteria for commercial battery systems with respect to different applications
- CO3: Utilize electrochemical data to formulate an electrochemical half-cell and cell reactions for corrosion control processes
- CO4: Differentiate the polymers used in day to day life based on its source, properties and applications
- CO5: Identify the applications of analytical methods for the estimation of elements in aqueous media

REFERENCES:

1. Ashima Srivastava and Janhavi N N., “Concepts of Engineering Chemistry”, ACME Learning Private Limited., New Delhi, 2010.
2. Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2016.
3. RenuBapna and Renu Gupta., “Engineering Chemistry”, Macmillan India Publisher Pvt Ltd, 2010.
4. Willard Merritt and Dean Settle, Instrumental methods of analysis, CBS publishers, Seventh edition, 2012.
5. Dara.S.S, Umare S.S.“Engineering Chemistry”, S. Chand & Company Ltd., New Delhi., 2010.
6. <https://www.ccdc.cam.ac.uk/solutions/csd-system/components/csd/>
7. https://link.springer.com/chapter/10.1007/978-3-642-28030-6_2
8. www.santarosa.edu/~yataiia/4D/QuantumDotsMk2.ppt
9. onlinelibrary.wiley.com/doi/10.1002/9780470661345.smc107/pods

10. https://en.wikipedia.org/wiki/Molecular_electronics.

11. Jain and Jain, "Engineering Chemistry", Sixteenth edition, Dhanpatrai publications, 2012.

1701GE102

BASIC CIVIL ENGINEERING
(B.E – Electrical and Electronics Engineering)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

4. To educate students about basic surveying
5. To impart knowledge about the building materials, foundations and superstructures
6. To impart knowledge about the solid mechanics and fluid properties

UNIT I GENERAL & BASICS OF SURVEYING

9 Hours

General introduction to Civil Engineering - types of buildings - Surveying – Principles, Objectives, Horizontal measurements with chain and tapes, Ranging; Levelling – Instruments, Reduction of levels; Modern surveying instruments.

UNIT II BUILDING MATERIALS

9 Hours

Building materials – Stones, Bricks, Sand, Cement, Cement mortar, Cement concrete, Steel, Timber, Decorative finishes, Paints.

UNIT III FOUNDATIONS & SUPERSTRUCTURE

9 Hours

Foundations: Types, Bearing capacity – Requirement of good foundations. Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering.

UNIT IV BASICS OF SOLID MECHANICS

9 Hours

Stress and strain at a point – Tension, Compression, Shear Stress – Hooke's Law – Relationship among elastic constants – Ultimate Stress – Yield Stress – Factor of Safety- beams and bending – types of loads-methods of joints – method of sections.

UNIT V FLUID PROPERTIES

9 Hours

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillarity and surface tension.

TOTAL: 45 HOURS

FURTHER READING:

The testing methods of materials and applications of solids and fluids.

COURSE OUTCOMES:

On the successful completion of the course, Students will be able to

- CO1: Realize the concepts of basic surveying
- CO2: Select & utilize the suitable building materials
- CO3: Demonstrate the classifications of foundation and superstructures
- CO4: Explain the properties of solids
- CO5: Explain the properties of fluids

REFERENCES:

1. Ramamrutham S., "Basic Civil Engineering", DhanpatRai Publishing Co. (P) Ltd. (1999).
2. S. Rajput, Strength of Materials, S. Chand & Co., 2006
3. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 2005
4. S. K. Duggal, Building Materials, New Age International (P) Ltd., 2003
5. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (2005).
6. Shanmugam G and Palanichamy M S, "Basic Civil and Mechanical Engineering", TataMcGraw Hill Publishing Co., New Delhi, (1996).
7. <http://nptel.ac.in/>

1701GE103

BASIC MECHANICAL ENGINEERING
(B.E - EEE Programme)

L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To impart basic knowledge on Mechanical Engineering.
2. To explain the component of power plant units and detailed explanation to IC engines their working principles.
3. To explain the R & AC system.
4. To explain the system of forces and free body diagram.
5. To study about the manufacturing process.

UNIT I POWER PLANT ENGINEERING

9 Hours

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT II IC ENGINES

9 Hours

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT III REFRIGERATION AND AIR CONDITIONING SYSTEM

9 Hours

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

UNIT IV BASIC CONCEPTS AND FORCE SYSTEM

9 Hours

Introduction to mechanics - idealization of mechanics - laws of mechanics - principle of transmissibility - vector - addition, subtraction and product. Force- types - system of forces - resultant forces - composition of forces - resolution of force-free body diagram for real world systems.

UNIT V MANUFACTURING PROCESSES

9 Hours

Basic Concepts, Demonstration, measurement and experiments: Turning, facing, drilling, internal and external thread cutting, boring, grooving, taper turning in lathe. Milling using end milling cutters. drilling using universal drilling machine -sheet metal spinning, deep drawing, forging of clay models, making water tank using FRP, sheet metal work-arc welding, brazing, riveting -investment casting, sand casting, injection molding, vacuum molding, blow molding -powder coating.

FURTHER READING:

Water Supply and Transportation Systems - Engineering Materials and Manufacturing Processes

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

- CO1: Identify the components use in power plant cycle.
- CO2: Demonstrate working principles of petrol and diesel engine.
- CO3: Explain the components of refrigeration and Air conditioning cycle.
- CO4: Explain the force system and free body diagram.
- CO5: Explain the manufacturing process.

REFERENCES:

1. Venugopal K. and Prahuraja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam, 2000.
2. Shantha Kumar S R J., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2000.
3. F.P. Beer, and Jr. E.R Johnston, Vector Mechanics for Engineers - Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2007.
4. Roger Timing, Engineering Fundamentals, Newnes, 2002.
5. C. F. Gerald and P. O. Wheatley, Applied Numerical Analysis, Pearson Education 2003.

1701HS151

PHYSICS AND CHEMISTRY LABORATORY-I
(Common to all B.E. / B.Tech Degree Programmes)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies
2. To achieve perfectness in experimental skills
3. To bring confidence and ability to develop and fabricate engineering and technical equipments.
4. To train the students to analyses the water sample
5. To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

PHYSICS

LIST OF EXPERIMENTS:

1. Determine the moment of inertia of the disc and calculate the rigidity modulus of a given wire using torsion pendulum (symmetrical masses method).
2. Find the elevation of the given wooden beam at the midpoint by loading at the ends and hence calculate the Young's modulus of the material by uniform bending.
3. Determine the coefficient of viscosity of the given liquid by Poiseuille's method.
4. From the interference fringes from the air wedge setup and calculate the thickness of the given wire.
5. By applying the principle of diffraction, determine the wavelength of given laser light and the average particle size of lycopodium powder using laser source.
6. Determine the
 - (i) Wavelength of ultrasonic in a liquid medium
 - (ii) Velocity of ultrasonic waves in the given liquid
 - (iii) Compressibility of the given liquid using ultrasonic interferometer.

CHEMISTRY

LIST OF EXPERIMENTS:

1. Determination of total, temporary & permanent hardness of water by EDTA method
2. Determination of strength of given hydrochloric acid using pH meter
3. Estimation of iron content of the given solution using potentiometer
4. Estimation of sodium present in water using flame photometer
5. Corrosion experiment – weight loss method
6. Determination of molecular weight of a polymer by viscometry method
7. Conductometric titration of strong acid Vs strong Base

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

- CO1: Realize the concept of properties of matter and apply the same for practical applications.
CO2: Identify the suitable laser source for fiber optic communication applications.
CO3: Determine the velocity of ultrasonic waves and apply the same for day today applications.
CO4: Classify the different types of crystal structures and analyze their properties.
CO5: Comprehend the efficacy of quantum equations in modern areas.
CO6: Identify the pH of the solution.
CO7: Find the iron content of the water sample using potentiometer.
CO8: Explain and demonstrate the conductance of the solution.
CO9: Interpret the hardness and metal ions present in the water.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi, 2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012.
3. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd, 2013.
7. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New Yor (2001).
8. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel's Textbook of practical organic chemistry", LBS Singapore (1994).
9. Jeffery G.H., Bassett J., Mendham J. and Denny vogel's R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
10. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

1701GEX52

COMMUNICATION SKILLS LAB
(Common to all B.E. / B.Tech Degree Programmes)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

1. To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts
2. Further, they would be required to communicate their ideas relevantly and coherently in writing.
3. To prepare all the students for their placements.

LIST OF EXPERIMENTS: The following course content to conduct the activities is prescribed for the Communication Skills Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** - General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading & effective googling.
3. **Activities on Writing Skills** - Structure and presentation of different types of writing - letter writing/ Resume writing/ e-correspondence/ Technical report writing/ Portfolio writing - planning for writing - improving one's writing.
4. **Activities on Presentation Skills** - Oral presentations (individual and group) through JAM sessions / seminars / PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.
5. **Activities on Group Discussion and Interview Skills** - Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS:

Phonetics

COURSE OUTCOMES:

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

- CO1: Accomplishment of sound vocabulary and its proper use contextually.
- CO2: Flair in Writing and felicity in written expression
- CO3: Enhanced job prospects.
- CO4: Effective Speaking Abilities.

REFERENCES:

1. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009
2. Advanced Communication Skills Laboratory Manual by Sudha Rani, D, Pearson Education 2011.
3. Technical Communication by Paul V. Anderson, 2007. Cengage Learning pvt. Ltd. New Delhi
4. English Vocabulary in Use series, Cambridge University Press 2008.
5. Management Shapers Series by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw Hill 2009.
7. Books on TOFEL/ GRE/ GMAT/ CAT/ IELTS by Barron's/ DELTA/ Cambridge University Press.

1701GEX53

WORKSHOP PRACTICE
(Common to all B.E. / B.Tech Degree Programmes)

L T P C
0 0 2 1

COURSE OBJECTIVES:

1. To provide hands on training for fabrication of components using sheet metal and welding equipment / tools.
2. To develop skill for using carpentry and fitting tools to make simple components and metal joints.
3. To provide hands on training for preparing the green sand mould using foundry tools.
4. To provide training for making simple house hold electrical & pipe line connections using suitable tools.
5. To develop the skill to make / operate/utilize the simple engineering components.

LIST OF EXPERIMENTS

1. Forming of simple object in sheet metal using suitable tools (Example: Dust Pan / Soap Box) (or) making simple object using Metal Spinning Machine. (Example: Aluminum Cup). **4 Hours**
2. Prepare V (or) Half round (or) Square (or) Dovetail joint from the given mild Steel flat. **4 Hours**
3. Fabrication of a simple component using thin and thick plates. (Example: Book rack) **2 Hours**
4. Making a simple component using carpentry power tools. (Example: Electrical switch Box/Tool box/ Letter box). **2 Hours**
5. Construct a household pipe line connections using pipes, Tee joint, Four way joint, elbow, union, bend, Gate way and Taps (or) Construct a pipe connections of house application centrifugal pump using pipes, bend, gate valve, flanges and foot valve. **4 Hours**
6. Prepare a green sand mould using solid pattern/split pattern. **4 Hours**
7. Study of gas welding equipment and its demonstration **2 Hours**
8. Soldering Practice for simple printed circuit board. **4 Hours**
9. Construct a domestic electrical wire connections using indicator, one way switch with calling bell, two way switch with lamp, one way switch with fan regulator and one way switch with socket. **4 Hours**

TOTAL: 30 HOURS

COURSE OBJECTIVES:

1. To develop an understanding of the standard techniques of Complex variable theory to apply in areas such as heat conduction, elasticity, fluid Dynamics and flow of electric current
2. To train the students with the concepts of Vector calculus needed for problems in all Engineering Disciplines
3. To make the Students apply Laplace Transform to create a new domain in which it is easier to handle the problem that is being investigated

UNIT I ANALYTIC FUNCTIONS**9 Hours**

Analytic functions – Cauchy Riemann Equations – Properties – Determination of Analytic function using Milne Thomson's method, Conformal Mappings – Mappings of $w = z + a$, az , $1/z$ – Bilinear Transformation – Application of Analytic Functions.

UNIT II COMPLEX INTEGRATION**9 Hours**

Cauchy's fundamental theorem (statement only) – Application of Cauchy's Integral formula – Laurent's series – Classification of singularities – Cauchy's Residue theorem (statement only) – Contour integration.

UNIT III MULTIPLE INTEGRAL**9 Hours**

Double integration – Cartesian and polar coordinates – Change the order of Integration – Applications: Area of a curved surface using double integral – Triple integration in Cartesian co-ordinates – Volume as triple integral.

UNIT IV VECTOR CALCULUS**9 Hours**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration: Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Applications of the above theorems to find surface area of a closed region and volume of cube and parallel piped.

UNIT V LAPLACE TRANSFORM**9 Hours**

Laplace Transform – Conditions for existence – Transform of Elementary Functions – Basic Properties – Transform of Unit step function and Impulse function – Transform of Periodic function – Inverse Laplace Transform – Convolution Theorem (excluding Proof) – Initial and Final value Theorems – Solution of Linear ODE of Second order with constant coefficient using Laplace Transform techniques.

TOTAL: 45 + 15 HOURS**FURTHER READING:**

1. Volume of Cylindrical and spherical polar co ordinates.
2. Application of Integral theorems in finding Volume/Area of Hemispheres, cylinders etc.

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

- CO1: Construct Analytic functions and trace the image of a region using transformation.
- CO2: Solve complex integrals.
- CO3: Apply multiple integral technique to find area and volume.
- CO4: Compute surface and volume integral in vector field.
- CO5: Apply Laplace Transform in solving Boundary value problems of second order ODE.

REFERENCES:

1. Veerarajan R., "Engineering Mathematics", updated second edition for Semester I and II, 2017.
2. Grewal. B.S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, Delhi, 2014.
3. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", Sixth edition, Laxmi Publications Pvt. Ltd., 2014.
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.
5. P.Kandasamy, K. Gunavathy and K. Thilagavathy, Engineering Mathematics, Volume II, S. Chand & Co., New Delhi, 2009.
6. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing, New Delhi, 2007.
7. Veerarajan R., "Engineering Mathematics", fifth Edition, Tata Mc Graw Hill Publishing Company, New Delhi, 2006.
8. M K Venkataraman, Engineering mathematics, Volume I, 2nd ed., National Publishing Co. 2003.
9. nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html
10. www.learnerstv.com/Free-maths-video lectures - ltv348-page1.htm

1701PH202

SEMICONDUCTOR PHYSICS AND DEVICES
(Common to B.E. - ECE & EEE Programmes)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To explain the properties of conducting, semiconducting and dielectric materials
2. To understand the working mechanism of junction diodes
3. To impart knowledge in optical and magnetic materials

UNIT I QUANTUM THEORY OF SOLIDS

9 Hours

Emission of electron: types of thermionic emission – principle – Richardson equation – secondary emission – principle – work function – Fermi-Dirac distribution function and its temperature dependence significance of Fermi energy – density of energy states – calculation of density of electrons and Fermi energy at 0K – average energy of electrons at 0K – Problem solving.

UNIT II SEMICONDUCTOR PHYSICS

9 Hours

Intrinsic semiconductors: the law of mass action – expression for density of electrons and holes – determine of carrier concentration – band gap energy. Extrinsic semiconductors: carrier concentration in p-type and n-type semiconductors. Hall Effect: theory – experimental determination of Hall voltage – applications – Problem solving.

UNIT III JUNCTION DIODE CHARACTERISTICS

9 Hours

Introduction – pn junction diode – volt-ampere characteristics – diode current equation – static and dynamic resistances – space charge – diffusion capacitance – junction diode switching times. Diode circuit with DC voltage source. Applications: full wave rectifier – capacitor filters – clamper circuits.

UNIT IV DIELECTRICS

9 Hours

Introduction: fundamental definitions in dielectrics – expressions for electronic and ionic polarizations – orientation polarization (qualitative) – space charge polarization – Langevin Debye equation – frequency and temperature effects on polarization – expression for internal field (cubic structure) – Clausius – Mosotti equation – dielectric loss-applications of dielectrics – problem solving.

UNIT V MAGNETIC MATERIALS

9 Hours

Magnetic materials: basic definitions – properties of Dia, Para and Ferro magnetic materials – explanation of hysteresis curve based on domain theory – hard and soft magnetic materials, Ferrites, Spinels – applications. Magnetic storage device: principle – working – giant magneto resistance.

TOTAL: 45 HOURS

FURTHER READING:

1. Motion of an electron in uniform and non-uniform magnetic fields-electric and magnetic fields in a crossed configuration.

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

- CO1: Identify different types of emission of electrons and significance of Fermi function
- CO2: Explore the carrier concentration and its variation with temperature of different semiconducting materials
- CO3: Analyze the I-V characteristics of a junction diode
- CO4: Investigate the various polarization mechanisms in dielectrics
- CO5: Select appropriate optical and magnetic materials for data storage devices

REFERENCES:

1. Jacob Millman, Christos C Halkias and Satyabrata Jit, “Electronic Devices and Circuits”, McGraw Hill Education (India) Private Limited, New Delhi, 2014.
2. Willam D.Callister, “Materials Science and Engineering an Introduction”, John Wiley and Sons, Inc., 2010.
3. Halliday and Resnick, “Fundamentals of Physics”, John Wiley and Sons, Inc., 2011.
4. R.S.Sedha, “A textbook of Applied Electronics”, S.Chand & Company Ltd., New Delhi, 2010.
5. S.O.Pillai, “Solid State Physics”, New Age International Publications, New Delhi, 2010.
6. M.N.Avadhanu and P.G.Kshirsagar, “A Text Book of Engineering Physics”, S.Chand & Company Ltd., New Delhi, 2011.

1701CH201

ENVIRONMENTAL STUDIES
(Common to all B.E. / B.Tech Degree Programmes)

L T P C
3 0 0 3

COURSE OBJECTIVES:

1. Realize the interdisciplinary and holistic nature of the environment.
2. Understand how natural resources and environment affect the quality of life and stimulate the quest for sustainable development.
3. Recognize the socio-economic, political and ethical issues in environmental science.

UNIT I ECOSYSTEMS AND BIODIVERSITY

10 Hours

Concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers - Oxygen cycle and Nitrogen cycle - energy flow in the ecosystem - ecological succession processes - Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Introduction to biodiversity definition: genetic, species and ecosystem diversity - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - hot - spots of biodiversity - threats to biodiversity: habitat loss, poaching of wildlife, man - wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Documentation of the medicinal plants in your native place.

UNIT II NATURAL RESOURCES

10 Hours

Forest resources: Use and over - exploitation, deforestation, case studies - timber extraction, mining, dams and their effects on forests and tribal people - Water resources: Use and overutilization of surface and ground water, dams-benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Energy Conversion processes - Biogas - production and uses, anaerobic digestion; case studies - 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. Documentation of the effect of modern Agriculture in your nearby Village.

UNIT III ENVIRONMENTAL POLLUTION 9 Hours

Definition - Source, causes, effects and control measures of: (a) Air pollution - Mitigation procedures - Control of particulate and gaseous emission, Control of SO_x, NO_x, CO and HC) - Technology for capturing CO₂ (metallo- organic frame works) (b) Water pollution - Waste water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes - (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards - role of an individual in prevention of pollution - pollution case studies. Documentation study of local polluted site - Urban / Rural / Industrial / Agricultural.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

8 Hours

From unsustainable to sustainable development - urban problems related to energy - water conservation, rain water harvesting, watershed management - environmental ethics: Issues and possible solutions - 12 Principles of green chemistry - consumerism and waste products - environment protection act - Air act - Water act - Wildlife protection act - Forest conservation act - The Biomedical Waste (Management and Handling) Rules; 1998 and amendments - scheme of labeling of environmentally friendly products (Ecomark) central and state pollution control boards - disaster management: floods, earthquake - Public awareness. Analyze the recent steps taken by government of India to prevent pollution (Green India and Clean India).

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

8 Hours

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS - women and child welfare - Environmental impact analysis (EIA) - GIS - remote sensing - role of information technology in environment and human health - Case studies. Documentation study of the Human health and the environment in nearby Hospital (Statistical report).

TOTAL: 45 HOURS

FURTHER READING:

Human rights: E - waste and biomedical waste - Identification of adulterants in food materials

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

CO1: Describe the importance of ecosystem and its conservation.

CO2: Differentiate various natural resources and the urgent need to conserve the natural resources.

CO3: Explain the different types of pollution and its effects.

CO4: Describe the various environmental protection acts.

CO5: Explain the major diseases, women, child development and the impacts of population explosion.

REFERENCES:

1. Trivedi. R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.
2. Cunningham, W.P.Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan. R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.
5. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
6. https://en.wikipedia.org/wiki/Carbon_capture_and_storage
7. Ravikrishnan. A., "Environmental Science and Engineering", Sri Krishna Hi-tech Publishing Company Pvt. Ltd.

1701GEX02

ENGINEERING GRAPHICS
(Common to all B.E. / B.Tech Degree Programmes)

L T P C
2 2 0 3

COURSE OBJECTIVES:

1. To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
2. To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)

2 Hours

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING

10 Hours

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, Scales: Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of Objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

10 Hours

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS

10 Hours

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

10 Hours

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

10 Hours

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only)

8 Hours

Basics commands of AutoCAD- two dimensional drawing, editing, layering and dimensioning - coordinate Systems-Drawing practice - orthographic views of simple solids using AutoCAD.

FURTHER READING:

Applications of engineering graphics in students' discipline

TOTAL: 60 HOURS

COURSE OUTCOMES:

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

- CO1: Perform free hand sketching of basic geometrical constructions and multiple views of objects.
- CO2: Do orthographic projection of lines and plane surfaces.
- CO3: Draw projections and solids and development of surfaces.
- CO4: Prepare isometric and perspective sections of simple solids.
- CO5: Demonstrate computer aided drafting.

REFERENCES:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore,2007.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 - 2001: Technical products Documentation - Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) - 2001: Technical products Documentation - Lettering.
3. IS 10714 (Part 20) - 2001 & SP 46 - 2003: Lines for technical drawings.
4. IS 11669 - 1986 & SP 46 - 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) - 2001: Technical drawings - Projection Methods.

SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.

1701GEX03

PROGRAMMING IN C
(Common to all B.E. / B.Tech Degree Programmes)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To prepare students to comprehend the fundamental concepts
2. To demonstrate fine grained operations in number system
3. To gain exposure in programming language using C
4. To develop programming skills using the fundamentals and basics of C Language

UNIT I BASIC CONCEPTS

8 Hours

Organization and Classifications of Computer- Generations of Computers- Number System- Problem Solving Techniques – Algorithm Design– Flowchart–Pseudocode

UNIT II INTRODUCTION TO C LANGUAGE

10 Hours

Overview of C - Constants, Variables and Data Types- Compilation and Linking - Operators and Expressions- Decision Making and Branching – Looping statements

UNIT III ARRAYS AND STRINGS

9 Hours

Arrays-One Dimensional Array- Declaration and Initialization-Two Dimensional Array-Declaration and Initialization- Programs using Arrays- Strings- String Handling Functions, Programs using Strings- Managing I/O Operations

UNIT IV FUNCTIONS & STRUCTURES

10 Hours

Functions-Function Prototypes-Declaring, Defining and Calling Functions-Call by value and Call by Reference-Recursive Functions-Structures- Declaration and Definition -Accessing Structure Members-Arrays of Structures-Unions- Programs using Structures and Unions

UNIT V POINTERS & FILES

8 Hours

Pointers-Dynamic Memory Allocation-Arithmetic Operations using Pointers, Files – File Manipulation-I/O Operations, Preprocessor Directives, Storage Classes

TOTAL: 45 HOURS

FURTHER READING:

Object Oriented Programming Approach.

COURSE OUTCOMES:

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

- CO1: Describe basic concepts of computers
- CO2: Paraphrase the operations of number system
- CO3: Describe about basic concepts of C-Language
- CO4: Understand the code reusability with the help of user defined functions
- CO5: Analyze the structure concept, union, file management and preprocessor in C language

REFERENCES:

1. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education India Private Limited; Seventh Edition, 2017.
2. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
3. Ashok N. Kamthane, "Programming in C", Pearson Education India, 3rd Edition, 2015.
4. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 15th Revised and Updated Edition, 2016.
5. <http://nptel.ac.in/>

1702EE201

ELECTRIC CIRCUIT ANALYSIS
(B.E – Electrical and Electronics Engineering)

L	T	P	C
3	2	0	4

COURSE OBJECTIVES:

1. To know about the basics of electric circuits
2. To impart knowledge on solving circuits using network theorems
3. To introduce the phenomenon of resonance and coupled circuits
4. To determine the transient response of circuits
5. To analyze three phase circuits

UNIT I DC CIRCUITS **9 Hours**

Review - Loop and Nodal methods for DC circuits; Theorems - Thevenin's, Norton's, Superposition, Reciprocity, Maximum power transfer theorem, etc.,

UNIT II AC CIRCUITS **9 Hours**

Review - Loop and Nodal methods for AC circuits; Theorems - Thevenin's, Norton's, Superposition, Reciprocity, Maximum power transfer theorem, etc.,

UNIT III THREE PHASE CIRCUITS AND NETWORK TOPOLOGY **9 Hours**

Three phase circuits: Three phase balanced/unbalanced voltage sources; analysis of three phase 3-wire and 4-wire circuits with star and delta connected, balanced and unbalanced loads.

Network topology: Graph, directed graph, branch, chord, tree for two port networks; incidence and reduced incidence matrices; applications to network solutions; link current and tie set; tree branch voltage and cut set; duality and dual networks.

UNIT IV TRANSIENT ANALYSIS AND TWO PORT NETWORKS **9 Hours**

Transient response of RL, RC and RLC circuits to DC and AC excitation; Natural and forced oscillations; Laplace transform application to transient solution; Two port networks - Z, Y and H parameters.

UNIT V RESONANCE AND COUPLED CIRCUITS **9 Hours**

Resonant circuits - Series, parallel, series-parallel circuits; effect of variation of Q on resonance; Relations between circuit parameters - Q, resonant frequency and bandwidth.

Coupled circuits - Self and mutual inductance, coefficient of coupling, dot convention; analysis of simple coupled circuits, inductively coupled circuits; single tuned and double tuned circuits.

TOTAL: 45 + 15 HOURS

FURTHER READING:

1. Practical applications of network theorems
2. Applications of coupled circuits and tank circuits

COURSE OUTCOMES:

On the Successful completion of the course, Students will be able to

- CO1: Explain the basic laws, theorems and concepts of DC / AC (1 phase and 3 phase) circuits, Resonant and coupled circuits.
- CO2: Solve the problems in network topology and to identify the dual of the network.
- CO3: Solve the problems in resonance circuits, coupled circuits and two port networks.
- CO4: Analyze the transient behavior of first and second order circuits using Laplace transforms.
- CO5: Apply Ohms law, Kirchhoff's laws, mesh & nodal methods and network theorems to solve circuit problems.
- CO6: Analyze three phase 3 wire/ 4wire balanced/ unbalanced star/delta connected loads.

REFERENCES:

1. A. Sudhakar and S.P. Shyammohan, "Circuits and Networks: Analysis and Synthesis", TMH, 4th Edition, 2010.
2. M.Nahvi and Joseph A.Edminister, "Electric Circuits", Schaum's Outline series, Tata McGraw Hill, New Delhi, 6th Edition, 2014.
3. James W. Nilsson and Susan Riedel, "Electric Circuits", Pearson, 10th Global Edition, 2014.
4. William H. Hayt, Jack Kemmerly, and Steven M. Durbin, "Engineering circuit analysis", Tata McGrawHill, 8th Edition, 2013.
5. Charles. K .Alexander and Mathew N.O.Sadiku, "Fundamental of Electric Circuits", TMH, 5th Edition, New Delhi, 2013.
6. S.N.Sivanandam, "Electric Circuit Analysis", Vikas Publishing House Pvt. Ltd., New Delhi, 2nd Edition, 2008.
7. T.S.KV. IYER, "Theory and Problems in Circuit Analysis", Tata McGraw Hill, 2nd Edition, 2010.
8. A. Chakrabarti, "Circuits Theory: Analysis and Synthesis", Dhanpat Rai & Co., New Delhi, 2014.

1701GEX51

PROGRAMMING IN C LABORATORY
(Common to all B.E. / B.Tech. Degree Programmes)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. To prepare students to comprehend the fundamental concepts.
2. To demonstrate fine grained operations in number system.
3. To gain exposure in programming language using C.
4. To develop programming skills using the fundamentals and basics of C Language.

LIST OF EXPERIMENTS:

1. Working with word and style sheets.
2. Write a C program to implement basic concepts.
3. Write a C program to implement Decision Making and Branching statements.
4. Write a C program to implement looping statements.
5. Write a C program to implement Arrays.
6. Write a C program to implement Strings.
7. Write a C program to implement pointers.
8. Write a C program to implement Structures.
9. Write a C program to work with files in C. **TOTAL: 30 HOURS ADDITIONAL EXPERIMENTS:**
 1. Write a c program to remove the occurrence of "the" word from entered string.
 2. Create two files test1.txt and test2.txt and write a C program to read the file test1.txt character by character on the screen and paste it at the end of test2.txt

COURSE OUTCOMES:

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

CO1: Understand basic concepts of computers.

CO2: Implement basic concepts of c-language.

CO3: Implement arrays, strings and pointers.

CO4: Implement the basics of structures, unions, file management and preprocessor in C language.

REFERENCES:

1. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education India Private Limited; Seventh Edition, 2017.
2. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
3. Ashok N. Kamthane, "Programming in C", Pearson Education India, 3rd Edition, 2015.
4. Yashavant P. Kanetkar, "Let Us C", BPB Publications, 15th Revised and Updated Edition, 2016.
5. <http://nptel.ac.in/>

1701HS251

PHYSICS AND CHEMISTRY LABORATORY-II
(Common to all B.E. / B.Tech Degree Programmes)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills.
3. To bring confidence and ability to develop and fabricate engineering and technical equipments.
4. To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of hardness, alkalinity, metal ion content, corrosion in metals and cement analysis.

PHYSICS

LIST OF EXPERIMENTS:

1. Using lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.
2. Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the given semiconductor.
3. With the aid of spectrometer, find the angle of Prism and refractive index of the medium.
4. Determine the wavelengths of polychromatic source in the visible region using spectrometer grating.
5. Find the depression at the midpoint of the given wooden beam subjected to non-uniform bending and determines the Young's modulus of the material of the beam.
6. Find the given unknown resistance using Carey-Foster's Bridge.

CHEMISTRY

LIST OF EXPERIMENTS:

1. Conductometric Precipitation titration of BaCl_2 Vs Na_2SO_4
2. Estimation of dissolved oxygen in a water sample/sewage by Winklers method.
3. Estimation of chloride content in water by argentometric method.
4. Conductometric titration of mixture of acids.
5. Comparison of alkalinities of the given water samples.

ADDITIONAL EXPERIMENTS:

1. Estimation of heavy metals in the given solution by EDTA method.
2. Determination of concentration of unknown colored solution using spectrophotometer.

TOTAL: 30 HOURS

COURSE OUTCOMES:

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

- CO1 : Realize the concept of properties of matter and apply the same for practical applications.
- CO2 : Identify the suitable laser source for fiber optic communication applications.
- CO3 : Determine the velocity of ultrasonic waves and apply the same for day today applications.
- CO4 : Classify the different types of crystal structures and analyze their properties.
- CO5 : Comprehend the efficacy of quantum equations in modern areas.
- CO6 : Illustrate the EMF of the Redox reaction.
- CO7 : Compare the Alkalinity of given water Sample with their standards.
- CO8 : Identify the Concentration of metal ion present in water sample.
- CO9 : Outline the precipitation titration using Conductivity meter.
- CO10: Interpret the dissolved oxygen present in the water.

REFERENCES:

1. D.S.Mathur, Elements of Properties of matter, 5th edition, S.Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012.
3. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, Concepts of Modern Physics, 6th edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2010.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi, 2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd, 2013.
7. Laboratory Manual on Engineering Chemistry, S.K. Bhasin, S. Rani, Dhanpat Rai Publishing Company, New Delhi, 2011.

UNIT V VHDL**9**

RTL Design - combinational logic - Sequential circuit - Operators - Introduction to Packages - Subprograms - Test bench. (Simulation /Tutorial Examples: adders, counters, flipflops, FSM, Multiplexers /Demultiplexers).

TOTAL (L:45+T:15): 60 PERIODS**OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Raj Kamal, ' Digital systems-Principles and Design', Pearson Education 2nd edition, 2007.
2. M. Morris Mano, 'Digital Design with an introduction to the VHDL', Pearson Education, 2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES:

1. Mandal "Digital Electronics Principles & Application, McGraw Hill Edu,2013.
2. William Keitz, Digital Electronics-A Practical Approach with VHDL,Pearson,2013.
3. Floyd and Jain, 'Digital Fundamentals', 8th edition, Pearson Education, 2003.
4. Anand Kumar, Fundamentals of Digital Circuits,PHI,2013.
5. Charles H.Roth,Jr,Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2013.
6. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 2002.
7. Gaganpreet Kaur, VHDL Basics to Programming, Pearson, 2013.
8. Botros, HDL Programming Fundamental, VHDL& Verilog, Cengage, 2013.

EE6302**ELECTROMAGNETIC THEORY****L T P C
3 1 0 4****OBJECTIVES:**

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of electrostatics, electrical potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations
- To impart knowledge on the concepts of Concepts of electromagnetic waves and Pointing vector.

UNIT I ELECTROSTATICS - I**9**

Sources and effects of electromagnetic fields - Coordinate Systems - Vector fields -Gradient, Divergence, Curl - theorems and applications - Coulomb's Law - Electric field intensity - Field due to discrete and continuous charges - Gauss's law and applications.

OBJECTIVES:

To the study of nature and the facts about environment.

- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY****12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment - concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle - energy flow in the ecosystem - ecological succession processes - Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Introduction to biodiversity definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels - India as a mega-diversity nation - hot-spots of biodiversity - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds
Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT II**ENVIRONMENTAL POLLUTION****10**

Definition - causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO₂, NO_x, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters - physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes - (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards-role of an individual in prevention of pollution - pollution case studies -
Field study of local polluted site - Urban / Rural / Industrial / Agricultural.

UNIT III**NATURAL RESOURCES****10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people - Water resources: Use and overutilization of surface and ground water, dams-benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes - Biogas - production and uses, anaerobic digestion; case studies - 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. Introduction to Environmental Biochemistry: Proteins -Biochemical

degradation of pollutants, Bioconversion of pollutants.

Field study of local area to document environmental assets - river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

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 - role of non-governmental organization- environmental ethics: Issues and possible solutions - 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. - wasteland reclamation - consumerism and waste products - environment production act - Air act - Water act - Wildlife protection act - Forest conservation act - The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides.

Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS - women and child welfare -Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health - Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.

OBJECTIVES:

The student should be made to:

- Be familiar with the structure of basic electronic devices.
- Be exposed to the operation and applications of electronic devices.

UNIT I PN JUNCTION DEVICES

9

PN junction diode -structure, operation and V-I characteristics, diffusion and transient capacitance - Rectifiers - Half Wave and Full Wave Rectifier,- Display devices- LED, Laser diodes- Zener diode- characteristics-Zener Reverse characteristics - Zener as regulator

UNIT II TRANSISTORS

9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS

9

BJT small signal model - Analysis of CE, CB, CC amplifiers- Gain and frequency response - MOSFET small signal model- Analysis of CS and Source follower - Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER

9

BIMOS cascade amplifier, Differential amplifier - Common mode and Difference mode analysis - FET input stages - Single tuned amplifiers - Gain and frequency response - Neutralization methods, power amplifiers -Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS

9

Advantages of negative feedback - voltage / current, series , Shunt feedback -positive feedback - Condition for oscillations, phase shift - Wien bridge, Hartley, Colpitts and Crystal oscillators.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- To explain the structure of the basic electronic devices.
- To design applications using the basic electronic devices.

TEXT BOOKS:

1. David A. Bell ,”Electronic Devices and Circuits”, Prentice Hall of India, 2004.
2. Sedra and smith, “Microelectronic Circuits “ Oxford University Press, 2004.

REFERENCES:

1. Rashid, “Micro Electronic Circuits” Thomson publications, 1999.
2. Floyd, “Electron Devices” Pearson Asia 5th Edition, 2001.
3. Donald A Neamen, “Electronic Circuit Analysis and Design” Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L.Boylestad, “Electronic Devices and Circuit theory”, 2002.
5. Robert B. Northrop, “Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation”, CRC Press, 2004.

OBJECTIVES:

- To study the IC fabrication procedure.
- To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.
- To study the applications of Op-amp.
- To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance and FETs.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics,, differential amplifier; frequency response of OP-AMP; Basic applications of op-amp - Inverting and Non-inverting Amplifiers-V/I & I/V converters ,summer, differentiator and integrator.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier, Log and Antilog Amplifiers, first and second order active filters, , comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using opamps.

UNIT IV SPECIAL ICs 9

Functional block, characteristics & application circuits with 555 Timer Ic-566 voltage controlled oscillator Ic; 565-phase lock loop Ic ,Analog multiplier ICs.

UNIT V APPLICATION ICs 9

IC voltage regulators -LM78XX,79XX Fixed voltage regulators - LM317, 723 Variable voltage regulators, switching regulator- SMPS- LM 380 power amplifier- ICL 8038 function generator IC.

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. David A.Bell, 'Op-amp & Linear ICs', Oxford, 2013.
2. D.Roy Choudhary, Sheil B.Jani, 'Linear Integrated Circuits', II edition, New Age, 2003.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, 2003 / PHI. 2000.

REFERENCES:

1. Fiore,"Opamps & Linear Integrated Circuits Concepts & Applications",Cengage,2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system',Tata McGraw Hill, 2003.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', PHI Learning, 6th edition,2012.

OBJECTIVES:

To enable the students to understand the behavior of semiconductor device based on experimentation

LIST OF EXPERIMENTS:

1. Characteristics of Semi conductor diode and Zener diode
2. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET(Draw the equivalent circuit)
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and Frequency response characteristics of a Common Emitter amplifier
7. Characteristics of photo diode & photo transistor, Study of light activated relay circuit
8. Design and testing of RC phase shift, LC oscillators
9. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
10. Differential amplifiers using FET
11. Study of CRO for frequency and phase measurements
12. Astable and Monostable multivibrators
13. Realization of passive filters

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor
2. Resistors, Capacitors and inductors
3. Necessary digital IC 8
4. Function Generators 10
5. Regulated 3 output Power Supply 5, \pm 15V 10
6. CRO 10
7. Storage Oscilloscope 1
8. Bread boards 10
9. Atleast one demo module each for the listed equipments.
10. Component data sheets to be provided

OBJECTIVES:

Working Practice in simulators / CAD Tools / Experiment test bench to learn design, testing and characterizing of circuit behaviour with digital and analog ICs.

LIST OF EXPERIMENTS:

1. Implementation of Boolean Functions, Adder/ Subtractor circuits.
2. Code converters: Excess-3 to BCD and Binary to Gray code converter and vice-versa
3. Parity generator and parity checking
4. Encoders and Decoders
5. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC's and specific counter IC.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC's.
7. Study of multiplexer and demultiplexer
8. Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
9. Application of Op-Amp: inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator.
10. Study of VCO and PLL ICs:
 - i. Voltage to frequency characteristics of NE/ SE 566 IC.
 - ii. Frequency multiplication using NE/SE 565 PLL IC.

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**(3 per Batch)**

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variable Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog)	2	
6	Bread board	10	
7	Computer (PSPICE installed)	1	

Consumables (Minimum of 25 Nos. each)			
1	IC 741/ IC NE555/566/565	25	
2	Digital IC types	25	
3	LED	25	
4	LM317	25	
5	LM723	25	
6	ICSG3524 / SG3525	25	
7	Transistor - 2N3391	25	
8	Diodes,	25	IN4001,BY126
9	Zener diodes	25	
10	Potentiometer		
11	Step-down transformer	1	230V/12-0-12V
12	Capacitor		
13	Resistors 1/4 Watt Assorted	25	
14	Single Strand Wire		

MA6459

NUMERICAL METHODS

L T P C
3 1 0 4

OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 10+3

Solution of algebraic and transcendental equations - Fixed point iteration method - Newton Raphson method- Solution of linear system of equations - Gauss elimination method - Pivoting - Gauss Jordan method - Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION 8+3

Interpolation with unequal intervals - Lagrange's interpolation - Newton's divided difference interpolation - Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule - Romberg's method - Two point and three point Gaussian quadrature formulae - Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

9+3

Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bashforth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

9+3

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain - One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods - One dimensional wave equation by explicit method.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields.

TEXT BOOKS:

1. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.

REFERENCES:

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.
2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, 3rd Edition, New Delhi, 2007.

EE6401

ELECTRICAL MACHINES – I

L T P C

3 1 0 4

OBJECTIVES:

- To introduce techniques of magnetic-circuit analysis and introduce magnetic materials
- To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
- To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
- To study the working principles of DC machines as Generator types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
- To estimate the various losses taking place in D.C. Motor and to study the different testing methods to arrive at their performance.

UNIT I MAGNETIC CIRCUITS AND MAGNETIC MATERIALS 9

Magnetic circuits -Laws governing magnetic circuits - Flux linkage, Inductance and energy - Statically and Dynamically induced EMF - Torque – Properties of magnetic materials, Hysteresis and Eddy Current losses - AC excitation, introduction to permanent magnets-Transformer as a magnetically coupled circuit.

UNIT II TRANSFORMERS 9

Construction - principle of operation - equivalent circuit parameters - phasor diagrams, losses - testing - efficiency and voltage regulation-all day efficiency-Sumpner's test, per unit representation - inrush current - three phase transformers-connections - Scott Connection - Phasing of transformer-parallel operation of three phase transformers-auto transformer - tap changing transformers- tertiary winding.

UNIT III ELECTROMECHANICAL ENERGY CONVERSION AND CONCEPTS IN ROTATING MACHINES 9

Energy in magnetic system - Field energy and coenergy-force and torque equations - singly and multiply excited magnetic field systems-mmf of distributed windings - Winding Inductances-, magnetic fields in rotating machines - rotating mmf waves - magnetic saturation and leakage fluxes.

UNIT IV DC GENERATORS 9

Construction and components of DC Machine - Principle of operation - Lap and wave windings-EMF equations- circuit model – armature reaction -methods of excitation-commutation and interpoles - compensating winding -characteristics of DC generators.

UNIT V DC MOTORS 9

Principle and operations - types of DC Motors - Speed Torque Characteristics of DC Motors-starting and speed control of DC motors -Plugging, dynamic and regenerative braking- testing and efficiency - Retardation test- Swinburne's test and Hopkinson's test - Permanent magnet dc motors(PMDC)-DC Motor applications.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. Nagrath I. J and Kothari D. P. 'Electric Machines', Fourth Edition, Tata McGraw Hill Publishing Company Ltd, 2010.
2. M.N.Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2009.
3. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, Tata McGraw Hill Books Company, 2003.

REFERENCES:

1. P. C. Sen., 'Principles of Electrical Machines and Power Electronics', John Wiley & Sons, 1997.
2. Syed A. Nasar, Electric Machines and Power Systems: Volume I, Mcgraw-Hill College; International Edition, January 1995.
3. Deshpande M. V., "Electrical Machines" PHI Learning Pvt. Ltd., New Delhi, 2011.
4. P.S. Bimbhra, 'Electrical Machinery', Khanna Publishers, 2003.
5. S.Sarma & K.Pathak "Electric Machines", Cengage Learning India (P) Ltd., Delhi, 2011.

OBJECTIVES:

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++.

UNIT I	OVERVIEW	9
Why Object-Oriented Programming in C++ - Native Types and Statements -Functions and Pointers-Implementing ADTs in the Base Language.		
UNIT II	BASIC CHARACTERISTICS OF OOP	9
Data Hiding and Member Functions- Object Creation and Destruction- Polymorphism data abstraction: Iterators and Containers.		
UNIT III	ADVANCED PROGRAMMING	9
Templates, Generic Programming, and STL-Inheritance-Exceptions-OOP Using C++.		
UNIT IV	OVERVIEW OF JAVA	9
Data types, variables and arrays, operators, control statements, classes, objects, methods – Inheritance		
UNIT V	EXCEPTION HANDLING	9
Packages and Interfaces, Exception handling, Multithreaded programming, Strings, Input/Output		

TOTAL : 45 PERIODS**OUTCOMES:**

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.

TEXT BOOKS:

1. Ira Pohl, "Object-Oriented Programming Using C++", Pearson Education Asia, 2003.
2. H.M.Deitel, P.J.Deitel, "Java : how to program", Fifth edition, Prentice Hall of India private limited, 2003.

REFERENCES:

1. Herbert Schildt, "The Java 2: Complete Reference", Fourth edition, TMH, 2002
2. Bjarne Stroustrup, "The C++ Programming Language", Pearson Education, 2004.
3. Stanley B. Lippman and Josee Lajoie , "C++ Primer", Pearson Education, 2003.
4. K.R.Venugopal, Rajkumar Buyya, T.Ravishankar, "Mastering C++", TMH, 2003.

REFERENCES:

1. B.R.Gupta, , S.Chand, 'Power System Analysis and Design'New Delhi, Fifth Edition, 2008.
2. Luces M.Fualken berry ,Walter Coffe, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3. Hadi Saadat, 'Power System Analysis,' PSA Publishing; Third Edition, 2010.
4. J.Brian, Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2012.
5. G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.

EE6403

DISCRETE TIME SYSTEMS AND SIGNAL PROCESSING

L T P C
3 0 0 3

OBJECTIVES:

- To classify signals and systems & their mathematical representation.
- To analyse the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

UNIT I

INTRODUCTION

9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect.

UNIT II

DISCRETE TIME SYSTEM ANALYSIS

9

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform,application to discrete systems - Stability analysis, frequency response - Convolution - Discrete TimeFourier transform , magnitude and phase representation.

UNIT III

DISCRETE FOURIER TRANSFORM & COMPUTATION

9

Discrete Fourier Transform- properties, magnitude and phase representation - Computation of DFT using FFT algorithm - DIT &DIF using radix 2 FFT - Butterfly structure.

UNIT IV

DESIGN OF DIGITAL FILTERS

9

FIR & IIR filter realization - Parallel & cascade forms. FIR design: Windowing Techniques - Need and choice of windows - Linear phase characteristics. Analog filter design - Butterworth and Chebyshev approximations; IIR Filters, digital design using impulse invariant and bilinear transformation - mWarping, pre warping.

UNIT V

DIGITAL SIGNAL PROCESSORS

9

Introduction - Architecture - Features - Addressing Formats - Functional modes - Introduction to Commercial DSProcessors.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.
2. S.K. Mitra, 'Digital Signal Processing - A Computer Based Approach', McGraw Hill Edu, 2013.
3. Robert Schilling & Sandra L.Harris, 'Introduction to Digital Signal Processing using Matlab', Cengage Learning,2014.

REFERENCES:

1. Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.
2. B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010
3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4. Sen M.kuo, woonseng...s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5. Dimitris G.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012
6. Lonnie C.Ludeman , "Fundamentals of Digital Signal Processing",Wiley,2013

EE6404

MEASUREMENTS AND INSTRUMENTATION

L T P C
3 0 0 3

OBJECTIVES:

- To introduce the basic functional elements of instrumentation
- To introduce the fundamentals of electrical and electronic instruments
- To educate on the comparison between various measurement techniques
- To introduce various storage and display devices
- To introduce various transducers and the data acquisition systems

UNIT I INTRODUCTION

9

Functional elements of an instrument - Static and dynamic characteristics - Errors in measurement - Statistical evaluation of measurement data - Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS

9

Principle and types of analog and digital voltmeters, ammeters, multimeters - Single and three phase wattmeters and energy meters - Magnetic measurements - Determination of B-H curve and measurements of iron loss - Instrument transformers - Instruments for measurement of frequency and phase.

UNIT III COMPARISON METHODS OF MEASUREMENTS

9

D.C & A.C potentiometers, D.C & A.C bridges, transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic interference – Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape - Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & dot matrix display – Data Loggers.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive transducers - Piezoelectric, Hall effect, optical and digital transducers - Elements of data acquisition system – A/D, D/A converters – Smart sensors.

TOTAL :45 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2003.
3. Doebelin E.O. and Manik D.N., Measurement Systems - Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2007.

REFERENCES:

1. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw Hill, II Edition 2004.
2. D.V.S. Moorthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2007.
3. A.J. Bouwens, 'Digital Instrumentation', Tata McGraw Hill, 1997.
4. Martin Reissland, 'Electrical Measurements', New Age International (P) Ltd., Delhi, 2001.
5. Alan. S. Morris, Principles of Measurements and Instrumentation, 2nd Edition, Prentice Hall of India, 2003.

CS6461 OBJECT ORIENTED PROGRAMMING LABORATORY

**L T P C
0 0 3 2**

OBJECTIVES:

- To get a clear understanding of object-oriented concepts.
- To understand object oriented programming through C++ & JAVA.

LIST OF EXPERIMENTS:

C++:

1. program using functions
 - functions with default arguments
 - implementation of call by value, address, reference
2. simple classes for understanding objects, member functions & constructors
 - classes with primitive data members,
 - classes with arrays as data members
 - classes with pointers as data members
 - classes with constant data members
 - classes with static member functions
3. compile time polymorphism
 - operator overloading

- function overloading
- 4. run time polymorphism
 - inheritance
 - virtual functions
 - virtual base classes
 - templates
- 5. file handling
 - sequential access
 - random access

JAVA:

- 6. simple java applications
 - for understanding references to an instant of a class
 - handling strings in JAVA
- 7. simple package creation
 - developing user defined packages in java
- 8. interfaces
 - developing user defined interfaces
 - use predefined interfaces
- 9. threading
 - creation of threading in java applications
 - multi threading
- 10. exception handling mechanism in java
 - handling predefined exceptions
 - handling user defined exceptions

TOTAL :45 PERIODS

OUTCOMES:

- Gain the basic knowledge on Object Oriented concepts.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of object oriented programming to solve real world problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C++ compiler 30 Nos.

(or)

Server with C++ compiler supporting 30 terminals or more.

OBJECTIVES :

To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

LIST OF EXPERIMENTS:

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt and compound motor.
4. Load test on DC series motor.
5. Swinburne's test and speed control of DC shunt motor.
6. Hopkinson's test on DC motor - generator set.
7. Load test on single-phase transformer and three phase transformers.
8. Open circuit and short circuit tests on single phase transformer.
9. Polarity Test and Sumpner's test on single phase transformers.
10. Separation of no-load losses in single phase transformer.
11. Study of starters and 3-phase transformers connections

TOTAL: 45 PERIODS**OUTCOMES:**

- Ability to model and analyze electrical apparatus and their application to power system

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement - 3 nos
2. DC Shunt Motor Coupled With Three phase Alternator - 1 No.
3. Single Phase Transformer - 4 nos
4. DC Series Motor with Loading Arrangement - 1 No.
5. DC compound Motor with Loading Arrangement - 1 No.
6. Three Phase Induction Motor with Loading Arrangement - 2 nos
7. Single Phase Induction Motor with Loading Arrangement - 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator - 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor - 1 No.
10. Tachometer -Digital/Analog - 8 nos
11. Single Phase Auto Transformer - 2 nos
12. Three Phase Auto Transformer - 1 No.
13. Single Phase Resistive Loading Bank - 2 nos
14. Three Phase Resistive Loading Bank. - 2 nos
15. SPST switch - 2 nos

OBJECTIVES:

- To model the power system under steady state operating condition.
- To apply numerical methods to solve the power flow problem.
- To model and analyze the system under faulted conditions.
- To model and analyze the transient behaviour of power system when it is subjected to a fault.

UNIT I INTRODUCTION 9

Need for system planning and operational studies - basic components of a power system.-Introduction to restructuring - Single line diagram – per phase and per unit analysis – Generator - transformer – transmission line and load representation for different power system studies.- Primitive network - construction of Y-bus using inspection and singular transformation methods - z-bus.

UNIT II POWER FLOW ANALYSIS 9

Importance of power flow analysis in planning and operation of power systems - statement of power flow problem - classification of buses - development of power flow model in complex variables form - iterative solution using Gauss-Seidel method - Q-limit check for voltage controlled buses – power flow model in polar form - iterative solution using Newton-Raphson method .

UNIT III FAULT ANALYSIS – BALANCED FAULTS 9

Importance of short circuit analysis - assumptions in fault analysis - analysis using Thevenin's theorem - Z-bus building algorithm - fault analysis using Z-bus – computations of short circuit capacity, post fault voltage and currents.

UNIT IV FAULT ANALYSIS – UNBALANCED FAULTS 9

Introduction to symmetrical components - sequence impedances - sequence circuits of synchronous machine, transformer and transmission lines - sequence networks analysis of single line to ground, line to line and double line to ground faults using Thevenin's theorem and Z-bus matrix.

UNIT V STABILITY ANALYSIS 9

Importance of stability analysis in power system planning and operation - classification of power system stability - angle and voltage stability – Single Machine Infinite Bus (SMIB) system: Development of swing equation - equal area criterion - determination of critical clearing angle and time - solution of swing equation by modified Euler method and Runge-Kutta fourth order method.

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. John J. Grainger and W.D. Stevenson Jr., 'Power System Analysis', Tata McGraw-Hill, Sixth reprint, 2010.
3. P. Venkatesh, B.V. Manikandan, S. Charles Raja, A. Srinivasan, 'Electrical Power Systems- Analysis, Security and Deregulation', PHI Learning Private Limited, New Delhi, 2012.

REFERENCES:

1. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

TEXT BOOKS:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi , 2007.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051,McGraw Hill Edu,2013.

REFERENCES:

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford,2013.
3. Valder - Perez, "Microcontroller - Fundamentals and Applications with Pic," Yeesdee Publishers, Tayler & Francis, 2013.

ME6701

POWER PLANT ENGINEERING

L T P C
3 0 0 3

OBJECTIVES:

- Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I **COAL BASED THERMAL POWER PLANTS** 10

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II **DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS** 10

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III **NUCLEAR POWER PLANTS** 7

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor* (BWR), *Pressurized Water Reactor* (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV **POWER FROM RENEWABLE ENERGY** 10

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar Photo Voltaic* (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V **ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS** 8

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

OUTCOMES:

- Upon completion of this course, the Students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
- Analyse and solve energy and economic related issues in power sectors.

TEXT BOOK:

1. P.K. Nag, Power Plant Engineering, Tata McGraw - Hill Publishing Company Ltd., Third Edition, 2008.

REFERENCES:

1. M.M. El-Wakil, Power Plant Technology, Tata McGraw - Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, Power Plant Engineering, 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, Standard Handbook of Power Plant Engineering, Second Edition, McGraw - Hill, 1998.
4. Godfrey Boyle, Renewable energy, Open University, Oxford University Press in association with the Open University, 2004.

EE6503

POWER ELECTRONICS

L T P C
3 0 0 3

OBJECTIVES:

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

UNIT I POWER SEMI-CONDUCTOR DEVICES

9

Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

UNIT II PHASE-CONTROLLED CONVERTERS

9

2-pulse, 3-pulse and 6-pulse converters- performance parameters -Effect of source inductance- Gate Circuit Schemes for Phase Control-Dual converters.

UNIT III DC TO DC CONVERTER

9

Step-down and step-up chopper-control strategy-Forced commutated chopper-Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck- boost converter, Introduction to Resonant Converters.

UNIT IV INVERTERS **9**
Single phase and three phase voltage source inverters(both 120° mode and 180° mode)-Voltage & harmonic control--PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM - Introduction to space vector modulation -Current source inverter.

UNIT V AC TO AC CONVERTERS **9**
Single phase and Three phase AC voltage controllers-Control strategy- Power Factor Control - Multistage sequence control -single phase and three phase cyclo converters -Introduction to Matrix converters.

TOTAL:45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI Third Edition, New Delhi, 2004.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition, 2003.
3. L. Umanand, " Power Electronics Essentials and Applications", Wiley, 2010.

REFERENCES:

1. Joseph Vithayathil, ' Power Electronics, Principles and Applications', McGraw Hill Series, 6th Reprint, 2013.
2. Ashfaq Ahmed Power Electronics for Technology Pearson Education, Indian reprint, 2003.
3. Philip T. Krein, "Elements of Power Electronics" Oxford University Press, 2004 Edition.
4. Ned Mohan, Tore. M. Undel and, William. P. Robbins, ' Power Electronics: Converters, Applications and Design', John Wiley and sons, third edition,2003.
5. Daniel.W.Hart, "Power Electronics", Indian Edition, Mc Graw Hill, 3rd Print, 2013.
6. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 2013.

EE6504

ELECTRICAL MACHINES – II

L T P C
3 1 0 4

OBJECTIVES:

- To impart knowledge on Construction and performance of salient and non – salient type synchronous generators.
- To impart knowledge on Principle of operation and performance of synchronous motor.
- To impart knowledge on Construction, principle of operation and performance of induction machines.
- To impart knowledge on Starting and speed control of three-phase induction motors.
- To impart knowledge on Construction, principle of operation and performance of single phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR **9**
Constructional details - Types of rotors -winding factors- emf equation - Synchronous reactance - Armature reaction - Phasor diagrams of non salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation - Synchronizing torque -Change of excitation and

5. S.N.Sivanandam, S.N.Deepa, Control System Engineering using Mat Lab, 2nd Edition, Vikas Publishing, 2012.
6. S.Palani, Anoop. K.Jairath, Automatic Control Systems including Mat Lab, Vijay Nicole/ Mcgraw Hill Education, 2013.

EE6511

CONTROL AND INSTRUMENTATION LABORATORY

**LT P C
0 0 3 2**

OBJECTIVES:

To provide knowledge on analysis and design of control system along with basics of instrumentation

LIST OF EXPERIMENTS:

CONTROLSYSTEMS:

1. P, PI and PID controllers
2. Stability Analysis
3. Modeling of Systems - Machines, Sensors and Transducers
4. Design of Lag, Lead and Lag-Lead Compensators
5. Position Control Systems
6. Synchro-Transmitter- Receiver and Characteristics
7. Simulation of Control Systems by Mathematical development tools.

INSTRUMENTATION:

8. Bridge Networks -AC and DC Bridges
9. Dynamics of Sensors/Transducers a.
 - Temperature
 - b. Pressure
 - c. Displacement
 - d. Optical
 - e. Strain f. Flow
10. Power and Energy Measurement
11. Signal Conditioning
 - a. Instrumentation Amplifier
 - b. Analog - Digital and Digital -Analog converters (ADC and DACs)
12. Process Simulation.

TOTAL : 45 PERIODS

OBJECTIVES:

To enable learners to,

- Develop their communicative competence in English with specific reference to speaking and listening
- Enhance their ability to communicate effectively in interviews.
- Strengthen their prospects of success in competitive examinations.

UNIT I LISTENING AND SPEAKING SKILLS 12

Conversational skills (formal and informal)- group discussion- making effective presentations using computers, listening/watching interviews conversations, documentaries. Listening to lectures, discussions from TV/ Radio/ Podcast.

UNIT II READING AND WRITING SKILLS 12

Reading different genres of texts ranging from newspapers to creative writing. Writing job applications- cover letter- resume- emails- letters- memos- reports. Writing abstracts- summaries- interpreting visual texts.

UNIT III ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS AND PLACEMENTS 12

International English Language Testing System (IELTS) - Test of English as a Foreign Language (TOEFL) - Civil Service(Language related)- Verbal Ability.

UNIT IV INTERVIEW SKILLS 12

Different types of Interview format- answering questions- offering information- mock interviews-body language(paralinguistic features)- articulation of sounds- intonation.

UNIT V SOFT SKILLS 12

Motivation- emotional intelligence-Multiple intelligences- emotional intelligence- managing changes-time management-stress management-leadership traits-team work- career planning - intercultural communication- creative and critical thinking

TOTAL: 60 PERIODS

Teaching Methods:

1. To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
2. Suitable audio/video samples from Podcast/YouTube to be used for illustrative purposes.
3. Portfolio approach for writing to be followed. Learners are to be encouraged to blog, tweet, text and email employing appropriate language.
4. GD/Interview/Role Play/Debate could be conducted off the laboratory (in a regular classroom) but learners are to be exposed to telephonic interview and video conferencing.
5. Learners are to be assigned to read/write/listen/view materials outside the classroom as well for gaining proficiency and better participation in the class.

OBJECTIVES:

To expose the students to the operation of synchronous machines and induction motors and give them experimental skill.

LIST OF EXPERIMENTS:

1. Regulation of three phase alternator by emf and mmf methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. Regulation of three phase salient pole alternator by slip test.
4. Measurements of negative sequence and zero sequence impedance of alternators.
5. V and Inverted V curves of Three Phase Synchronous Motor.
6. Load test on three-phase induction motor.
7. No load and blocked rotor test on three-phase induction motor (Determination of equivalent circuit parameters).
8. Separation of No-load losses of three-phase induction motor.
9. Load test on single-phase induction motor.
10. No load and blocked rotor test on single-phase induction motor.
11. Study of Induction motor Starters

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Synchronous Induction motor 3HP - 1 No.
2. DC Shunt Motor Coupled With Three phase Alternator - 4 nos
3. DC Shunt Motor Coupled With Three phase Slip ring Induction motor - 1 No.

OBJECTIVES:

- To introduce different methods of analog communication and their significance
- To introduce Digital Communication methods for high bit rate transmission
- To introduce the concepts of source and line coding techniques for enhancing rating of transmission of minimizing the errors in transmission.
- To introduce MAC used in communication systems for enhancing the number of users.
- To introduce various media for digital communication

UNIT I ANALOG COMMUNICATION 9

AM - Frequency spectrum - vector representation - power relations - generation of AM - DSB, DSB/SC, SSB, VSB AM Transmitter & Receiver; FM and PM - frequency spectrum - power relations : NBFM & WBFM, Generation of FM and DM, Amstrong method & Reactance modulations : FM & PM frequency.

UNIT II DIGITAL COMMUNICATION 9

Pulse modulations - concepts of sampling and sampling theormes, PAM, PWM, PPM, PTM, quantization and coding : DCM, DM, slope overload error. ADM, DPCM, OOK systems - ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication.

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL (Qualitative only) 9

Primary communication - entropy, properties, BSC, BEC, source coding : Shaum, Fao, Huffman coding : noiseless coding theorem, BW - SNR trade off codes: NRZ, RZ, AMI, HDBP, ABQ, MBnBcodes : Efficiency of transmissions, error control codes and applications: convolutions & block codes.

UNIT IV MULTIPLE ACCESS TECHNIQUES 9

SS&MA techniques : FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits)

permanent magnet synchronous motor.

UNIT V **DESIGN OF CONTROLLERS FOR DRIVES**

9

Transfer function for DC motor / load and converter - closed loop control with Current and speed feedback-armature voltage control and field weakening mode – Design of controllers; current controller and speed controller- converter selection and characteristics.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and apply basic science, circuit theory, Electro-magnetic field theory control theory and apply them to electrical engineering problems.

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 1992.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002.
3. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Prentice Hall of India, 2001.

REFERENCES:

1. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System," Elsevier 2012.
2. Shaahin Felizadeh, "Electric Machines and Drives", CRC Press(Taylor and Francis Group), 2013.
3. S.K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 1993.
4. S. Sivanagaraju, M. Balasubba Reddy, A. Mallikarjuna Prasad "Power semiconductor drives" PHI, 5th printing, 2013.
5. N.K.De., P.K.SEN"Electric drives" PHI, 2012.
6. Vedam Subramanyam, "Thyristor Control of Electric Drives", Tata McGraw Hill, 2007.

EE6602

EMBEDDED SYSTEMS

LT P C
3 0 0 3

OBJECTIVES:

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in Various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real-time operating system tool

UNIT I **INTRODUCTION TO EMBEDDED SYSTEMS**

9

Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II	EMBEDDED NETWORKING	9
Embedded Networking: Introduction, I/O Device Ports & Buses- Serial Bus communication protocols - RS232 standard - RS422 - RS485 - CAN Bus -Serial Peripheral Interface (SPI) - Inter Integrated Circuits (I ² C) -need for device drivers.		
UNIT III	EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT	9
Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.		
UNIT IV	RTOS BASED EMBEDDED SYSTEM DESIGN	9
Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication-shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, μ C/OS-II, RT Linux.		
UNIT V	EMBEDDED SYSTEM APPLICATION DEVELOPMENT	9
Case Study of Washing Machine- Automotive Application- Smart card System Application,.		

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

TEXT BOOKS:

1. Rajkamal, 'Embedded System-Architecture, Programming, Design', Mc Graw Hill, 2013.
2. Peckol, "Embedded system Design", John Wiley & Sons,2010
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013

REFERENCES:

1. Shibu. K.V, "Introduction to Embedded Systems", Tata Mcgraw Hill,2009.
2. Elicia White," Making Embedded Systems", O' Reilly Series,SPD,2011.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang, "Embedded system Design Using C8051", Cengage Learning,2009.
5. Rajib Mall "Real-Time systems Theory and Practice" Pearson Education, 2007.

OBJECTIVES:

- To have an overview of power system operation and control.
- To model power-frequency dynamics and to design power-frequency controller.
- To model reactive power-voltage interaction and the control actions to be implemented for maintaining the voltage profile against varying system load.
- To study the economic operation of power system.
- To teach about SCADA and its application for real time operation and control of power systems.

UNIT I INTRODUCTION 9

An overview of power system operation and control - system load variation - load characteristics - load curves and load-duration curve - load factor - diversity factor - Importance of load forecasting and quadratic and exponential curve fitting techniques of forecasting – plant level and system level controls .

UNIT II REAL POWER - FREQUENCY CONTROL 9

Basics of speed governing mechanism and modeling - speed-load characteristics – load sharing between two synchronous machines in parallel - control area concept - LFC control of a single-area system - static and dynamic analysis of uncontrolled and controlled cases - two-area system – modeling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control - excitation systems - modeling - static and dynamic analysis - stability compensation - methods of voltage control: tap-changing transformer, SVC (TCR + TSC) and STATCOM – secondary voltage control.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Formulation of economic dispatch problem - I/O cost characterization - incremental cost curve - co-ordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ -iteration method - statement of unit commitment problem - priority-list method - forward dynamic programming.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need for computer control of power systems - concept of energy control centre - functions - system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - network topology - state estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies.

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 34th reprint, 2010.
2. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
3. Abhijit Chakrabarti, Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES:

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition, 2011.
2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th reprint, 2010.
3. Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.
4. N.V.Ramana, "Power System Operation and Control," Pearson, 2011.
5. C.A.Gross, "Power System Analysis," Wiley India, 2011.

EE6604**DESIGN OF ELECTRICAL MACHINES****LT P C
3 1 0 4****OBJECTIVES:**

- To study mmf calculation and thermal rating of various types of electrical machines.
- To design armature and field systems for D.C. machines.
- To design core, yoke, windings and cooling systems of transformers.
- To design stator and rotor of induction machines.
- To design stator and rotor of synchronous machines and study their thermal behaviour.

UNIT I INTRODUCTION**9**

Major considerations in Electrical Machine Design - Electrical Engineering Materials - Space factor - Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow - Temperature rise and Insulating Materials - Rating of machines - Standard specifications.

UNIT II DC MACHINES**9**

Output Equations - Main Dimensions - Choice of Specific Electric and Magnetic Loading - Magnetic Circuits Calculations - Carter's Coefficient - Net length of Iron - Real & Apparent flux densities - Selection of number of poles - Design of Armature - Design of commutator and brushes - performance prediction using design values.

UNIT III TRANSFORMERS**9**

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

UNIT IV INDUCTION MOTORS**9**

Output equation of Induction motor - Main dimensions - Choice of Average flux density - Length of air gap - Rules for selecting rotor slots of squirrel cage machines - Design of rotor bars & slots - Design of end rings - Design of wound rotor - Magnetic leakage calculations - Leakage reactance of polyphase machines - Magnetizing current - Short circuit current - Operating characteristics - Losses and Efficiency.

UNIT V SYNCHRONOUS MACHINES**9**

Output equations - choice of Electrical and Magnetic Loading - Design of salient pole machines - Short circuit ratio - shape of pole face - Armature design - Armature parameters - Estimation of air

gap length – Design of rotor -Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. M.V.Deshpande "Design and Testing of Electrical Machine Design" Wheeler Publications, 2010.

REFERENCES:

1. A.Shanmuga Sundaram, G.Gangadharan, R.Palani 'Electrical Machine Design Data Book', New Age International Pvt. Ltd., Reprint, 2007.
2. R.K.Agarwal "Principles of Electrical Machine Design" Esskay Publications, Delhi, 2002.
3. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

EE6611

POWER ELECTRONICS AND DRIVES LABORATORY

LT P C

0 0 3 2

OBJECTIVES:

To provide hands on experience with power electronic converter design and testing

LIST OF EXPERIMENTS:

1. Gate Pulse Generation using R,RC and UJT.
2. Characteristics of SCR and Triac
3. Characteristics of MOSFET and IGBT
4. AC to DC half controlled converter
5. AC to DC fully controlled Converter
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter
8. IGBT based three phase PWM inverter
9. AC Voltage controller
10. Switched mode power converter.
11. Simulation of PE circuits (1 Φ & 3 Φ semiconverter, 1 Φ & 3 Φ full converter, dc-dc converters, ac voltage controllers).

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Device characteristics (for SCR, MOSFET, TRIAC and IGBT kit with builtin / discrete power supply and meters) - 2 each

2. Single phase SCR based half controlled converter and fully controlled converter along with built-in/separate/firing circuit/module and meter - 2 each
3. MOSFET based step up and step down choppers (Built in/ Discrete) - 1 each
4. IGBT based single phase PWM inverter module/Discrete Component - 2
5. IGBT based three phase PWM inverter module/Discrete Component - 2
6. Switched mode power converter module/Discrete Component - 2
7. SCR & TRIAC based 1 phase AC controller along with lamp or rheostat load - 2
8. Cyclo converter kit with firing module -
9. Dual regulated Dc power supply with common ground
10. Cathode ray Oscilloscope - 10
11. Isolation Transformer - 5
12. Single phase Auto transformer - 3
13. Components (Inductance, Capacitance) 3 set for each
14. Multimeter - 5
15. LCR meter - 3
16. Rheostats of various ranges - 2 sets of 10 value
17. Work tables - 10
18. DC and AC meters of required ranges - 20
19. Component data sheets to be provided

EE6612

MICROPROCESSORS AND MICROCONTROLLERS LABORATORY

**LT P C
0 0 3 2**

OBJECTIVES:

To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.

LIST OF EXPERIMENTS:

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions:
 - (i) Ascending / Descending order, Maximum / Minimum of numbers
 - (ii) Programs using Rotate instructions
 - (iii) Hex / ASCII / BCD code conversions.
3. Interface Experiments: with 8085
 - (i) A/D Interfacing. & D/A Interfacing.
4. Traffic light controller.
5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source

7. Read a key ,interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
 - (i) Conditional jumps, looping
 - (ii) Calling subroutines.
- 9.. Programming I/O Port 8051
 - (i) study on interface with A/D & D/A
 - (ii) study on interface with DC & AC motor .
10. Mini project development with processors.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand and analyse, linear and digital electronic circuits.
- To understand and apply computing platform and software for engineering problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Sl.No.	Description of Equipment	Quantity required
1.	8085 Microprocessor Trainer with Power Supply	15
2.	8051 Micro Controller Trainer Kit with power supply	15
3.	8255 Interface board	5
4.	8251 Interface board	5
5.	8259 Interface board	5
6.	8279 Keyboard / Display Interface board	5
7.	8254 timer counter	5
8.	ADC and DAC card	5
9.	AC & DC motor with Controller	5
10.	Traffic Light Control System	5

EE6613

PRESENTATION SKILLS AND TECHNICAL SEMINAR

**L T P C
0 0 2 1**

OBJECTIVES:

- To encourage the students to study advanced engineering developments
- To prepare and present technical reports.
- To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

METHOD OF EVALUATION :

During the seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. Each student is expected to present atleast twice during the semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A Faculty

guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Evaluation is 100% internal.

TOTAL : 30 PERIODS

OUTCOMES:

- Ability to review, prepare and present technological developments
- Ability to face the placement interviews

EE6701

HIGH VOLTAGE ENGINEERING

**L T P C
3 0 0 3**

OBJECTIVES:

- To understand the various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9
Causes of over voltages and its effects on power system - Lightning, switching surges and temporary overvoltages, Corona and its effects – Reflection and Refraction of Travelling waves- Protection against overvoltages.

UNIT II DIELECTRIC BREAKDOWN 9
Gaseous breakdown in uniform and non-uniform fields - Corona discharges - Vacuum breakdown - Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality - Breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS 9
Generation of High DC, AC, impulse voltages and currents - Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS 9
High Resistance with series ammeter - Dividers, Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters – Sphere Gaps - High current shunts- Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION 9
High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers- Insulation Coordination.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals', Newnes Second

Edition Elsevier , New Delhi, 2005.

3. Subir Ray, 'An Introduction to High Voltage Engineering' PHI Learning Private Limited, New Delhi, Second Edition, 2013.

REFERENCES:

1. L.L. Alston, 'High Voltage Technology', Oxford University Press, First Indian Edition, 2011.
2. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Third Edition, 2010.

EE6702

PROTECTION AND SWITCHGEAR

L T P C
3 0 0 3

OBJECTIVES:

- To educate the causes of abnormal operating conditions (faults, lightning and switching surges) of the apparatus and system.
- To introduce the characteristics and functions of relays and protection schemes.
- To impart knowledge on apparatus protection
- To introduce static and numerical relays
- To impart knowledge on functioning of circuit breakers

UNIT I PROTECTION SCHEMES 9

Principles and need for protective schemes - nature and causes of faults - types of faults - fault current calculation using symmetrical components - Methods of Neutral grounding - Zones of protection and essential qualities of protection - Protection schemes

UNIT II ELECTROMAGNETIC RELAYS 9

Operating principles of relays - the Universal relay - Torque equation - R-X diagram - Electromagnetic Relays - Overcurrent, Directional, Distance, Differential, Negative sequence and Under frequency relays.

UNIT III APPARATUS PROTECTION 9

Current transformers and Potential transformers and their applications in protection schemes - Protection of transformer, generator, motor, busbars and transmission line.

UNIT IV STATIC RELAYS AND NUMERICAL PROTECTION 9

Static relays - Phase, Amplitude Comparators - Synthesis of various relays using Static comparators - Block diagram of Numerical relays - Overcurrent protection, transformer differential protection, distant protection of transmission lines.

UNIT V CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption - DC and AC circuit breaking - re-striking voltage and recovery voltage - rate of rise of recovery voltage - resistance switching - current chopping - interruption of capacitive current - Types of circuit breakers - air blast, air break, oil, SF6 and vacuum circuit breakers - comparison of different circuit breakers - Rating and selection of Circuit breakers.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Sunil S.Rao, 'Switchgear and Protection', Khanna Publishers, New Delhi, 2008.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., First Edition 2011.
3. M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarti, 'A Text Book on Power System Engineering', Dhanpat Rai & Co., 1998.

REFERENCES:

1. Badri Ram ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New Age International Pvt Ltd Publishers, Second Edition 2011.
2. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2010.
3. C.L.Wadhwa, 'Electrical Power Systems', 6th Edition, New Age International (P) Ltd., 2010
4. Ravindra P.Singh, ' Switchgear and Power System Protection', PHI Learning Private Ltd., New Delhi, 2009.
5. Bhavesh Bhalja, R.P. Maheshwari, Nilesh G. Chotani,'Protection and Switchgear' Oxford University Press, 2011.

EE6703**SPECIAL ELECTRICAL MACHINES****L T P C
3 0 0 3****OBJECTIVES:**

- To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of stepping motors.
- To impart knowledge on the Construction, principle of operation, control and performance of switched reluctance motors.
- To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
- To impart knowledge on the Construction, principle of operation and performance of permanent magnet synchronous motors.

UNIT I SYNCHRONOUS RELUCTANCE MOTORS**9**

Constructional features - Types - Axial and Radial flux motors - Operating principles - Variable Reluctance Motors - Voltage and Torque Equations - Phasor diagram - performance characteristics - Applications.

UNIT II STEPPER MOTORS**9**

Constructional features - Principle of operation - Variable reluctance motor - Hybrid motor - Single and multi stack configurations - Torque equations - Modes of excitation - Characteristics - Drive circuits - Microprocessor control of stepper motors - Closed loop control-Concept of lead angle-Applications.

UNIT III SWITCHED RELUCTANCE MOTORS (SRM) 9

Constructional features - Rotary and Linear SRM - Principle of operation - Torque production - Steady state performance prediction- Analytical method -Power Converters and their controllers - Methods of Rotor position sensing - Sensor less operation - Characteristics and Closed loop control - Applications.

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Permanent Magnet materials - Minor hysteresis loop and recoil line-Magnetic Characteristics - Permeance coefficient -Principle of operation - Types - Magnetic circuit analysis - EMF and torque equations -Commutation - Power Converter Circuits and their controllers - Motor characteristics and control- Applications.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) 9

Principle of operation - Ideal PMSM - EMF and Torque equations - Armature MMF - Synchronous Reactance – Sine wave motor with practical windings - Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements- Applications.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to model and analyze electrical apparatus and their application to power system

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
3. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.

REFERENCES:

1. R.Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor Theory and Practice', Peter Perengrinus London, 1982.
3. T. Kenjo and S. Nagamori, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1988.
4. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

MG6851

PRINCIPLES OF MANAGEMENT

**LT P C
3 0 0 3**

OBJECTIVES:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers - managerial roles and skills - Evolution of Management - Scientific, human relations , system and contingency approaches - Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment - Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives - policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose - Formal and informal organization - organization chart - organization structure - types - Line and staff authority - departmentalization - delegation of authority - centralization and decentralization - Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management , Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour - motivation - motivation theories - motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication - process of communication - barrier in communication - effective communication - communication and IT.

UNIT V CONTROLLING 9

System and process of controlling - budgetary and non-budgetary control techniques - use of computers and IT in Management control - Productivity problems and management - control and performance - direct and preventive control – reporting.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXT BOOKS:

1. Stephen P. Robbins & Mary Coulter, “ Management”, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, 6th Edition, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, “ Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Wehrich “Essentials of Management” Tata McGraw Hill, 1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999.

OBJECTIVES:

To provide better understanding of power system analysis through digital simulation

LIST OF EXPERIMENTS:

1. Computation of Parameters and Modelling of Transmission Lines
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Load Flow Analysis - I : Solution of load flow and related problems using Gauss-Seidel Method
4. Load Flow Analysis - II: Solution of load flow and related problems using Newton Raphson.
5. Fault Analysis
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System
7. Transient Stability Analysis of Multi machine Power Systems
8. Electromagnetic Transients in Power Systems
9. Load - Frequency Dynamics of Single- Area and Two-Area Power Systems
10. Economic Dispatch in Power Systems.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Personal computers (Pentium-IV, 80GB, 512 MBRAM) - 25 nos
2. Printer laser- 1 No.
3. Dot matrix- 1 No.
4. Server (Pentium IV, 80GB, 1GBRAM) (High Speed Processor) - 1 No.
5. Software: any power system simulation software - 5 licenses
6. Compilers: C, C++, VB, VC++ - 25 users

OBJECTIVES:

To encourage the students to comprehend the knowledge acquired from the first Semester to Sixth Semester of B.E Degree Course through periodic exercise.

METHOD OF EVALUATION:

The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics

TOTAL : 30 PERIODS

OUTCOMES:

- Ability to review, prepare and present technological developments

OBJECTIVES:

- To analyze the various concepts behind renewable energy resources.
- To introduce the energy saving concept by different ways of illumination.
- To understand the different methods of electric heating and electric welding.
- To introduce knowledge on Solar Radiation and Solar Energy Collectors
- To introduce concepts of Wind Energy and its utilization

UNIT I ELECTRIC DRIVES AND TRACTION 9

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services - traction motors - characteristic features of traction motor - systems of railway electrification - electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear.

UNIT II ILLUMINATION 9

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps - design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting - energy saving lamps, LED.

UNIT III HEATING AND WELDING 9

Introduction - advantages of electric heating - modes of heat transfer - methods of electric heating - resistance heating - arc furnaces - induction heating - dielectric heating - electric welding - types - resistance welding - arc welding - power supply for arc welding - radiation welding.

UNIT IV SOLAR RADIATION AND SOLAR ENERGY COLLECTORS 9

Introduction - solar constant - solar radiation at the Earth's surface - solar radiation geometry - estimation of average solar radiation - physical principles of the conversion of solar radiation into heat - flat-plate collectors - transmissivity of cover system - energy balance equation and collector efficiency - concentrating collector - advantages and disadvantages of concentrating collectors - performance analysis of a cylindrical - parabolic concentrating collector - Feedin Invertors.

UNIT V WIND ENERGY 9

Introduction - basic principles of wind energy conversion - site selection considerations - basic components of a WECS (Wind Energy Conversion System) - Classification of WECS - types of wind Turbines - analysis of aerodynamic forces acting on the blade - performances of wind.

TOTAL : 45 PERIODS**OUTCOMES:**

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOKS:

1. N.V. Suryanarayana, "Utilisation of Electric Power", Wiley Eastern Limited, New Age International Limited, 1993.
2. J.B.Gupta, "Utilisation Electric power and Electric Traction", S.K.Kataria and Sons, 2000.
3. G.D.Rai, "Non-Conventional Energy Sources", Khanna Publications Ltd., New Delhi, 1997.

REFERENCES:

1. R.K.Rajput, Utilisation of Electric Power, Laxmi publications Private Limited., 2007.

2. H.Partab, Art and Science of Utilisation of Electrical Energy”, Dhanpat Rai and Co., New Delhi, 2004.
3. C.L.Wadhwa, “Generation, Distribution and Utilisation of Electrical Energy”, New Age International Pvt.Ltd., 2003.
4. S. Sivanagaraju, M. Balasubba Reddy, D. Srilatha,’ Generation and Utilization of Electrical Energy’, Pearson Education, 2010.
5. Donals L. Steeby,’ Alternative Energy Sources and Systems’, Cengage Learning, 2012.

EE6811

PROJECT WORK

**L T P C
0 0 12 6**

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging

EE6002

POWER SYSTEM TRANSIENTS

**L T P C
3 0 0 3**

OBJECTIVES:

- To study the generation of switching transients and their control using circuit - theoretical concept.
- To study the mechanism of lightning strokes and the production of lightning surges.
- To study the propagation, reflection and refraction of travelling waves.
- To study the impact of voltage transients caused by faults, circuit breaker action, load rejection on integrated power system.

UNIT I INTRODUCTION AND SURVEY

9

Review and importance of the study of transients - causes for transients. RL circuit transient with sine wave excitation - double frequency transients - basic transforms of the RLC circuit transients. Different types of power system transients - effect of transients on power systems – role of the study of transients in system planning.

UNIT II SWITCHING TRANSIENTS 9

Over voltages due to switching transients - resistance switching and the equivalent circuit for interrupting the resistor current - load switching and equivalent circuit - waveforms for transient voltage across the load and the switch - normal and abnormal switching transients. Current suppression - current chopping - effective equivalent circuit. Capacitance switching - effect of source regulation - capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients - ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9

Review of the theories in the formation of clouds and charge formation - rate of charging of thunder clouds – mechanism of lightning discharges and characteristics of lightning strokes – model for lightning stroke - factors contributing to good line design - protection using ground wires - tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS 9

Computation of transients - transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - step response - Bewely's lattice diagram - standing waves and natural frequencies - reflection and refraction of travelling waves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9

The short line and kilometric fault - distribution of voltages in a power system - Line dropping and load rejection - voltage transients on closing and reclosing lines - over voltage induced by faults -switching surges on integrated system Qualitative application of EMTP for transient computation.

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. Allan Greenwood, 'Electrical Transients in Power Systems', Wiley Inter Science, New York, 2nd Edition, 1991.
2. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2009.
3. C.S. Indulkar, D.P.Kothari, K. Ramalingam, 'Power System Transients - A statistical approach', PHI Learning Private Limited, Second Edition, 2010.

REFERENCES:

1. M.S.Naidu and V.Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. R.D. Begamudre, 'Extra High Voltage AC Transmission Engineering', Wiley Eastern Limited, 1986.
3. Y.Hase, Handbook of Power System Engineering," Wiley India, 2012.
4. J.L.Kirtley, "Electric Power Principles, Sources, Conversion, Distribution and use," Wiley, 2012.

OBJECTIVES:

- To Introduce Fundamentals of Biomedical Engineering
- To study the communication mechanics in a biomedical system with few examples
- To study measurement of certain important electrical and non-electrical parameters
- To understand the basic principles in imaging techniques
- To have a basic knowledge in life assisting and therapeutic devices

UNIT I FUNDAMENTALS OF BIOMEDICAL ENGINEERING 9

Cell and its structure - Resting and Action Potential - Nervous system and its fundamentals - Basic components of a biomedical system- Cardiovascular systems- Respiratory systems -Kidney and blood flow - Biomechanics of bone - Biomechanics of soft tissues - Basic mechanics of spinal column and limbs -Physiological signals and transducers - Transducers – selection criteria – Piezo electric, ultrasonic transducers - Temperature measurements - Fibre optic temperature sensors.

UNIT II NON ELECTRICAL PARAMETERS MEASUREMENT AND DIAGNOSTIC PROCEDURES 9

Measurement of blood pressure - Cardiac output - Heart rate - Heart sound - Pulmonary function measurements – spirometer – Photo Plethysmography, Body Plethysmography – Blood Gas analysers, pH of blood -measurement of blood pCO₂, pO₂, finger-tip oxymeter - ESR, GSR measurements.

UNIT III ELECTRICAL PARAMETERS ACQUISITION AND ANALYSIS 9

Electrodes - Limb electrodes -floating electrodes - pregelled disposable electrodes - Micro, needle and surface electrodes - Amplifiers, Preamplifiers, differential amplifiers, chopper amplifiers - Isolation amplifier - ECG - EEG - EMG - ERG - Lead systems and recording methods – Typical waveforms - Electrical safety in medical environment, shock hazards - leakage current-Instruments for checking safety parameters of biomedical equipments.

UNIT IV IMAGING MODALITIES AND ANALYSIS 9

Radio graphic and fluoroscopic techniques - Computer tomography - MRI - Ultrasonography - Endoscopy - Thermography -Different types of biotelemetry systems - Retinal Imaging - Imaging application in Biometric systems - Analysis of digital images.

UNIT V LIFE ASSISTING, THERAPEUTIC AND ROBOTIC DEVICES 9

Pacemakers - Defibrillators - Ventilators - Nerve and muscle stimulators - Diathermy - Heart - Lung machine - Audio meters - Dialysers - Lithotripsy - ICCU patient monitoring system - Nano Robots - Robotic surgery - Advanced 3D surgical techniques- Orthopedic prostheses fixation.

TOTAL: 45 PERIODS**OUTCOMES:**

- Ability to understand and analyze Instrumentation systems and their applications to various industries.

TEXT BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi, 2007.
2. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.

3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, 2nd Edition, 2003.

REFERENCES:

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, New York, 1998.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition, 2007.
3. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques, Springer, 1st Edition, 2011.
4. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
5. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.

EE6004

FLEXIBLE AC TRANSMISSION SYSTEMS

L T P C
3 0 0 3

OBJECTIVES:

- To introduce the reactive power control techniques
- To educate on static VAR compensators and their applications
- To provide knowledge on Thyristor controlled series capacitors
- To educate on STATCOM devices
- To provide knowledge on FACTS controllers

UNIT I INTRODUCTION 9

Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation - Basic concepts of Static Var Compensator (SVC) - Thyristor Controlled Series capacitor (TCSC) - Unified power flow controller (UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC - Advantages of slope in dynamic characteristics - Influence of SVC on system voltage - Design of SVC voltage regulator -Modelling of SVC for power flow and fast transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC - Different modes of operation - Modelling of TCSC - Variable reactance model - Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS 9

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability - prevention of voltage instability. SSSC-operation of SSSC and the control of power flow -modelling of SSSC in load flow and transient stability studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS 9

Controller interactions - SVC - SVC interaction - Co-ordination of multiple controllers using linear control techniques - Control coordination using genetic algorithms.

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.

TEXT BOOKS:

1. R.Mohan Mathur, Rajiv K.Varma, “Thyristor - Based Facts Controllers for Electrical Transmission Systems”, IEEE press and John Wiley & Sons, Inc, 2002.
2. Narain G. Hingorani, “Understanding FACTS -Concepts and Technology of Flexible AC Transmission Systems”, Standard Publishers Distributors, Delhi- 110 006, 2011.
3. K.R.Padiyar,” FACTS Controllers in Power Transmission and Distribution”, New Age International(P) Limited, Publishers, New Delhi, 2008.

REFERENCES:

1. A.T.John, “Flexible A.C. Transmission Systems”, Institution of Electrical and Electronic Engineers (IEEE), 1999.
2. V.K.Sood,HVDC and FACTS controllers - Applications of Static Converters in Power System, APRIL 2004 , Kluwer Academic Publishers, 2004.
3. Xiao - Ping Zang, Christian Rehtanz and Bikash Pal, “Flexible AC Transmission System: Modelling and Control” Springer, 2012.

EE6008

MICROCONTROLLER BASED SYSTEM DESIGN

**L T P C
3 0 0 3**

OBJECTIVES:

- To introduce the architecture of PIC microcontroller
- To educate on use of interrupts and timers
- To educate on the peripheral devices for data communication and transfer
- To introduce the functional blocks of ARM processor
- To educate on the architecture of ARM processors

UNIT I INTRODUCTION TO PIC MICROCONTROLLERc 9

Introduction to PIC Microcontroller-PIC 16C6x and PIC16C7x Architecture-PIC16cxx-- Pipelining - Program Memory considerations - Register File Structure - Instruction Set - Addressing modes - Simple Operations.

UNIT II INTERRUPTS AND TIMER 9

PIC micro controller Interrupts- External Interrupts-Interrupt Programming-Loop time subroutine - Timers-Timer Programming- Front panel I/O-Soft Keys- State machines and key switches- Display of Constant and Variable strings.

UNIT III PERIPHERALS AND INTERFACING 9

I²C Bus for Peripherals Chip Access- Bus operation-Bus subroutines- Serial EEPROM–Analog to

Digital Converter-UART-Baud rate selection-Data handling circuit-Initialization - LCD and keyboard Interfacing -ADC, DAC, and Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR 9
ARM Architecture -ARM programmer's model -ARM Development tools- Memory Hierarchy -ARM Assembly Language Programming-Simple Examples-Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION 9
3-Stage Pipeline ARM Organization- 5-Stage Pipeline ARM Organization-ARM Instruction Execution- ARM Implementation- ARM Instruction Set- ARM coprocessor interface- Architectural support for High Level Languages - Embedded ARM Applications.

TOTAL: 45 PERIODS

OUTCOMES:

- To understand and apply computing platform and software for engineering problems.
- To understand ethical issues, environmental impact and acquire management skills.

TEXT BOOKS:

1. Peatman,J.B., "Design with PIC Micro Controllers" Pearson Education, 3rd Edition, 2004.
2. Furber,S., "ARM System on Chip Architecture" Addison Wesley trade Computer Publication, 2000.

REFERENCE:

1. Mazidi, M.A., "PIC Microcontroller" Rollin Mckinlay, Danny causey Printice Hall of India, 2007.

**EE6009 POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS LT P C
3 0 0 3**

OBJECTIVES:

- To Provide knowledge about the stand alone and grid connected renewable energy systems.
- To equip with required skills to derive the criteria for the design of power converters for renewable energy applications.
- To analyse and comprehend the various operating modes of wind electrical generators and solar energy systems.
- To design different power converters namely AC to DC, DC to DC and AC to AC converters for renewable energy systems.
- To develop maximum power point tracking algorithms.

UNIT I INTRODUCTION 9
Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

UNIT II ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION 9
Reference theory fundamentals-principle of operation and analysis: IG, PMSG, SCIG and DFIG.

UNIT III POWER CONVERTERS 9

Solar: Block diagram of solar photo voltaic system -Principle of operation: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing
Wind: Three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

UNIT IV ANALYSIS OF WIND AND PV SYSTEMS 9

Stand alone operation of fixed and variable speed wind energy conversion systems and solar system- Grid connection Issues -Grid integrated PMSG, SCIG Based WECS, grid Integrated solar system

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9

Need for Hybrid Systems- Range and type of Hybrid systems- Case studies of Wind-PV Maximum Power Point Tracking (MPPT).

TOTAL : 45 PERIODS

OUTCOMES:

- Ability to understand and analyze power system operation, stability, control and protection.
- Ability to handle the engineering aspects of electrical energy generation and utilization.

TEXT BOOK:

1. S. N. Bhadra, D.Kastha, S.Banerjee, "Wind Electrical Systems", Oxford University Press, 2005.
2. B.H.Khan Non-conventional Energy sources Tata McGraw-hill Publishing Company, New Delhi,2009.

REFERENCES:

1. Rashid .M. H "power electronics Hand book", Academic press, 2001.
2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", prentice hall linc, 1995.
5. Andrzej M. Trzynadlowski, 'Introduction to Modern Power Electronics', Second edition, wiley India Pvt. Ltd, 2012.

**GE6075 PROFESSIONAL ETHICS IN ENGINEERING LT P C
3 0 0 3**

OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics - Integrity - Work ethic - Service learning - Civic virtue - Respect for others - Living peacefully - Caring - Sharing - Honesty - Courage - Valuing time - Cooperation - Commitment - Empathy - Self confidence - Character - Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' - Variety of moral issues - Types of inquiry - Moral dilemmas - Moral

Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and Controversy – Models of professional roles - Theories about right action - Self-interest - Customs and Religion - Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation - Engineers as responsible Experimenters - Codes of Ethics - A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) - Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Moral Leadership - Code of Conduct - Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics - Concepts and Cases”, Cengage Learning, 2009.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6. World Community Service Centre, ‘ Value Education’, Vethathiri publications, Erode, 2011.

Web sources:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org