1901MA103	MATHEMATICS – I (CALCULUS AND DIFFERENTIAL EQUATIONS)	L	T	P	C
		3	2	0	4

MODULE I **DIFFERENTIAL CALCULUS** **12 Hours**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature- Evolutes and involutes.

MODULE II **INTEGRAL CALCULUS** **12 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.

MODULE III **ORDINARY DIFFERENTIAL EQUATIONS** **12 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

MODULE IV **FOURIER SERIES** **12 Hours**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis.

MODULE V **APPLICATION OF PARTIAL DIFFERENTIAL EQUATIONS** **12 Hours**

Variable separable methods-classification-one dimensional wave equation with and without velocity-one dimensional heat equation.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

REFERENCES:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2018.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

WAVE, OPTICS AND ELECTROMAGNETISM **L T P C**

1901PH102

3 0 0 3

MODULE I **WAVES** **9 Hours**

Mechanical and electrical simple harmonic oscillators- damped harmonic oscillator- forced mechanical and electrical oscillators – impedance - steady state motion of forced damped harmonic oscillator

MODULE II **NON-DISPERSIVE TRANSVERSE AND LONGITUDINAL WAVES** **9 Hours**

Transverse wave on a string - The wave equation on a string - Harmonic waves - reflection and transmission of waves at a boundary - impedance matching, standing waves and their Eigen frequencies - longitudinal waves and the wave equation.

MODULE III **WAVE OPTICS** **9 Hours**

Interference of light by wave front splitting and amplitude splitting - Young's double slit experiment - Michelson interferometer - The Rayleigh criterion for limit of resolution and its application to vision - Diffraction gratings and their resolving power.

MODULE IV **ELECTROSTATICS** **9 Hours**

Calculation of electric field and electrostatic potential for a charge distribution - Laplace's and Poisson's equations for electrostatic potential- Practical examples like Faraday's cage and coffee-ring effect Electrostatic field and potential of a dipole - Electric displacement; boundary conditions on displacement - applications in photoconductors - Smoke precipitator and electrostatic air cleaners

MODULE V **MAGNETOSTATICS** **9 Hours**

Bio-Savart law - Divergence and curl of static magnetic field; vector potential and magnetic field using Stokes' theorem - Equation for the vector potential and its solution for given current densities - Solving for magnetic field due to simple magnets like a bar magnet - Magnetic susceptibility and ferromagnetic-paramagnetic and diamagnetic materials - applications: measurement of magnetic flux density - Frequency modulation - DC measurements and Magnetic field measurements in permanent magnets.

TOTAL: 45 HOURS

REFERENCES:

1. I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.
2. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
3. E. Hecht, "Optics", Pearson Education, 2008.
4. A. Ghatak, "Optics", McGraw Hill Education, 2012.
5. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.
6. David Griffiths, Introduction to Electrodynamics
7. Halliday and Resnick, Physics
8. W. Saslow, Electricity, magnetism and light

1901GE101	ELECTRICAL CIRCUIT ANALYSIS	L	T	P	C
		3	0	0	3

MODULE I **DC CIRCUITS** **6 Hours**

Ohm's law and Kirchhoff's laws - Mesh Analysis - Node Analysis - Network reduction - Voltage and current division - Source transformation - Star-delta conversion.

MODULE II **AC CIRCUITS** **7 Hours**

RMS, average, form factor and peak factor for basic waveforms - Steady state analysis of RL, RC and RLC circuits; power and power factor - Solving AC circuits using mesh and node analysis - Three phase circuits.

MODULE III **NETWORK THEOREMS** **7 Hours**

Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem and Maximum power transfer theorem; applications of network theorems.

MODULE IV **RESONANT CIRCUITS** **7 Hours**

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

MODULE V **COUPLED CIRCUITS** **7 Hours**

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

MODULE VI **TRANSIENT ANALYSIS** **7 Hours**

Transient response of RL, RC and RLC circuits to DC and AC excitation; Natural and forced oscillations; Laplace transform application to transient solution.

MODULE VII **TWO PORT NETWORKS** **4 Hours**

Z, Y, H and ABCD parameters.

TOTAL: 45 HOURS

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 McGrawHill, New Delhi, 6th Edition, 2014.
3. James W. Nilsson and Susan Riedel, "Electric Circuits", Pearson, 10th Global Edition, 2014.
4. William H. Haytand Jack Kemmerly, "Engineering circuit analysis", Tata McGrawHill, 8th Edition, 2013.
5. Charles. K.Alexander and Mathew N.O.Sadiku, "Fundamental of Electric Circuits", TMH, 5thEdition, New Delhi, 2013.
6. S.N. Sivanandam, "Electric Circuit Analysis", Vikas Publishing House Pvt. Ltd., New Delhi, 2nd Edition, 2008.
7. T.S.K.V IYER, "Theory and Problems in Circuit Analysis", Tata McGrawHill, 2nd edition, 2010.
8. A.Chakrabarti, "Circuits Theory: Analysis and Synthesis", Dhanpat Rai& Co., 2014 Edition.

1901GEX02	ENGINEERING GRAPHICS	L	T	P	C
	(Common for all B.E./B.Tech. Programme)	**2**	**0**	**2**	**3**

MODULE I CONCEPTS AND CONVENTIONS (Not for Examination)

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

MODULE II PLANE CURVES AND FREE HAND SKETCHING 9 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.

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.

MODULE III PROJECTION OF POINTS, LINES AND PLANE SURFACES 9 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.

MODULE IV PROJECTION OF SOLIDS 9 Hours

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

MODULE V PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 9 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.

MODULE VI ISOMETRIC AND PERSPECTIVE PROJECTIONS 9 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.

TOTAL: 45 HOURS

REFERENCES:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore,2016.
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, 2015.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2017.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2015.
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, 2016.

1901GEX51	CAD (COMPUTER AIDED DRAFTING) LAB	L	T	P	C
	(Common for all B.E./B.Tech. Programme)	0	0	2	1

List of Experiments:

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

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B-spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
7. Drawing isometric projection of simple objects.
8. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Total: 30 Hours

References:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing House Pvt. Ltd., 2014.
2. P.S. Gill, A Textbook of Machine Drawing, Katson books, 2013.
3. R.K. Dhawan, A Textbook of Machine Drawing, S. Chand,2012.
4. K.C. John, Textbook of Machine Drawing, PHI Learning Pvt. Ltd.,2009.

1901GEX53	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

List of Experiments:

1. Experiments related to verification of Ohm's law and Kirchhoff's laws
2. Experiments involving logic gates
3. Fan and light control using regulators
4. Design of 6V regulated power supply
5. Energy conservation demonstration experiment using energy meter
6. Waveform generation and calculation of rms and average values
7. IC 555 and IC 741 based experiments
8. Experiments in earthing
9. Staircase wiring and residential building wiring
10. Speed control of DC shunt motor

Total: 30 Hours

References:

1. Edward Hughes, " Electrical Technology,", Pearson Education
2. D.P. Kothari and Nagrath " Basic Electronics",MH Education 2013.
3. Paul Scherz and Simon Monk "Practical Electronics for inventors" Mc Graw Hill Publications 2013.

1901PHX51	ENGINEERING PHYSICS LAB (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

List of Experiments:

1. Determination of wavelength of various colours of mercury spectrum using Laser grating
2. Determination of velocity of liquids using ultrasonic interferometer
3. Determine the dispersive power of a prism using spectrometer
4. Determine the unknown resistance of the given wire using Carey-Foster's Bridge
5. Determine the band gap of the given semiconductor
6. Determine the acceptance angle and particle size using Laser
7. Torsional pendulum – Rigidity modulus of a steel wire
8. Thickness of a thin wire – Air Wedge
9. Measurement of Young's modulus – Uniform and Non-uniform bending
10. Thermal conductivity –Lee's Disc method

Total: 30 Hours

References:

1. 'Practical Physics', R.K. Shukla, Anchal Srivastava, New age international (2011)
2. 'B.Sc. Practical Physics', C.L Arora, S. Chand &Co. (2012)

1901GE151	Engineering Intelligence-I	L	T	P	C
	(Common for all B.E./B.Tech. Programme)	0	0	2	1

List of Experiments:

1. **Activities on Fundamentals of Inter-personal Communication**

Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals.

2. **Activities on Reading Comprehension**

General Vs Local comprehension, reading for facts, guessing meanings from context, Scanning, skimming, and 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/ Proposal writing/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.- creative and critical thinking.

5. **Activities on Soft 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-Time management-stress management –paralinguistic features- Multiple intelligences – emotional intelligence – spiritual quotient (ethics) – intercultural communication – creative and critical.

Total: 30 Hours

References:

1. Raman, Meenakshi and Sangeetha Sharma, “Technical Communication: Principles and Practice”, Oxford University Press, New Delhi, 2011.
2. Sudha Rani, D , “Advanced Communication Skills Laboratory Manual” , Pearson Education 2011.
3. Paul V. Anderson ,“Technical Communication”,. Cengage Learning pvt. Ltd. New Delhi, 2007.
4. “English Vocabulary in Use series”, Cambridge University Press 2008.
5. “Management Shapers Series” ,Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Rizvi and Ashraf M., “Effective Technical Communication”, Tata McGrawHill, New Delhi, 2005.
7. Jones, D, “The Pronunciation of English”, CUP, . Cambridge,2002.

1901MA203	ENGINEERING MATHEMATICS – II (Linear Algebra, Transform Calculus and Numerical Methods)	L	T	P	C
		3	2	0	4

MODULE I **MATRICES** **12 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

MODULE II **TRANSFORM CALCULUS** **12 Hours**

Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

MODULE III **SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS** **12 Hours**

Solution of algebraic and transcendental equations – Newton-Raphson method. Finite differences, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's formulae. Numerical Differentiation (first two derivatives) Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 thrules (single integral)

MODULE IV **NUMERICAL METHODS OF ORDINARY DIFFERENTIAL EQUATIONS** **12 Hours**

Taylor's series, Euler and modified Euler's methods.RungeKutta method of fourth order for solving first order equations.Milne's and Adam's predicator-corrector methods.

MODULE V **NUMERICAL METHODS OF PARTIAL DIFFERENTIAL EQUATIONS** **12 Hours**

Finite difference solution two dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

REFERENCES:

1. D. Poole, "Linear Algebra: A Modern Introduction", Brooks/Cole, 2005.
2. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.

1901CH202	APPLIED CHEMISTRY	L	T	P	C
		3	0	0	3

MODULE I ELECTROCHEMISTRY **9 Hours**

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

MODULE II POLARISATION AND OVER POTENTIAL **9 Hours**

Polarisation and Over Potential- Electrolytic polarization, Dissolution and Decomposition potential, Overvoltage – hydrogen and oxygen overvoltage, applications, Polarography – principles, diffusion layer, limiting current density, polarographic circuit, dropping mercury electrode, merits & demerits, supporting electrolyte, current maxima, polarograms, half wave potential, diffusion current, applications

MODULE III CONVENTIONAL ENERGY RESOURCES AND NON CONVENTIONAL ENERGY RESOURCES **9 Hours**

Conventional Energy Resources and Non Conventional Energy Resources- Conventional- Petroleum Oil, Coal, Natural Gas, Non Conventional -Introduction- nuclear energy- nuclear fission, nuclear fusion- nuclear chain reactions- breeder reactor- Nuclear Reactor-solar energy conversion- solar cells- wind energy.

MODULE IV STORAGE DEVICES **9 Hours**

Storage Devices- Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery nickel-cadmium battery- lithium battery- fuel cell H2 -O2 fuel cell- applications.

MODULE V POWER PLANTS AND TRANSMISSION MATERIALS **9 Hours**

Power Plants and Transmission Materials- power plant- types- hydroelectric power plants thermal power plants, solar power plants, wind *power plant*, geo thermal power generation and tidal power generation, transmission materials- conducting material- low resistivity or high conductivity- high resistivity or low conductivity conducting material- materials for lamp filaments, transmission line, electrical carbon and Fuse, Transformer oil, insulators.

TOTAL: 45 HOURS

REFERENCES:

1. Dara S.S, Umare S.S, “Engineering Chemistry”, S. Chand & Company Ltd., New Delhi 2010.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company, Ltd., New delhi 2010
3. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, “Polymer Science”, New Age
4. Kannan P. and Ravikrishnan A., “Engineering Chemistry”, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009
5. J.O.M.Bockris & A.K.N.Reddy, “Modern Electrochemistry –Vol. I & II” , Plenum Press, New York, 2000.
6. Peter Atkins and Julio de Paula, “Physical Chemistry”, VII Edition, Oxford University Press, New York, 2002.
7. A.J. Bard and L.R. Faulkner, “Electrochemical Methods – Fundamentals and applications” 3 rd edition John Wiley & Sons Inc, 2001.

8. https://mnre.gov.in/file-manager/UserFiles/pdf/Trainers%20Textbook_SHP.pdf
9. onlinelibrary.wiley.com/doi/10.1002/9780470661345.smc107/pdf
10. https://www.electrical4u.com/classification-of-electrical-conducting-material/

1901GEX03 **PROGRAMMING FOR PROBLEM SOLVING** **L T P C**
3 0 0 3

MODULE I **INTRODUCTION TO PROGRAMMING** **9 Hours**

Components of Computers and its Classifications- Generations of Computers- Number System- Problem Solving Techniques – Algorithm Design– Flowchart–Pseudocode-Algorithm to program, Compilation and Execution.

MODULE II **BASICS OF C PROGRAMMING** **9 Hours**

Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives

MODULE III **ARRAYS AND STRINGS** **9 Hours**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode - Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

MODULE IV **FUNCTIONS AND POINTERS** **9 Hours**

Introduction to functions: Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference

MODULE V **STRUCTURES & FILE PROCESSING** **9 Hours**

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Dynamic memory allocation - Singly linked list -Files – Types of file processing: Sequential access, Random access – Sequential access file - Example Program: Finding average of numbers stored in sequential access file - Random access file - Example Program: Transaction processing using random access files – Command line arguments.

TOTAL: 45 Hours

REFERENCES:

1. Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, ―Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, ―Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.

1901ENX01	ENGLISH FOR ENGINEERS	L	T	P	C
		2	0	0	2

MODULE I **FOCUS ON LANGUAGE (Vocabulary and Grammar)** **6 Hours**

Vocabulary -The Concept of Word Formation - prefixes- suffixes- Synonyms - Antonyms. Grammar -Articles- Preposition- Adjective-Adverb-connectives -Tenses (present, past & future)-Impersonal passive voice - Wh-Questions

MODULE II **LISTENING SKILLS** **6 Hours**

Listening- listening intently-arousing and sustaining interest-listening to short or longer texts- formal and informal conversations- telephonic etiquettes- narratives from different sources.-listening and Note taking-correlative verbal and non verbal communication-listening to TOEFL & IELTS programs .

MODULE III **SPEAKING SKILLS** **6 Hours**

Speaking - stress and intonation –persuasive speaking -Describing person, place and thing - sharing personal information — greetings –taking leave -Individual and Group Presentation-impromptu presentation-public speaking-Group Discussion.

MODULE IV **READING SKILLS** **6 Hours**

Reading– comprehending general and technical articles -cloze reading - inductive reading- short narratives and descriptions from newspapers – Skimming and scanning-reading and interpretation-critical reading-interpreting and transferring graphical information- sequencing of sentences.

MODULE V **WRITING SKILLS** **6 Hours**

Writing- Precise writing –Summarizing- interpreting visual texts (pie chart, bar chart, picture, advertisements etc., -Proposal writing -report writing-job application-e-mail drafting- letter writing(permission, accepting and decaling)-instructions –recommendations –checklist.

TOTAL: 30 Hours

REFERENCES:

1. Raman, Meenakshi and Sangeetha Sharma. (2011). Technical Communication: Principles and Practice. New Delhi: Oxford University Press.
2. Rizvi and Ashraf M. (2005). Effective Technical Communication. New Delhi: Tata McGraw-Hill.
3. G. Radhakrishna Pillai. English for Success- Central Institute of English and Foreign Languages, Hyderabad: Emerald Publishers.
4. Jones, D. (2002).The Pronunciation of English. Cambridge: CUP; rpt in facsimile in Jones.
5. English for Engineers - Regional Institute of English (2006) .New Delhi: Cambridge University Press.
6. Rutherford and Andrea. (2001). Basic Communication Skills for Technology. New Delhi: Pearson.
7. Viswamohan A. (2008). English for Technical Communication. New Delhi: Tata McGraw-Hill.

1901GE201	ENGINEERING EXPLORATION	L	T	P	C
		2	0	0	2

What is Engineering: Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements.

Engineering Design: Problem definition, idea generation through brainstorming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement.

Defining problems and Brainstorming: Researching design, sketching problem solving.

Communicating solution: Dimensioning orthographic drawing, perspective drawing.

Modeling and Testing final output: Product evaluation, reverse engineering, final project report.

Civil Engineering: Structural forces structural analysis, bridge design components, structural design.

Mechanical Engineering: Types of motion, mechanical power system, mechanical power formula, mechanical design.

Electrical Engineering: Reading analog multimeter, measuring current, voltage and resistance, electricity from chemicals, solar cells, magnets, Ohms law and watts law, circuit identification and circuit calculation, resistor color code, continuity.

Computer Engineering: Logic gates, algorithms, computer architecture, binary code.

TOTAL: 30 Hours

REFERENCES:

1. Ryan A.Brown, Joshua W.Brown and Michael Berkihiser: “Engineering Fundamentals: Design, Principles, and Careers”, Goodheart-Willcox Publisher, Second Edition, 2014.
2. Saeed Moaveni ,“Engineering Fundamentals: An Introduction to Engineering”, Cengage learning, Fourth Edition, 2011.

1901CHX51	ENGINEERING CHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

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 viscometer method
7. Conductometric titration of strong acid Vs strong Base
8. Estimation of dissolved oxygen in a water sample/sewage by Winkler's method.
9. Comparison of alkalinities of the given water samples
10. Determination of concentration of unknown colored solution using spectrophotometer
11. Determination of percentage of copper in alloy
12. Determination of ferrous iron in cement by spectrophotometry method
13. Adsorption of acetic acid on charcoal
14. Determination the flash point and fire point of a given oil using pen skyMartine closed cup apparatus
15. Determination the calorific value of solid fuels
16. Determination the structural of the compound using chemo software.

Total: 30 Hours

References:

5. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel"s Textbook of practical organic chemistry", LBS Singapore (1994).
6. 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.
7. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New Yor (2001).
8. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

1901GE253	BASIC WORKSHOP LABORATORY	L	T	P	C
		0	0	2	1

List of Experiments

1. Forming of simple object in sheet metal using suitable tools (Example: Dust Pan, Soap Box, Aluminum Cup, etc).
2. Prepare V (or) Half round (or) Square (or) Dovetail joint from the given mild Steel flat.
3. Prepare simple components using arc and gas weldings
4. Making a simple component using carpentry power tools. (Example: Electrical switch Box/Tool box/ Letter box.
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.
6. Rapid Prototyping

REFERENCES: Lab manual

TOTAL: 30 Hours

1901GEX52	COMPUTER PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

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

References:

1. Paul Deitel and Harvey Deitel, ―C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, ―Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, ―Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, ―Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.

1901HSX51	COMMUNICATION SKILL LABORATORY	L	T	P	C
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List of Experiments:

1. **Activities on Fundamentals of Inter-personal Communication**

Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals.

2. **Activities on Reading Comprehension**

General Vs Local comprehension, reading for facts, guessing meanings from context, Scanning, skimming, and 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/ Proposal writing/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.- creative and critical thinking.

5. **Activities on Soft 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-Timemanagement-stress management –paralinguistic features- Multiple intelligences – emotionalintelligence – spiritual quotient (ethics) – intercultural communication – creative and critical.

Total: 30 Hours

References:

1. Raman, Meenakshi and Sangeetha Sharma, “Technical Communication: Principles and Practice”, Oxford University Press, New Delhi, 2011.
2. Sudha Rani, D , “Advanced Communication Skills Laboratory Manual” , Pearson Education 2011.
3. Paul V. Anderson ,“Technical Communication”,. Cengage Learning pvt. Ltd. New Delhi, 2007.
4. “English Vocabulary in Use series”, Cambridge University Press 2008.
5. “Management Shapers Series” ,Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Rizvi and Ashraf M., “Effective Technical Communication”, Tata McGrawHill, New Delhi, 2005.
7. Jones, D, “The Pronunciation of English”, CUP, . Cambridge,2002.

1901GE252	ENGINEERING INTELLIGENCE II	L	T	P	C
		0	0	2	1

MODULE I **VOCABULARY BULIDING** **6 hours**

Parts of Grammar- SVA- Art of Writing- word building activities

MODULE II **COMMUNICATION WORKSHOP** **6 Hours**

Story Telling- Newspaper Reading-Extempore

MODULE III **INTERPERSONAL SKILLS** **6 Hours**

Personality Development - Creativity and innovation –Critical Thinking and Problem Solving – Work Ethics-Technical Skill Vs Interpersonal Skills

MODULE IV **LEADERSHIP& EMPLOYABILITY SKILLS** **6 Hours**

Levels of Leadership-Making of a leader-Type of leadership-Transactions Vs Transformational Leadership –Exercises - Industry Expectations & Career Opportunities- Recruitment patterns.

MODULE V **RESUME BUILDING** **6 Hours**

Importance of Resume- Resume Preparation - introducing onself

TOTAL: 30 Hours

REFERENCES:

1. Barun K. Mitra; (2011), *"Personality Development & Soft Skills*", First Edition; Oxford Publishers.
2. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007
3. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017

1701MA301 ENGINEERING MATHEMATICS III **L T P C**
(Common to B.E - Civil, CSE, EEE, Mech **3 2 0 4**
B.Tech- IT Degree Programmes)

PREREQUISITE :

1. Engineering Mathematics I
2. Engineering Mathematics II

COURSE OBJECTIVES:

1. To introduce Fourier series analysis and applications in Engineering, apart from its use in Solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time Systems.

COURSE OUTCOMES:

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

CO1 Use Fourier series analysis which is central to many applications in engineering(K3)
CO2 Apply Fourier transform techniques used in wide variety of situations(K3)
CO3 Compute the solution of partial differential equations(K3)
CO4 Solve boundary value problem using partial differential equation(K3)
CO5 Apply Z transform techniques for discrete time systems(K3)

UNIT I FOURIER SERIES **12 Hours**

Dirichlet‘s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Perceval’s identity – Harmonic analysis – Simple Applications

UNIT II FOURIER TRANSFORMS **12 Hours**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s identity

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Formation of partial differential equations – Singular integrals — Solutions of standard types of first order partial differential equations – Lagrange‘s linear equation — Linear partial differential equations of second order with constant coefficients of homogeneous type- Applications

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12 Hours**

Classification of PDE – Solutions of one dimensional wave equation – One dimensional equation of heat Conduction – Steady state solution of two-dimensional equation of heat conduction.

UNIT V Z – TRANSFORMS AND DIFFERENCE EQUATIONS **12 Hours**

Z - Transforms – Elementary properties – Inverse Z – transform (using partial fraction and residues) – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Linear Algebra
2. Numerical Solution of non-homogeneous partial differentialequations

REFERENCES:

1. Veerarajan. T., ‐Transforms and Partial Differential Equations‖, Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012
2. Grewal. B.S., ‐HigherEngineering Mathematics‖, 42ndEdition, KhannaPublishers,Delhi, 2012.
3. Bali.N.P and Manish Goyal, ―A Textbook of Engineering Mathematics‖, 7th Edition, Laxmi Publications Pvt. Ltd , 2007
4. Ramana.B.V., ‐Higher Engineering Mathematics‖, Tata McGrawHill Publishing Company Limited, New Delhi, 2008.
5. Narayanan.S., Manicavachagom Pillay.T.K and Ramanaiah.G ‐Advanced Mathematics for Engineering Students‖ Vol. II & III, S.Viswanathan Publishers Pvt. Ltd. 1998.
6.www.nptelvideos.in/2012/11/mathematics-iii.html

1702EE301 ELECTRON DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Semiconductor Physics and Devices
2. Electric Circuit Analysis

COURSE OBJECTIVES:

1. To understand the structure and operation of electronic devices
2. To explain the operation and characteristics of electronic circuits
3. To analyze the BJT and FET based amplifier circuits

COURSE OUTCOMES:

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

CO1: Explain the structure, operation and V-I Characteristics of Diodes(K2).

CO2: Describe the V-I characteristics of BJT in CB,CE & CC configurations also able to design and analyze amplifier circuits containing BJT as a device (K2).

CO3: Discuss the structure, operation and V-I characteristics of FET also able to design and analyze amplifier circuits containing FET as a device. (K2).

CO4: Explain the need and operation of differential amplifiers, single tuned amplifiers and power amplifiers able to analyze differential and single tuned amplifiers. (K2)

CO5: Analyze negative feedback amplifiers to determine necessary expressions & RC, LC and Crystal Oscillators to find out frequency of oscillations(K2)

UNIT I DIODES **9 Hours**

PN Junction Diode – structure, operation and V-I characteristics; capacitance effect – diffusion capacitance and transition capacitance; diode model; operation of clippers & clampers.

Zener Diode – V-I Characteristics, breakdown mechanism; application – voltage regulator.

Special Function Devices – Structure and operation of LED, Laser diode, Tunnel diode, Schottky diode and Photodiode.

UNIT II BIPOLAR JUNCTION TRANSISTOR CIRCUITS **9 Hours**

BJT – Structure, operation, V-I characteristics of common base, common emitter and common collector configurations; DC and AC load line analysis; determination of Q point; biasing circuits; small signal model – analysis of CB, CE and CC amplifiers; low and high frequency response of an amplifier; Darlington Amplifier and thermal run away/ secondary breakdown.

UNIT III FIELD EFFECT TRANSISTOR CIRCUITS **9 Hours**

JFET – Structure, operation – n channel and p channel, V-I characteristics and biasing circuits of JFET. **MOSFET** – Structure and operation of D-MOSFET & E-MOSFET, V-I characteristics, biasing circuits, small signal mode – analysis of common source and common drain amplifier, high frequency equivalent circuit;
Comparison of devices.

UNIT IV DIFFERENTIAL AND POWER AMPLIFIERS **9 Hours**

Differential Amplifier – Common mode and difference mode analysis of BJT based differential amplifier. **Single Tuned Amplifiers** – Gain and frequency response of single tuned BJT and FET amplifier; neutralization methods.
Power Amplifiers – Class A, class B, class C and class AB Amplifiers (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS **9 Hours**

Negative Feedback – Voltage series, current series, current shunt and voltage shunt amplifiers – Input impedance, output impedance, current gain, voltage gain, overall current gain and overall voltage gain.

Positive Feedback – Barkhausen criterion; RC oscillators – RC phase shift and Wien bridge oscillators; LC oscillators – Hartley, Colpitts and Clapp; Crystal oscillators – Miller and Pierce crystal oscillators.

FURTHER READING / CONTENT BEYOND SYLABUS / SEMINAR : **TOTAL: 45 HOURS**

1. Multistage Amplifiers
2. Design of Multi vibrators using BJT

REFERENCES:

1. Milman, Halkias and satyabrata Jit, ―Electronic Devices and Circuits‖ 4th Edition, McGraw Hill Pvt. Ltd., 2015.
2. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory‖, 11th Edition, PHI Ltd., 2015.
3. David A. Bell, ―Electronic Devices and Circuits‖, 5th Edition, Oxford University Press, 2008.
4. Thomas L. Floyd, ―Electronic Devices‖, 10th Edition, An Imprint of Mc Millan publishing company, 2017.
5. Prof. A. N. Chandorkar., IIT Bombay online lecture series on Analog Electronics
ttp://nptel.ac.in/courses/117101106/
6.Prof.S.Karmalkar,IIT Madras, online lecture series on Solid State Devices
http://nptel.ac.in/courses/117106091/
7.https://onlinecourses.nptel.ac.in/noc18_ee32/preview

1702EE302 DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Applied Physics for Engineers
2. Electric Circuit Analysis

COURSE OBJECTIVES:

1. To study the fundamentals of digital systems, programmable logic devices and logic families.
2. To design and analyze digital systems.
3. To apply the digital simulation techniques for application oriented digital circuits.

COURSE OUTCOMES:

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

CO1 Solve digital system problems using number systems, binary codes, logic gates and Boolean algebra(K3)

CO2 Apply Boolean laws and Karnaugh map to reduce the switching functions(K3)

CO3 Construct combinational logic circuits using logic gates and multiplexers(K3)

CO4 Build synchronous sequential logic circuits using excitation table, stable table and state diagrams(K3)

CO5 Construct asynchronous sequential logic circuits using flow table, transition table, state assignment and state reduction techniques (K3)

CO6 Implement Boolean functions and combinational logic circuits using memories, programmable logic devices and logic families (K3).

UNIT I NUMBER SYSTEM AND BOOLEAN ALGEBRA 9 Hours

Review of number system, Types and conversion codes , BCD, Gray code, Excess 3 code; Error detection and correction codes – Parity ,Hamming codes; Boolean algebra – De Morgan's theorem ,switching functions and Simplification using K-maps.

UNIT II COMBINATIONAL CIRCUITS 9 Hours

Design using logic gates – Design of adders, subtractors, comparators; code converters – encoders, decoders; Multiplexers and de-multiplexers– Function realization using multiplexers; Booth multiplier and Array Multiplier.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9 Hours

Flip flops – SR, JK, Master Slave JK and D flip flop, T flip flop; Analysis of synchronous sequential circuits – Design of synchronous sequential circuits, Counters; state diagram – state reduction – state assignment.

Unit IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9 Hours

Analysis of asynchronous sequential machines – State assignment, Asynchronous design problem.

UNIT V MEMORY DEVICES, PROGRAMMABLE LOGIC DEVICES AND LOGIC FAMILIES 9 Hours

Memories – ROM, PROM, EPROM ; Programmable Logic Devices – PLA, PAL, PLD ; Logic families: TTL, ECL, CMOS; Case study on four-bit accumulator.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Introduction to VHDL programming
2. Hazards in Asynchronous sequential circuits

REFERENCES:

1. M. Morris Mano, ―Digital Logic and Computer Design‖, Prentice Hall of India, 4th edition, 2013.
2. A.Anand kumar, ―Fundamentals of digital circuits‖, 3rd Edition, PHI Learnings Pvt. Ltd, 2014.
3. Malvino and Leach, Digital Principles and Applications, Tata McGraw Hill, New Delhi, 7th edition, 2011.
4. Floyd, Digital Fundamentals, Pearson Education, 10th edition, 2011.
5. John F.Wakerly, Digital Design Principles and Practice, Pearson Education, 4th edition, 2008.
6.http://nptel.ac.in/courses/117106086/

1702EE303 ELECTROMAGNETIC THEORY

L	T	P	C
3	2	0	4

PREREQUISITE :

1. Vector Calculus.
2. Electric Circuit Analysis.

COURSE OBJECTIVES:

1. Understand the concepts of vectorcalculus
2. Understand the principles of electric and magneticfields
3. Comprehend the concepts of electromagneticwaves

COURSE OUTCOMES:

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

CO1 Explain the basics of electromagnetism, gauss law, coulomb's law, ampere law and thermos of divergence, stokes and pointing.(K2)

CO2 Make use of vector, gradient, divergence, curl in electrostatics and magneto statics. (K3)

CO3 Correlate gauss law, coulomb is law for calculating the charges, forces, field intensity and flux density for a finite, infinite, circular line and boundary condition in an electric field.(K3)

CO4 Correlate gauss law, coulomb's law for calculating the charges, forces, field intensity and flux density or a finite, infinite, circular line and boundary condition in a magnetic field.(K3)

CO5 Determine the Maxwell's equation, wave equation for a time varying field. (K2)

UNIT I INTRODUCTION TO VECTOR CALCULUS 12 Hours

Introduction- scalar and vector fields; different coordinate systems-Cartesian, cylindrical ,spherical coordinate system; divergence theorem; Stroke's theorem; Coulomb's law, Gauss law and its applications.

UNIT II STATIC ELECTRIC FIELDS 12 Hours

Electric field intensity-field due to different types of charges, electric flux density; electric potential due to uniformly charged infinite line, electric potential due to charged circular disc; potential gradient, dipole, field due to dipole; energy density in electrostatic field; electric boundary conditions (between two perfect dielectric and between free space and conductor), capacitance-concept of capacitance, capacitance of two dielectric media and three dielectricmedia.

UNIT III MAGNETOSTATICS 12 Hours

Biot-savart law- applications (infinite and finite long straight conductor, circular loop); Ampere circuital law-applications (infinite long straight conductor, coaxial cable); curl of magnetic field intensity; magnetic flux and magnetic flux density; scalar and vector magnetic potentials; magnetic boundary conditions (between two Perfect dielectric and between free space and conductor).

UNIT IV FORCE, TORQUE AND INDUCTANCE 12 Hours

Lorentz force equation; force between differential current elements; force and torque on a closed circuit; the nature of magnetic materials; magnetization and permeability; self-inductance and mutual inductance-solenoid, Toroid.

UNIT V MAXWELLS EQUATIONS AND TIME VARYING FIELDS 12 Hours

Maxwell's equations for steady fields in point form and integral form; Faraday's law; displacement current; Maxwell's equations in point form and integral form for time-varying field's; comparison of field theory and circuit theory; Poynting theorem, Poynting vector.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. A Seminar on wave propagations in free space, in a conducting medium, dielectric mediums
2. A report on EMI study in home appliances

REFERENCES:

1. William H.Hayt, _Engineering Electromagnetics', Tata McGraw Hill, 2005.
2. Mathew N. O. SADIKU, Elements of Electromagnetics', Oxford University press Inc., seventh edition, 2018.
3. Joseph. A.Edminister, _Theory and Problems of Electromagnetics', Second edition, Schaum Series, Tata McGraw Hill, 1995.
4. AshutoshPramanik, _Electromagnetism – Theory and Applications', Prentice-Hall of India Private Limited, New Delhi, 2006.
5. Kraus and Fleish, _Electromagnetic with Applications', McGraw Hill International Editions, Fifth Edition, 1999.
6. https://onlinecourses.nptel.ac.in/noc18_ee04/preview

1702EE304 POWER PLANT ENGINEERING

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Basic Mechanical Engineering
2. Applied Chemistry

COURSE OBJECTIVES:

1. To have a detailed knowledge about energy sources available and their management.
2. To understand layout of various power plants and the function of various components of the Power plant.
3. To become familiar with operation of various power plants.

COURSE OUTCOMES:

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

CO1 Understand the construction and operation of Thermal power plants.(K2)
CO2 Select the suitable turbine for hydro power plants. (K2)
CO3 Identify the required turbine, site for diesel and gas power plant. (K2)
CO4 Explain the reactor operation and selection of site in Nuclear power plant. (K2)
CO5 Describe the power generation from various renewable resources. (K2)

UNIT I COAL BASED THERMAL POWER PLANTS **9 Hours**

Layout of modern coal power plant; types of boiler; super critical boilers, FBC boilers; Turbines; condensers; steam and heat rate; subsystems of thermal power plants – fuel and ash handling, draught system, feed water Treatment; Energy Scenario – National, international context.

UNIT II HYDRO POWER PLANTS **9 Hours**

Introduction to hydro power plant – layout of dams; types, selection of water turbine, advantages and Disadvantages; selection of site for hydro power plant; pumped storage hydro power plant.

UNIT III DIESEL AND GAS POWER PLANTS **9 Hours**

Types, open and closed cycle gas turbine, work output & thermal efficiency; inter cooling – regeneration - Advantages and disadvantages; Diesel engine power plant - component and layout.

UNIT IV NUCLEAR POWER PLANTS **9 Hours**

Basics of nuclear energy - layout and subsystems of nuclear power plants, nuclear fission and fusion; types of reactor, working of nuclear reactors, boiling water reactor (BWR), pressurized water reactor(PWR), Canada deuterium- uranium reactor (CANDU), breeder, gas cooled reactors; safety measures for nuclear power plants.

UNIT V POWER FROM RENEWABLE ENERGY **9 Hours**

Typical layout and associated components including turbines; Principle; Construction and working of wind, tidal, solar photo voltaic, solar thermal, geo thermal, biogas.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. MHD/OTEC power plants
2. New and alternate energy sources

REFERENCES:

1. P.K. Nag, –PowerPlantEngineering,Tata McGraw-HillPublishing CompanyLtd., Third Edition, 2014.
2. M.M. El-Wakil, –PowerPlantTechnology‖, Tata McGraw-HillPublishing CompanyLtd., 2010.
3. Black &Veatch,–PowerPlantEngineering‖Springer, 1996.
4. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, ―Standard Handbook of Power Plant Engineering‖ Third Edition, McGraw-Hill, 2004.
5. Godfrey Boyle, ―Renewable energy‖ Oxford University Press in association with the Open University, 2004.

1702EE305 ELECTRICAL MACHINERY - 1

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Electric Circuit Analysis
2. Basic Electrical Engineering

COURSE OBJECTIVES:

1. Understand the basic concepts behind the rotating and stationary machines.
2. Evaluate the performance characteristics of DC Generator and DC Motor
3. Explain the different types of Transformers, their working principle and performance

COURSE OUTCOMES:

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

CO1 Understand the operation characteristics of DC machines(K2)
CO2 Understand the operation characteristics of Transformer(K2)
CO3 Analyze the performance parameters of DC machine and Transformer(K3)
CO4 Elucidate the applications of transformer(K3)
CO5 Apply the different testing methods to assess the performance of Electrical machines(K3)

UNIT I INTRODUCTION TO MACHINERY CONCEPTS 9 Hours

Magnetic circuits; flux; Inductance; Dynamically and Statically induced EMF; Properties of Magnetic materials;Lossesinmagneticmaterials,ACoperationofmagneticmaterials;PrinciplesofElectromechanical Energy conversion - Energy conversion through magnetic field and electric field.

UNIT II DC GENERATOR 9 Hours

Principle, Construction and Working of DC generator; EMF equation; Classification; Armature reaction; Commutation; Compensating winding; Generator characteristics.

UNIT III DC MOTOR 9 Hours

Principle of operation; Back EMF of DC motors; Classification; Torque equation; Speed-torque characteristics; Winding diagram; Motor starters; Braking methods; Introduction to permanent magnet DC motor.

UNIT IV TRANSFORMER 9 Hours

Transformer-Principle, construction, Ideal transformer, Equivalent circuit, Phasor diagram, Parallel operation of Transformers; Three phase transformer connections-Tertiary winding; Voltage regulation; Inrush current; Per unit representation; Autotransformer.

UNIT V TESTING & APPLICATIONS OF ELECTRICAL MACHINES 9 Hours

Efficiency and Losses in Electrical machines; DC motor testing- Swinburne‘s test, Brake test, Hopkinson test- Transformer testing- Sumpner‘s test, Polarity test; Selection of DC Motors; Applications of DC motors; Applications of transformers.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. DC motors in everyday life.
2. Applications of transformer in home and industries.

REFERENCES:

1. D. P. Kothari and I. J. Nagrath, Electric Machines, Tata McGraw Hill Publishing Company Ltd, 2010.
2. Edward Hughes, Electrical and Electronic Technology, 12th edition, Pearson, 2016.
3. P. S. Bimbhra, Electrical Machinery, Khanna Publishers, 7th edition, 2011.
4. B. L. Theraja and A. K. Theraja, ―Text Book of Electrical Technology: AC & DC Machines (Volume- 2)‖, S.Chand & Company Ltd., New Delhi, 2008.
5. M.N.Bandyopadhyay, Electrical Machines Theory and practice, PHI Learning Pvt. Ltd, New Delhi 2007.
6. Electrical Machines-I Nptel lecture video by Dr. D.Kastha, IIT Kharagpur

1702EE351 ELECTRICAL MACHINERY LABORATORY - 1

L	T	P	C
0	0	4	2

PREREQUISITE :

1. Study of Electrical circuits
2. Basics of rotating and static machinery concepts

COURSE OBJECTIVES:

1. Complete the circuit to test a given electrical machine.
2. Analyze the performance characteristics of various electrical machines
3. Evaluate the performance of transformer

COURSE OUTCOMES:

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

CO1 Draw the circuits for a given electrical machine (k2).

CO2 Obtain the performance characteristics of DC Generators.(K3)

CO3 Analyze the operating behavior of DC motors under various loading condition. (K3)

CO4 Obtain the equivalent circuit parameters of transformer(K3)

CO5 Know the different starting and control measures involved in the operation of electrical machines. (K2)

LIST OF EXPERIMENTS:

1. Study of DC Motor starters
2. Study of DC motor windings.
3. Study of three phase transformer connections
4. Swinburne‘s test and Load test on DC shunt motor.
5. Load test on DC series motor
6. Load test on DC compound motor
7. Speed control of DC shunt motor (Field control & armature control method)
8. Open circuit and load characteristics of DC shunt generator
9. Open circuit and short circuit test on single phase transformer
10. Open circuit and short circuit test on three phase transformer
11. Load test on single/three phase transformer
12. Separation of core losses on single phase transformer

TOTAL: 60 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Cut view study of DC motor.
2. Sumpner‘s test on single phase transformer.

REFERENCES:

1. B.A.Naveen Antony, ―Electrical Machinery laboratory-1 Manual‖, 2018.

2. D.P. Kothari & B.S. Umre, Laboratory Manual for Electrical Machines, I.K. International publishing house Pvt. Ltd., 2013.

3. B. L. Theraja and A. K. Theraja, ―Text Book of Electrical Technology: AC & DC Machines – Volume 2‖, S.Chand & Company Ltd., New Delhi, 2008.

1702EE352 ELECTRON DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	2	1

PREREQUISITE:

1. Semiconductor Physics and Devices
2. Electric Circuit Analysis

COURSE OBJECTIVES:

1. To analyze V-I Characteristics of different switches
2. To Design a transistor based amplifier circuits
3. To understand the operations of Digital Storage Oscilloscope.

COURSE OUTCOMES:

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

CO1 Illustrate the turn on and turn off process of different switches (K3)
CO2 Design a circuit, which is used to convert ac signal to dc signal (K4)
CO3 Determine voltage gain from CE and CB configurations (K3)
CO4 Determine the frequency and gain value of various types of oscillators and amplifiers.(K3)
CO5 Study and understand the operation of digital storage oscilloscope(K2)

LIST OF EXPERIMENTS:

1. Study on data sheets of electronic devices.
2. Study of digital storage oscilloscope.
3. Characteristics of PN junction diode and Zener diode.
4. Design a half wave and full wave rectifier with and without capacitive filter.
5. Design of Clipper and Clamper circuit.
6. Verify the V-I characteristic of photo diode and phototransistor.
7. Characteristics of CE and CB configurations.
8. Design and verify the frequency response of single stage transistor amplifier.
9. Characteristics of JFET /MOSFET.
10. Design and verify the frequency response of RC phase shift oscillator.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Design of transistor based differential amplifier
2. Design of monostable multivibrators

REFERENCES:

1. K. Krishnaram, ―Electronic Devices and Circuits – Lab Manual‖2018.
2. Milman, Halkias and SatyabrataJi,–ElectronicDevicesandCircuits‖4th Edition, McGraw Hill Education (India) Private Ltd, 2015.
3. Thomas L. Floyd, Electronic Devices, 10th Edition, an Imprint of McMillan Publishing Company, 2017.

1704GE351 LIFE SKILLS : SOFT SKILLS **L T P C**

(Common to all B.E / B.Tech Degree Programmes) **0 0 2 1**

PREREQUISITE :

1. Technical English
2. Communicative English

COURSE OBJECTIVES:

1. To develop the students basic soft skills and enable them to get a job.
2. To develop the students 'interpersonal skills and to enable them to respond effectively.
3. To develop the students selling skills and to enable them to apply in their interview process.
4. To develop the students 'Corporate Etiquettes and enable them to respond effectively.
5. To develop the students 'learning by practice of giving different situations.

COURSE OUTCOMES:

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

CO1 Communicate effectively in their business environment.
CO2 Improve their interpersonal skills, which are mandatory in a corporate world.
CO3 Brand themselves to acquire a job.
CO4 Involve in corporate etiquettes.
CO5 Survive in the different situations.

UNIT I INTRODUCTION TO SOFT SKILLS **6 Hours**

Soft Skills an Overview - Basics of Communication – Body Language – Positive attitude –Improving Perception and forming values – Communicating with others.

UNIT II TEAM Vs TRUST **6 Hours**

Interpersonal skills – Understanding others – Art of Listening - Group Dynamics – Networking - Individual and group presentations - Group interactions – Improved work Relationship.

UNIT III SELLING ONESELF **6 Hours**

How to brand oneself – social media – job hunting – Resume writing – Group Discussion – Mock G.D - .Interview skills – Mock Interview

UNIT IV CORPORATE ETIQUETTES **6 Hours**

What is Etiquette – Key Factors – Greetings – Meeting etiquettes – Telephone etiquettes – email etiquettes – Dining etiquettes – Dressing etiquettes – Rest room etiquettes – Life etiquettes.

UNIT V LEARNING BY PRACTICE **6 Hours**

1. My family. Myself. 2. Meeting people. Making Contacts. 3. A city. Getting about town. 4. Our flat. Home life.5. Travelling. Going abroad. 6. Going through Customs. 7. At a hotel. 8. Shopping. 9. Eating out. 10. Making a phone call. 11. A modern office.12 Discussing business.

TOTAL: 30 HOURS

ASSSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

REFERENCES:

1. Dr.K.Alex, _Soft Skills' Third Edition, S.Chand & Publishing Pvt. Limited, 2009
2. Aruna Koneru, _Professional Communication' Second Edition, Tata McGraw-Hill Education, 2008
3. D.K.Sarma, _You & Your Career' First Edition, Wheeler Publishing & Co Ltd, 1999
4. Shiv Khera _You Can Win' Third Edition, Mac Millan Publisher India Pvt. Limited, 2005

1701MA403	NUMERICAL METHODS AND STATISTICS (Common to B.E - Civil, EEE and Mech.)	L	T	P	C
		3	2	0	4

PREREQUISITE:

1. Engineering Mathematics I
2. Engineering Mathematics II
3. Engineering Mathematics III

COURSE OBJECTIVES:

1. To sole the engineering problem, by use of numerical tools 2.To understand the concept of interpolation
3. To analyze the population and samples using statistics techniques

COURSE OUTCOMES:

After completion of the course, Students will be able to

CO1: Find the intermediate values, when huge amounts of experimental data are involved (K3)
CO2: Solve first order differential equation using Numerical methods (K3)
CO3: Perform Integration using Numerical methods (K3)
CO4: Solve algebraic and transcendental Equations numerically (K3)
CO5: Analyses the statistical data (K3)

UNIT I **INTERPOLATION AND APPROXIMATION** **12Hours**

Interpolationwithunequalintervals-Lagrange'sinterpolation–Newton's divided difference interpolation– Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT II **NUMERICAL DIFFERENTIATION** **12 Hours**

Approximation of derivatives using interpolation polynomials-Taylor's series method – Euler's method -Modified Euler's method-Fourth order Runge-Kutta method for solving first order equations

Unit III **NUMERICAL INTEGRATION** **12 Hours**

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 **SOLUTION OF ALGEBRAIC AND TRANSCENDENTALEQUATIONS** **12Hours**

Solution of algebraic and transcendental equations - Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel

UNIT V **TESTING OF HYPOTHESIS** **12Hours**

Large sample test based on Normal distribution for single mean and difference of means - Tests based on t and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Finding Eigen value using power method
2. Cubic Spline

REFERENCES:

1. Johnson R.A.Gupta C. B, Miller and Freunds Probability and statistics for Engineers, 7th edition ,Pearson Education,2007
2. Grewal B.S and Grewal J.S, Numerical methods in Engineering and Science, 6th edition,Khanna puplishers,2004
3. Walpole R.E. Myers S.L, Ye.K, Probability and statistics for Eng. and scientists, 8th edition Pearson education,2007
4. Gerald C.F Wheatley P.O, Applied Numerical Analysis, 6th edition ,Pearson education Asia2006
5. Nptel.ac.in/courses/111105035,www.nptelvideos.in/2012/11/Mathematics.html
6. www.learnerstv.com/Free-maths-video lectures -ltv348-page1.html
7. www.indiastudychannel.com

1702EE401	MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

PREREQUISITE :

1. Semiconductor Physics and Devices
2. Electron Devices and Circuits

COURSE OBJECTIVES:

1. To learn the measuring instrument characteristics and also to calculate different parameters of Instruments.
2. To empower students to understand the working of electrical equipment used in everyday life.
3. To understand the necessary of modern tools in electrical industry.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Describe the basic functional elements of measuring instruments and the errors in the measurements systems(K2)

CO2: Discuss the operation and applications of measuring instrument under typical environment (K2).

CO3: Identify the unknown values of resistor, inductor and capacitor of given network using suitable bridge circuit (K3) .

CO4: Explain the construction and working principle of various storage and display devices(K2)

CO5: Make use of sensor and transducers in measuring purpose using data acquisition system(K3)

UNIT I INTRODUCTION OF MEASURING INSTRUMENTS 9 Hours

Classification of measuring instruments; Functional elements of an instrument ; Static and dynamic characteristics ; loading effect of ammeter and voltmeter; Errors in measurement - Gross, Systematic and Random errors; Statistical Evaluation of measurement data; Standards - International, primary, secondary and working standard, calibration – A case study in calibration of measuring instruments.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9 Hours

Principle and types of analog and digital voltmeters, ammeters, multimeters,; Single phase and three phase wattmeter and energy meter; Determination of B-H curve; Instrument transformers-current and potential Transformer; comparison of CT and PT; Instruments for measurement of frequency – vibrating read type, electrical resonance type, and Weston frequency meter; Megger.

UNIT III COMPARISON METHODS OF MEASUREMENTS 9 Hours

D.C & A.C potentiometers; D.C bridges –Wheatstone and Kelvin bridges; A.C bridges-Maxwell bridge, Anderson bridge, Hays bridge, and Schering bridge, self-balancing bridges; Interference & screening – Multiple earth and Earth loops; Electrostatic and electromagnetic interference; Grounding techniques.

UNIT IV STORAGE AND DISPLAY DEVICES 9 Hours

Recorders - X-Y recorders and digital plotters; CRT display- digital CRO; LED and LCD display; Power quality Analyzer.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9 Hours

Classification of transducers -Selection of transducers, Resistive, capacitive, inductive transducers, Piezoelectric and Hall effect transducers:Elementsofdataacquisitionsystem;DataLoggers;A/D,D/Aconverters;Smart Sensors.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Measurement of wind energy using anemometers.
2. Measurement of air pressure using barometers.

REFERENCES:

1. A.K. Sawhney, „A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & Co,2004.
2. J. B. Gupta, „A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 2003.
3. H.S. Kalsi, „Electronic Instrumentation", Tata McGraw Hill, II Edition 2004.
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
6. nptel.ac.in/syllabus/108106070/

1702EE402	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

PREREQUISITE :

1.Electric circuit Analysis

2.Electronic Devices and Circuits

COURSE OBJECTIVES:

1. To understand the fundamentals and fabrication of ICs.
2. To explain the functions, characteristics and applications of op. amp.
3. To describe operation of signal converters, special function ICs and voltage regulators.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Explain the fundamentals of IC technology and fabrication of diode, capacitance, resistance, FET and typical circuits. (K3)

CO2 Describe the functional block diagram, performance parameters and frequency compensation techniques of operational amplifier (K3).

CO3 Construct analog circuits using operational amplifiers for linear applications. (K3)

CO4 Construct analog circuits with operational amplifiers for non-linear applications. (K3)

CO5 Build signal converters using operational amplifiers. (K3)

CO6 Design timer and voltage regulator circuits using special function ICs(K3)

UNIT I FABRICATION OF INTEGRATED CIRCUITS **9 Hours**

IC classification, fundamental of monolithic IC technology; Epitaxial growth, masking and etching, diffusion of Impurities; realization of monolithic ICs and packaging; fabrication of diodes, capacitance, resistance and FET.

UNIT II OPERATIONAL AMPLIFIER **9 Hours**

Op. amp. introduction - functional block diagram, ideal and practical op-amp characteristics, CMRR, open loop Gain, slew rate, transfer characteristics, input bias and output offset voltage, offset compensation techniques, frequency response characterization, and frequency compensation.

UNIT III APPLICATIONS OF OPERATIONAL AMPLIFIER **9 Hours**

Inverting and non-inverting amplifiers, voltage follower, summing amplifier, differential amplifier, instrumentationamplifier;comparators;integratoranddifferentiator;sinusoidaloscillators-phaseshift,Wein Bridge& Hartley; sample and hold circuit; clipper and clamper; Schmitt trigger.

UNIT IV SIGNAL CONVERTERS **9 Hours**

V/F and F/V converters; V/I and I/V converter; D/A converter - weighted resistor type, R-2R ladder type; A/D Converters- flash type, successive approximation type, single slope type, dual slope type, A/D converter using voltage-to-time conversion.

UNIT V SPECIAL FUNCTION INTEGRATED CIRCUITS **9 Hours**

555 Timer - functional block diagram and description, monostable and astable operation; 566 voltage controlled oscillator; 565 PLL - functional block diagram, principle of operation, characteristics; IC voltage regulators – regulation, need for voltage regulation; LM78XX, 79XX fixed voltage regulators; LM 317 & LM723; Interpretation of IC data sheets.

Total: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Interpretation of data sheets of an OPAMP
2. Active filters

REFERENCES:

1. D Roy Choudhury and Sheil B.Jani, “Linear Integrated Circuits” 4th Edition, New Age International, New Delhi, 2014.
2. S Salivahanan and V S Kanchana Bhaaskaran, “Linear Integrated Circuits”, 2nd Edition, McGraw-Hill Education, 2014.
3. Ramakant A.Gayakward, “Op-amps and Linear Integrated Circuits”, 4th Edition, PHI Learnings, 2003.
4. B Somanathan Nair, “Linear Integrated Circuits: Analysis, Design and Applications”, Wiley, 2009.
5. Floyd and Buchla, “Fundamentals of Analog Circuits”, Pearson, 2013.
6. http://nptel.ac.in/courses/117107094/

1702EE403 **TRANSMISSION AND DISTRIBUTION** **L T P C**
3 2 0 4

PREREQUISITE :

1. Power Plant Engineering
2. Electric circuit analysis

COURSE OBJECTIVES:

1. To understand the structure of power system, insulators, cables and substation.
2. To develop expressions for various parameters related to transmission lines.
3. To obtain the equivalent circuits for the transmission lines to determine voltage regulation and efficiency.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Infer knowledge on the basics of transmission system of power system(K2)
CO2: Develop expressions for the computation of transmission line parameters(K3)
CO3: Obtain the voltage regulation and efficiency from the equivalent circuit of the transmission Lines(K3)
CO4: Compute the voltage distribution in insulator strings (K3)
CO5: Interpret the construction and parameters related to underground cable(K2)
CO6: Develop the transmission line and modern substation layout with grounding techniques(K3)

UNIT I **INTRODUCTION TO TRANSMISSION AND DISTRIBUTION SYSTEM** **12 Hours**

Structure of electric power system- Single line diagram, Typical standard specifications of transmission and distribution system; HVDC transmission - comparison between HVAC and HVDC; Substation and its types, Typical key diagram of a 11kV / 400V substation; feeders, distributors and service mains - radial and ring main systems; calculation of voltage in distributors with concentrated and distributed loads.

UNIT II **PARAMETERS OF TRANSMISSION LINE** **12 Hours**

Parameters of transmission lines; types of conductors; resistance, inductance and capacitance of single phase, three phase, symmetrical and unsymmetrical transposed conductors; self and mutual GMD; skin and proximity Effects; interference with neighboring communication circuits; corona discharges.

UNIT III **MODELLING AND PERFORMANCE OF TRANSMISSION LINES** **12 Hours**

Classification of lines - short line, medium line and long line; equivalent circuits, phasor diagram, attenuation Constant, phase constant, surge impedance; transmission efficiency and voltage regulation; real and reactive power flow in lines, surge impedance loading; methods of voltage control; Ferranti effect.

UNIT IV **INSULATORS AND UNDERGROUND CABLES** **12 Hours**

Insulators - types, potential distribution in insulator string, improvement of string efficiency, testing of insulators; underground cables - constructional features of LT and HT cables, capacitance of single-core cable, Grading of cables, power factor and heating, capacitance of 3- core belted cable; DC cables.

UNIT V **MECHANICAL DESIGN OF LINES AND GROUNDING** **12 Hours**

Mechanical design of transmission line; sag and tension calculations for different weather conditions; tower Spotting- types of towers; substation layout (AIS, GIS); methods of grounding.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Distribution automation
2. Distributed generation

REFERENCES:

1. C.L.Wadhwa, „Electrical Power Systems", New Academic Science Ltd, seventh edition 2017.
2. J.Brian, Hardy and Colin R. Bayliss, "Transmission and Distribution in Electrical Engineering" Newnes; 'Fourth Edition, 2012.
3. D.P.Kothari, I.J. Nagarath, "Power System Engineering", Tata McGraw-Hill Publishing Company limited, New Delhi, 2nd ed., 2008.
4. Hadi Saadat, „Power System Analysis, " PSA Publishing; Third Edition, 2010.
5. S. L. Uppal "Electrical Power" Khanna Publisher, 13th Edition , 1988
6. http://nptel.ac.in/courses/108108099/, http://nptel.ac.in/courses/108105053/2

1702EE404	ELECTRICAL MACHINERY-II	L	T	P	C
		3	0	0	3

PREREQUISITE :

1. Electrical Machinery-I.
2. Electromagnetic Field.

COURSE OBJECTIVES:

1. To impart the basic operation and construction of various AC machines.
2. To describe the performance of synchronous machine by different methods.
3. To analyze the performance characteristics and equivalent circuits of AC machines.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Investigate the percentage regulation of three-phase AC generator using various regulation methods(K3)

CO2: Inspect the performance characteristics of three-phase synchronous motor by conducting various test (K3).

CO3: Identify the performance characteristics of three-phase induction motor by conducting OC and SC test (K3).

CO4: Gain Knowledge about the concepts of starters & speed control methods (K2)

CO5: Describe the characteristics behavior of various types of single-phase induction motor and special machines (K2)

UNIT I SYNCHRONOUS GENERATOR **9 Hours**

Constructional details; types of rotors ;EMF equation; armature reaction ;parallel operation ;voltage regulation Methods – EMF, MMF, ZPF & ASA methods; two reaction theory; sliptest; capability curves.

UNIT II SYNCHRONOUS MOTOR **9 Hours**

Principle of operation; torque equation; V and Inverted V curves ;Power input and power developed equations; Starting methods; hunting; damper windings; synchronous condenser; Synchronous induction motor.

UNIT III THREE PHASE INDUCTION MOTOR **9 Hours**

Constructional details, types; principle of operation; rotating magnetic field; slip; equivalent circuit; Torque-Slip characteristics; torque equation; circle diagram; separation of losses; cogging and crawling; induction Generators; - double cage deep bar induction motors.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR **9 Hours**

Need for starting; types of starters – star delta starter, auto transformer starter, DOL starter; speed control – voltage control, frequency control, pole changing, cascaded connection, v/f control, slip power recovery scheme; Braking of three-phase induction motor.

UNIT V SINGLE PHASE INDUCTION MOTOR & FRACTIONAL HORSE POWERMOTOR **9 Hours**

Single phase induction motors ; rotating vs alternating magnetic field; double revolving field theory; Torque - speed characteristics; equivalent circuit; starting methods; hysteresis motor; stepper motor; universal motor; linear induction motor, brushless DC motor.

Total: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Role of poly phase induction machines in windmill power generation.
2. New alternator technology in hybrid vehicle.

REFERENCES:

1. Fitzgerald A.E,CharlesKingsley, Stephen. D.Umans, „Electric Machinery", Published byTata McGraw-Hill Education Pvt. Ltd. 2015, 6th Edison.
2. Kothari D.P and I.J. Nagrath, „Electric Machines", Published by Tata McGraw -Hill Education Pvt. Ltd, 2010, 5th Edison.
3. BhimbhraP.S, "Electrical Machinery"„Khanna Publishers, 7th Edition, 2003.
4. Bandyopadhyay M.N, "Electrical Machines Theory and Practice", PHI Learning PVT LTD., New Delhi, 2009
5. Charles's A. Gross, "Electric /Machines", CRC Press, 2nd Edition, 2010.

1702EC406 COMMUNICATION ENGINEERING

L	T	P	C
3	0	0	3

PREREQUISITE :NIL

COURSE OBJECTIVES:

1. To provide an introduction on different analog modulation and demodulation systems.
2. To know the principles of sampling & quantization.
3. To learn the various baseband transmission schemes.
4. To understand the various Band pass signaling schemes.
5. To become skilled at fundamentals of mobile and wireless communication technologies and its applications.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1:Explain the fundamental techniques of generations and detections for Amplitude, Frequency and Phase modulations(K2)

CO2:Construct a sampled and quantized signal for baseband transmission. (K3).

CO3:Describe the concepts of Digital modulation schemes for digital data transmission. (K3).

CO4:Apply cellular concepts in mobile communication networks(K3).

CO5:Make use of multiple access mechanisms of mobile communication networks(K3)

UNIT I AMPLITUDE MODULATION SYSTEMS 9 Hours

Need for modulation – Classifications of modulation techniques-Generation and detection: AM, DSBSC, SSB-SC, VSB-Comparison of Amplitude modulation systems- AM transmitters-AM receivers.

UNIT II ANGLE MODULATION SYSTEMS 9 Hours

Frequency modulation: Narrowband and wideband FM- Phase Modulation- Generation of FM signal: Direct FM, indirect FM- Demodulation of FM signals -FM stereo multiplexing- FM transmitters- FM receivers.

UNIT III SAMPLING AND QUANTIZATION 9 Hours

Sampling Process – Aliasing – Instantaneous sampling – Natural Sampling –Flat Sampling – Quantization of signals –sampling and quantizing effects –channel effects – SNR for quantization pulses – data formatting Techniques –Time division multiplexing.

UNIT IV DIGITAL TRANSMISSION 9 Hours

Baseband Transmission: Wave form representation of binary digits - PCM, DPCM, DM, ADM systems, Pass band Transmission: ASK, FSK, PSK, QPSK, DQPSK, MSK, QAM , Noise performance of ASK, FSK, PSK, QPSK, DQPSK, MSK, QAM

UNIT V CELLULAR COMMUNICATION 9 Hours

Introduction, Frequency reuse, Cell Assignment techniques, Hand off Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and capacity in cellular systems. Multiple Access techniques: FDMA, TDMA, CDMA, SDMA

Total: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Digital Communication Techniques
Advanced Wireless Communication

REFERENCES:

1. G.Kennedy and B.Davis, Electronic Communication Systems, fourth Edition, Tata McGraw-Hill -2008.
2. Simon Haykin, Communication Systems, John Wiley, 2001.
3. Simon Haykin, “Digital Communications”, John Wiley, 2006.
4. Amitabha Bhattacharya, “Digital Communication”, Tata McGraw Hill, 2006.
5. Rappaport. T.S., “Wireless Communications: Principles and Practices”, Second Edition, PHI, 2014

1702EE451 ELECTRICAL MACHINERY LABORATORY-II

L	T	P	C
0	0	4	2

PREREQUISITE :

Electrical Machinery Laboratory-I

COURSE OBJECTIVES:

1. To know the performance characteristics of induction motors.
2. To compare various regulation methods of Synchronous machines.
3. To study the characteristics of brushless DC motor.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Investigate various regulation methods of synchronous machines by conducting OCC and SCC test (K3)

CO2: Experiment on synchronous machines for obtaining performance characteristics by conducting V and inverted V curve test (K3).

CO3: Compute the performance characteristics of single phase and three-phase induction motor by conducting load, no load and blocked rotor test(K3)

CO4: Construct the characteristics of special machines (K3)

CO5: Study about various types of starters in AC motor (K2)

LIST OF EXPERIMENTS:

1. Study of AC motor starters
2. No load & blocked rotor test and Load test on single phase induction motor
3. No load & blocked rotor test and Load test on three phase induction motor
4. Separation of no load losses of three phase induction motor
5. Voltage regulation of an alternator by EMF,MMF method
6. Voltage regulation of an alternator by ZPF method
7. Voltage regulation of an alternator by ASA method
8. V & inverted V curve of three phase synchronous motor
9. Determination of Xd and Xq and regulation of salient pole alternator
10. Characteristic analysis of brushless DC motor

Total: 60 Hours

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Measurements of positive & negative sequence current in three phase alternator
2. Synchronization / Parallel operation of three phase alternator

REFERENCES:

1. Kothari. D.P & Umre. B.S “Laboratory manual for electrical machines”, I.K international Publishing House (P) Ltd. 2013 Edition
2. Suresh Babu. P.J, “Electrical Machinery Lab II Manual”, 2018.

1702EE452	ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Electronic Devices and Circuits Lab
2. Digital Electronics

COURSE OBJECTIVES:

1. To test the characteristics of Amplifiers
2. To design and testing of logic gates
3. To implement and characterizing the circuit behavior with digital and analog ICs

COURSE OUTCOMES:

After completion of the course, Student will be able

CO1: Apply various types of biasing and amplifier configuration (K3).

CO2: Use simplification techniques to design a combinational hardware circuit (K3)

CO3: Design and Implement combinational and sequential circuits (K3)

CO4: Design and Implement a simple digital system (K3)

CO5: Apply analog and digital electronic circuits (K3)

LIST OF EXPERIMENTS:

Frequency response of CE Amplifier
Darlington amplifier Using BJT
Implementation of Boolean functions, adder/ subtractor circuits.
Design and implementation of code converters using logic gates
Parity generator and parity checker
Design and implementation of encoder and decoder using logic gates
Construction and verification of 4 bit ripple counter
Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip-flops
Design and implementation of Multiplexer and De-multiplexer using logic gates
Timer IC application: Study of NE/SE 555 timer in astable and mono stable operation.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS:

1. IC voltage regulators
2. Real time applications using logic gates IC

REFERENCES:

1. Dr. T. Suresh Padmanabhan and K.Nandakumar, “Analog and Digital Integrated Circuits Manual”, 2018.
2. Integrated circuits: solution manual: analog digital circuits and systems manual by Jacob Millman.

1704GE451 LIFE SKILLS: VERBAL ABILITY

L	T	P	C
0	0	2	1

PREREQUISITE:

Technical English – I and II

COURSE OBJECTIVES:

1. To help students comprehend and use vocabulary words in their day-to-day communication.
2. To apply appropriate reading strategies for interpreting technical and non-technical Documents used in job-related settings.
3. To ensure students will be able to use targeted grammatical structures meaningfully and Appropriately in oral and written production.
4. To enable the students to arrange the sentences in meaningful unit and to determine whether constructions rely on active or passive voice.
5. To apply the principles of effective business writing to hone communication skills.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1: Use new words in their day-to-day communication.

CO2: Gather information swiftly while reading passages.

CO3: Students are proficient during their oral and written communication.

CO4: Rearrange the sentences and able to identify the voice of the sentence.

CO5: Students use their knowledge of the best practices to craft effective business documents

UNIT I VOCABULARY USAGE **6 Hours**

Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity.

UNITII COMPREHENSION ABILITY **6 Hours**

Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages – Theme detection – Deriving conclusion from passages.

UNIT III BASIC GRAMMAR AND ERROR DETECTION **6 Hours**

Parallelism – Redundancy – Ambiguity – Concord - Common Errors – Spotting Errors – Sentence Improvement – Error Detection FAQ in Competitive exams.

UNIT IV REARRANGEMENT AND GENERAL USAGE **6 Hours**

Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice – Spelling test.

UNIT V APPLICATION OF VERBAL ABILITY **6 Hours**

Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing – Essay writing– Indexing –Market surveying.

Total: 30 Hours

ASSESSMENT PATTERN

1. Two assignments (2 x 25 marks = 50 marks)
2. Pragmatic assessment (50 marks)

REFERENCES:

1. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017.
2. R S Aggarwal and Vikas Aggarwal , Quick Learning Objective General English, S.Chand Publishing House, 2017.
3. Dr.K. Alex, Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014.
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition, 2007.

1702EE501 **ELECTRICAL MACHINE DESIGN**

L	T	P	C
3	2	0	4

PREREQUISITE :

1. Electrical Machinery-I
2. Electrical Machinery-II

COURSE OBJECTIVES:

1. To study MMF calculation and thermal rating of various types of electrical machines.
2. To understand the design methods of armature and field systems for D.C. machines.
3. To analyze the design details of core, yoke, windings and cooling systems of transformers.
4. To analyze design of stator and rotor of induction and synchronous machines

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Explain the major considerations in electrical machine design by considering thermal, magnetic and electric loadings (K2)

CO2 Calculate the design parameters of a DC machine(K3)

CO3 Compute the design parameters of a transformer (K3)

CO4 Calculate the design parameters of Induction motor (K3)

CO5 Calculate the design parameters of synchronous machine (K3)

UNIT I **INTRODUCTION TO MACHINE DESIGN** **12 Hours**

Major considerations in electrical machine design, electrical engineering materials; space factor, choice of Specific electrical and magnetic loadings, thermal considerations, rating of machines; standard specifications.

UNIT II **DC MACHINES** **12 Hours**

Design of DC machines: general considerations, output equation, 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.

UNIT III **TRANSFORMERS** **12 Hours**

Design of transformers: general considerations, output equation, KVA output for single phase 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** **12 Hours**

Design of induction motors: general considerations, output equation, choice of average flux density, main dimensions, length of air gap; rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor ; magnetic leakage calculations, leakage reactance of poly Phase machines, magnetizing current, short circuit current.

UNIT V **SYNCHRONOUS MACHINES** **12 Hours**

Design of synchronous machines: general considerations, output equation, choice of electrical and magnetic loading, main dimensions, short circuit ratio, stator design, stator 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 **60 Hours**

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Case study/seminar on simulated design of machines using MAGNET software
2. Design of turbo generator

REFERENCES:

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 2013
2. M.V. Deshpande, “Design and Testing of Electrical Machine Design” Wheeler Publications, 2010.
3. A. E. Clayton, NN Hancock “The Performance and Design of Direct Current Machines” CBS Publisher, First Edition, 2004.
4. R.K. Agarwal, “Principles of Electrical Machine Design”, Esskay Publications, Delhi, 2002.
5. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.
6. http://nptel.ac.in/108106023/

1702EE502 LINEAR CONTROL SYSTEMS **L T P C**

3 2 0 4

PREREQUISITE :

1. Electric circuit analysis
2. Engineering Mathematics

Course Objectives:

1. To understand the basic components of control systems

2. To gain the knowledge in time and frequency domain tools for the design and analysis of Feedback control systems.

3. To understand the design of compensator and concepts of state variable analysis.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Calculate transfer function of various systems using block diagram reduction, signal flow graph technique(K3)

CO2 Investigate the time response behavior of first and second order system using time domain specification (K3)

CO3 Analyze the frequency response of open loop transfer function using bode plot and polar plot(K3)

CO4 Examine the Stability and compensator design in control systems using various Plots(K3).

CO5 Organize the concept of State Variable models and its applications (K3)

Unit I SYSTEMS AND THEIR REPRESENTATION **12 Hours**

Basic elements in control systems; open and closed loop systems; Electrical analogy of mechanical system; Transfer function, Block diagram reduction techniques, Signal flow graph.

Unit II TIME RESPONSE **12 Hours**

Time response - time domain specifications; types of test input, first and second order system response; error Coefficients, steady state error; effects of P, PI, PID modes of feedback control.

Unit III FREQUENCY RESPONSE **12 Hours**

Frequency response - Bode plot, Polar plot; determination of closed loop response from open loop response; Correlation between frequency domain and time domain specifications.

Unit IV STABILITY AND COMPENSATOR DESIGN **12 Hours**

Characteristics equation; Routh Hurwitz criterion, Root locus construction, Nyquist stability criterion; lag, lead and lag-lead networks; lag/lead compensator design using bode plots.

Unit V STATE VARIABLE ANALYSIS **12 Hours**

Concept of state variables, state models for linear and time invariant systems; solution of state and output equation in controllable canonical form, concepts of controllability andobservability.

Total: 60 Hours

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Lead, Lag compensator of frequency response.
2. AC and DC servomotor for control system applications.

REFERENCES:

1. M. Gopal, "Control Systems, Principles and Design", 4th Edition, Tata McGraw Hill, New Delhi,2012
2. S.K. Bhattacharya, "Control System Engineering" 3rd Edition, Pearson, 2013.
3. Dhanesh. N. Manik, "Control System" Cen gageLearning,2012
4. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Pearson Prentice Hall, 2012.
5. K. Ogata, „Modern Control Engineering", 5th edition, PHI, 2012.
6. Nagrath I.J and Gopal M, "Control Systems Engineering", New Age Publishers, 5tn Edition, 2009.
7. https://onlinecourses.nptel.ac.in/noc18_ee20/preview

1702EE503 POWER ELECTRONICS

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Electron Devices and Circuits
2. Linear Integrated Circuits

COURSE OBJECTIVES:

1. To study the important aspects of power semiconductor devices
2. To understand the concepts of power conversion and control using power electronic devices
3. To analyze the performance of power modulators

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Understand the structure and characteristics of power semiconductor devices (K2)

CO2 Elucidate the operation of power modulators(K2)

CO3 Analyze the control techniques used in power modulators(K3)

CO4 Analyze the performance parameters of power converters(K3)

CO5 Explain the operation and characteristics of various power electronics converters (K3).

UNIT I POWER SEMICONDUCTOR DEVICES 9 Hours

Power semiconductor devices – Power Diodes, Power Transistors, Power MOSFETs ,IGBTs , TRIACs, GTOs, IGCT, Working , Static and Dynamic characteristics;

SCR – Two-transistor analogy, Turn on and Turn off characteristics, Snubber circuits, Series and parallel operation of SCRs, Driver circuits.

UNIT II PHASE- CONTROLLED CONVERTERS 12 Hours

Principle of phase control – single phase and three phase half wave and full wave converter with R,RL,RLE load, Continuous and Discontinuous conduction, Estimation of average & RMS values of load voltage, load current ; Performance parameters for converters – Effect of freewheeling diodes , Effect of source inductance, Dual Converter.

UNIT III DC TO DC CONVERTER 8 Hours

DC Choppers – Principle of step up and step down chopper operation , Control strategies , Classification & Operation of choppers, Single quadrant, Two quadrant and four quadrant DC choppers – Buck, Boost and Buck boost converters; Introduction to Multilevel Inverter – single phase cascaded H-Bridge MLI.

UNIT IV INVERTERS 8 Hours

Types of inverters – operation of single phase VSI, Three phase VSI (120 , 180) degree modes – Inverter output voltage control, Pulse Width Modulation Techniques, single, multiple, sinusoidal modulation-Harmonic Elimination Techniques.

UNIT V AC TO AC CONVERTERS 8 Hours

AC Voltage Controllers (Single phase and three phase) – half wave with R, RL loads, Expression for Load voltage and current, sequence control of AC regulators ;

Cyclo converters – Single phase to single phase, three phase to single-phase cyclo converter, Control strategies; Introduction to Matrix converter.

Total: 45 Hours

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Space vector pulse width modulation
2. Advanced resonant converters

REFERENCES:

1. Rashid M H, “Power Electronics-Circuits, Devices and Applications”, Prentice Hall of India, New Delhi, 2011.
2. P.S.Bimbhra, “Power Electronics”, Khanna Publishers, New Delhi, 2006.
3. Vedam Subramanyam, “Power Electronics”, New Age International, New Delhi, 1996.
4. V.Jagannathan, “Power electronic devices and circuits”, PHI Publications.
5. Ned Mohan Tore.M.Undeland, and William.P.Robbins, “Power Electronics: Converters, applications and Design”, John Wiley and sons, third edition, 2003.
6. http://nptel.ac.in/courses/108108077/

1703EE001 **SPECIAL ELECTRICAL MACHINES**

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Electrical Machinery – I &II
2. Power Electronics
3. Microprocessor and Microcontroller

COURSE OBJECTIVES:

1. To understand the construction and operation of Special electrical machines.
2. To analyze the performance parameters of special electrical machines.
3. To design a closed loop control circuit for special electrical machines

COURSE OUTCOMES:

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

CO1 Explain the constructional features and operation of special electrical machines.
CO2 Draw and explain the phasor diagram and characteristics of special electrical machines.
CO3 Determine the torque and voltage equations of special electrical machines.
CO4 Describe the operations of circuits associated with special electrical machines.
CO5 Explain the closed loop control of special electrical machines and able to list its applications.

UNIT I **SYNCHRONOUS RELUCTANCE MOTOR** **9 Hours**

Constructional features, types – axial & radial flux motors, operating principles, variable reluctance motors – Voltage and torque equations, phasor diagram, performance characteristics, applications.

UNIT II **STEPPER MOTORS** **9 Hours**

Constructional features, principal 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** **9 Hours**

Evolution of switched reluctance motors, 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 DC MOTORS** **9 Hours**

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 SYNCHRONUS MOTOR** **9 Hours**

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 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Design of BLPM Motors and SRM
2. DSP Based Motion Control

REFERENCES:

1. K. Venkataratnam, “Special Electrical Machines”, 1st Edition, CRC Press, 2009.
2. E. G. Janardanan, “Special Electrical Machines”, PHI PVT LTD, 2014.
3. R.Krishnan, „Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application“, CRC Press, New York, 2001.
4. J.R.HendershotandT.J.E.Miller,“DesignofBrushlessPermanentMagnetMachines”,MotorDesignBooks, 2010.
5. T.J.E.Miller, „Brushless Permanent Magnet and Reluctance Motor Drives", Clarendon Press, Oxford, 1989.
6. T.Kenjo, “Stepping Motors and Their Microprocessor Controls”, Clarendon Press London, 1984.

1703EE002 ELECTRICAL SAFETY AND MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITE :

1. Transmission & Distribution

COURSE OBJECTIVES:

1. To Understand the concepts of Indian rules and earthing.
2. To get knowledge in first aid and fire extinguishers operating procedures.
3. To understand the safety policy in management & organizations.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Understand the Indian electricity rules and their significance.(K2)

CO2 Identify hazardous areas in Industrial sectors.(K2)

CO3 Describe the various steps in first aid and safety during electrical installation.(K2)

CO4 Investigate the various fire extinguishers and its mode of operation.(K3)

CO5 Make use of energy management and energy auditing procedures in industrial sectors. (K3).

UNIT I RULES &REGULATIONS 9 Hours

Power sector organization and their roles; significance of IE rules & IE acts; general safety requirements: span, Conductor configuration, spacing and clearing, sag, erection, hazards of electricity.

UNIT II INSTALLATION AND EARTHING OF EQUIPMENTS 9 Hours

Classification of electrical installation; earthing of equipment bodies; electrical layout of switching devices and SCprotection;safetyinuseofdomesticappliances;safetydocumentationandworkpermitsystem;flashhazard Calculations; tools and test equipment's.

UNIT III SAFETY MANAGEMENT AND FIRST AID 9 Hours

Safety aspects during commissioning-safety clearance notice before energizing, safety during maintenance, maintenance schedule; special tools; security grand; check list for plant security; effects of electric and electromagnetic fields in HV lines and substations; safety policy in management & organizations; first aid; basic Principles; action taken after electrical shock; artificial respiration and methods.

UNIT IV FIRE EXTINGUISHERS 9 Hours

Fundamentals of fire- initiation of fires, types; extinguishing techniques, prevention of fire, types of fire extinguishers, fire detection and alarm system; CO2 and Halogen gas schemes; foam schemes.

UNIT V ENERGY MANAGEMENT &ENERGY AUDITING 9 Hours

Objectives of energy management; energy efficient electrical systems; energy conservation and energy policy; Renewable source of energy; energy auditing; types and tips for improvement in industry.

Total: 45 Hours

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Brief about role of Bureau of Energy Efficiency (BEE) in energy conservation.
2. Implementation of engineering ethics in safety management.

REFERENCES:

1. Rao.S, Khanna.R.C, "Electrical safety, Fire safety engineering and safety management", Hanna publisher, Delhi, 2nd edition, 1998.
2. Cooper.W.F, "Electrical safety Engineering", Newnes-Butterworth company, 1978.
2. Power Engineering Hand book, TNEB Engineers officers, Chennai, 2002.
3. John Codick, "Electrical safety hand book", McGraw Hill Inc., New Delhi, 2000.
4. The Indian electricity rules, 1956, authority regulations, 1979, Commercial Law Publication, Delhi, 1999.
5. V. Manoilov, "Fundamentals of electrical safety", Mir Publishers, MOSCOW,1975

1702CS504 **OBJECT ORIENTED PROGRAMMING** **L 3** **T 0** **P 0** **C 3**

PREREQUISITE: 1. Programming in C
2. Introduction to Computer

Course Objectives:

1. To demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.
2. To understand the concepts behind object-oriented programming using C++
3. To analyze and understand the functionality of program code written in Java.

Course Outcomes:

After completion of the course, Student will be able to

CO1 Define the features of C++ supporting object oriented programming (K2)

CO2 Understand the major object-oriented concepts such that constructor and operator overloading in C++ (K2)

CO3 Identify to implement error handling techniques using exception handling (K3)

CO4 Identify classes, objects, methods of a class and relationships among them in Java (K3).

CO5 Understand the principles of Packages, Interfaces, Multithreading in Java (K2)

Unit I INTRODUCTION TO OOP'S AND C++ **9 Hours**

Object oriented programming concepts – objects – classes – methods and messages –abstraction and encapsulation – inheritance – abstract classes –polymorphism. Introduction to C++ – classes – access specifiers – function and data members – default arguments – function overloading – friend functions – const. and volatile functions – static members – Objects – pointers and objects – constant objects – nested classes – local classes

Unit II CONSTRUCTORS **9 Hours**

Constructors – default constructor – Parameterized constructors – Constructor with dynamic allocation – copy constructor – destructors – operator overloading – overloading through friend functions – overloading the assignment operator – type conversion – explicit constructor

Unit III EXCEPTION HANDLINGANDINHERITANCE **9 Hours**

Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and unexpected functions – Uncaught exception. Inheritance – public, private, and protected derivations – multiple inheritance – virtual base class – abstract class

Unit IV OVERVIEWOFJAVA **9 Hours**

Data types, Variables and Arrays, Operators, Control Statements, Classes, Objects, Methods - Inheritance

Unit V EXCEPTION HANDLING IN JAVA **9Hours**

Packages and Interfaces, Exception Handling, Multithreaded Programming, Strings, Input/output

Total: **45 Hours**

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

RTTI, Runtime Polymorphism, ANSI String Objects,

References:

1. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.
2.H.M.Deitel, P.J.Deitel, "Java how to program", Fifth edition, Prentice Hall of India private limited, 2003
3. Ira Pohl, "Object-Oriented Programming Using C++", Pearson Education Asia, 2003.
4.K.R.Venugopal, RajkumarBuyya, T.Ravishankar, "Mastering C++", TMH, 2003.
5.Herbert Schildt, "The Java 2: Complete Reference", Fourth edition, TMH, 2002

1702CS554	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Basic Computer knowledge.
2. Programming in C Lab

Course Objectives:

Justify the philosophy of object-oriented programming and the concepts of encapsulation, abstraction, inheritance, and polymorphism.

To make the student learn an object oriented way of solving problems using java.

To make the students to write programs using multithreading concepts and handle exceptions.

Course Outcomes:

After completion of the course, Student will be able to

CO1	Develop program to illustrate basic concept of OOP features and C++ concept
CO2	Implement the program using unary and binary operator overloading in C++
CO3	Write program to implement concept of inheritance and polymorphism in C++
CO4	Understand and Apply Object oriented features and Java concepts
CO5	Develop and implement program using exception handling and templates in Java

List of Experiments:

1. Static Data Members
2. Multiple constructor in a class
3. Operator overloading for Unary and binary operator
4. Multiple Inheritance
5. Constructor in derived classes
6. Virtual Base class
7. Friend Function
8. Control Statements in Java
9. Multi-threaded programming in Java
10. Exception handling in Java

Total: **45 Hours**

Additional Experiments:

1. Program to overload unary and binary operator as Nonmember function.
2. Write a Java program to develop simple application using OOP"s concept.

References:

1. https://lecturenotes.in/practicals/19363-lab-manuals-for-object-oriented-programming
2. http://studentsfocus.com/cs6461-object-oriented-programming-lab-manual
3. http://bietbvrm.ac.in/public/testimonia
4. http://www.srmuniv.ac.in/sites/default/files

1702EE551	MEASUREMENT AND CONTROL LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISTE;

1.Measurement and Instrumentation
2.Linear Control system

COURSE OBJECTIVES:

1.Knowledge on analysis and design of control system
2.Knowledge on analysis and design of instrumentation
3.Provide analysis and design of controller and compensators

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Investigate various characteristics of sensors and transducers
CO2 Make use of bridge networks in measurement circuits for measuring unknown values
CO3 Discuss the concept of controllers and compensators
CO4 Analyze the stability of LTI system using software tool
CO5 Perform the signal conditioning, position control system operation and power measurements.

LIST OF EXPERIMENTS:

1. Measurement of Inductance, Capacitance and Resistance using Bridge networks
2. To study the characteristics of Temperature/Pressure/Displacement sensors
3. Measurement of energy (single and three phase)
4. Perform Signal Conditioning by using ADC and DAC
5. Study the effect of P, PI, PID controllers using MATLAB.
6. Stability analysis (Bode, root locus, Nyquist) of linear time invariant system using MATLAB
7. Transfer function of Armature/Field controlled Dc motor
8. Design of Lag, Lead and Lag-Lead compensators using MATLAB
9. AC and DC position control systems
10. Synchro-transmitter and receiver

Total: 30 Hours

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS :

1. Plot the pole-zero configurations in s-plane for the given transfer function using Simulink.
2. Plot unit step response of given transfer function and find peak overshoot, peak time using Simulink.

REFERENCES:

1. Dr.T.Suresh Padmanabhan and J.Menaka, “Measurement and Control Laboratory Manual”, 2018.
2. Electrical Measurement and control manual byS.K.Bhattacharya.

1704GE551 **LIFE SKILLS: APTITUDE – I** **L T P C**
0 0 2 1

PREREQUISITE :
Technical English – I and II

COURSE OBJECTIVES:
1. To brush up problem solving skill and to improve intellectual skill of the students
2. TobeabletocriticallyevaluatevariousreallifesituationsbyresortingtoAnalysisOf key issues and factors
3. To be able to demonstrate various principles involved in solving mathematical problems And thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students
5. To augment logical and critical thinking of Student

COURSE OUTCOMES:
After completion of the course, Student will be able to
CO 1 - Understand about number system.
CO2 - Gather information about ratio and proportion, averages
CO3 - Discuss about percentages, profit and loss
CO4 –Describe about coding and decoding, direction sense
CO5 – Understand the number and letter series number

UNIT I **INTRODUCTION TO NUMBER SYSTEM, BASIC SHORTCUTS OF ADDITION, MULTIPLICATION,DIVISION** **6 Hours**

Classification of numbers – Types of Numbers - Divisibility rules - Finding the units digit - Finding remainders in divisions involving higher powers - LCM and HCF Models - Fractions and Digits – Square, Square roots – Cube, Cube roots – Shortcuts of addition, multiplication, Division.

UNIT II **RATIO AND PROPORTION, AVERAGES** **6 Hours**

Definition of Ratio - Properties of Ratios - Comparison of Ratios - Problems on Ratios - Compound Ratio - Problems on Proportion, Mean proportional and Continued Proportion Definition of Average - Rules of Average - Problems on Average - Problems on Weighted Average - Finding average using assumed mean Method.

UNIT III **PERCENTAGES, PROFIT AND LOSS** **6 Hours**

Introduction Percentage - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage equivalent of fractions - Problems on percentages - Problems on Profit and Loss percentage- Relation between Cost Price and Selling price - Discount and Marked Price - Two different articles sold at same Cost Price - Two different articles sold at same Selling Price - Gain% / Loss% on Selling Price.

UNIT IV **CODING AND DECODING, DIRECTION SENSE** **6 Hours**

Coding using same set of letters - Coding using different set of letters - Coding into a number - Problems on R-model - Solving problems by drawing the paths - Finding the net distance travelled - Finding the direction - Problems on clocks - Problems on shadows - Problems on direction sense using symbols and Notations.

UNIT V **NUMBER AND LETTER SERIES NUMBER AND LETTER ANALOGIES, ODD MAN OUT** **6 Hours**

Difference series - Product series - Squares series - Cubes series - Alternate series - Combination series - Miscellaneous series - Place values of letters - Definition of Analogy - Problems on number analogy - Problems on letter analogy - Problems on verbal analogy - Problems on number Odd man out - Problems on letter Odd man out - Problems on verbal Odd man out

Total: 30 Hours

REFERENCES:

1. ArunSharma,„HowtoPrepareforQuantitativeAptitudefortheCAT‟,7th edition,McGrawHills publication,2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT‟, 4th edition, McGraw Hills publication,2017.
3. R S Agarwal, „A modern approach to Logical reasoning‟, revised edition, S. Chand publication, 2017.
4. RSAgarwal,QuantitativeAptitudeforCompetitiveExaminations‟revisededition,S.Chand publication, 2017.
5. Rajesh Verma, “Fast Track Objective Arithmetic”, 3rd edition, Arihant publication,2018.
6. B.S. Sijwalii and InduSijwali, “A New Approach to REASONING Verbal & Non-Verbal”, 2nd edition, Arihnat publication,2014.

1701MGX02 INDUSTRIAL ECONOMICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To introduce the concepts of micro, macroeconomic systems and business Decisions in industry.
2. To acquire knowledge on laws of demand & supply and methods of forecasting the Demand.
3. To emphasis the systematic evaluation of the costs, breakeven point for return on economics and diseconomies.

COURSE OUTCOME:

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

CO1- Understand the fundamentals of Industrial Economics(K2)

CO2 -Explain about demand and supply in market(K2)

CO3- Calculate the cost involved in production function using Cost Curves (K3)

CO4 –Describe the different market structure involved in economics(K2)

CO5- Summarize the macro economics and financial accounting (K2)

UNIT I INTRODUCTION **9 Hours**

Introduction to Industrial economics- Micro and Macroeconomics - Kinds of Economic Systems - Production Possibility Frontier - Opportunity Cost - Objective of Organizations - Kinds of Organization.

UNIT II DEMAND AND SUPPLY **9 Hours**

Functions of Demand and Supply - Law of diminishing Marginal Utility - Law of Demand and Supply Elasticity of Demand - Demand Forecasting Methods - Indifference curve.

UNIT III PRODUCTION AND COST **9 Hours**

Production Function - Returns to Scale - Law of Variable Proportion - Cost and Revenue concepts and Cost Curves - Revenue curves - Economies and Dis-Economies of scale - Break Evenpoint.

UNIT IV MARKET STRUCTURE **9 Hours**

Market Structure - Perfect Competition - Monopoly - Monopolistic - Oligopoly - Components of Pricing - Methods f Pricing - Capital Budgeting IRR - ARR - NPV - Return on Investment - Payback Period.

UNIT V INTRODUCTION TO MACRO ECONOMICS AND FINANCIAL ACCOUNTING **9 Hours**

National Income - Calculation Methods - Problems - Inflation - Deflation - Business Cycle - Taxes - Direct and Indirect Taxes - Fiscal and monetary policies.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Nature and characteristics of Indian Economy.
2. Role and functions of Central bank - LPG - GATT - WTO.

REFERENCES:

1. A Ramachandra Aryasri and V V Ramana Murthy, Engineering Economics and Financial Accounting, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.
2. R Kesavan, C Elanchezhian and T Sunder Selwyn, Engineering Economics and Financial Accounting, Laxmi Publication Ltd, New Delhi, 2005.
3. V L Samuel Paul and G S Gupta, Managerial Economics Concepts and Cases, Tata McGraw Hill Publishing Company Limited, New Delhi, 1981.
4. S N Maheswari, Financial and Management Accounting, Sultan Chand
5. V L Samuel Paul and G S Gupta, Managerial Economics-Concepts and Cases.
6. Barthwal R.R., Industrial Economics - An Introductory Text Book, New Age.
7. https://nptel.ac.in/courses/110101005/

1702EE601 SOLID STATE DRIVES

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Power Electronics
2. Electrical Machinery – I & II

COURSE OBJECTIVES:

1. To understand the fundamentals of motor load system
2. To explain about power converters fed DC and AC drives

3. To design a controllers for closed loop operation of DC and AC drives

COURSE OUTCOMES:

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

CO CO1 - Explain the dynamics of motor load system and types of load along with their characteristics.

CO2 - Determine speed current voltage and torque of rectifier and chopper fed DC drive in all

CO3 - Calculate the performance parameters of induction motor drives with appropriate power electronics converter in motoring and braking modes.

CO4- Discuss about speed control techniques of VSI, CSI and cycloconverter fed synchronous motor drives.

CO5 -Design a speed & current controller for a closed loop drive system.

UNIT I DRIVE CHARACTERISTICS 8 Hours

Electric drives-classification, elements of electrical drive, equations governing motor load dynamics, torque components; classes of duty; steady state stability; multi quadrant dynamics - acceleration, deceleration, starting and stopping; typical load torque characteristics- Constant torque, torque proportional to speed, fan load, torque inversely proportional to speed; selection of motorrating.

UNIT II DC MOTOR DRIVE 9 Hours

Converter fed drive- review of one and two quadrant converter and its characteristics, steady state analysis of single phase and three phase converter fed separately excited dc motor drive- continuous and discontinuous conduction, four quadrant operation ofconverter.

Chopper fed drive – review of dc chopper and its control strategies, motoring mode, braking mode and four-quadrant operation of chopper fed drive.

UNIT III INDUCTION MOTOR DRIVE 12 Hours

Review of induction motor equivalent circuit and torque speed characteristics; speed control of induction motor drive -stator voltage control, v/f control, VSI fed induction motor drive, cycloconverter control and vector control –block diagram approach; impact of rotor resistance on induction motor speed torque curve, closed loop control of induction motor drive.

UNIT IV SYNCHRONOUS MOTOR DRIVE 8 Hours

V/F &self-control of synchronous motor drive, margin angle control and power factor control, VSI and CSIfed synchronous motor drive -permanent magnet synchronous motor – construction, types, BPLM DC motor and BLPM AC motor.

UNIT V CLOSED LOOP CONTROL OF DC DRIVE 8 Hours

Control structure of dc drive, armature voltage and field control of separately excited dc motor drive; Transfer function of separately excited dc motor and converter, design of controllers – speed controller and current controller.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Control of slip ring induction motor drive
2. Space vector modulation technique for induction motor drive

REFERENCES:

1. G.K Dubey, “Fundamentals of Electrical Drives”, 2nd Edition, Narosa Book Distributors, 2010.
2. N. K. De, P. K. Sen, “Electric Drives”, 16th, PHI Learning PVT. LTD.,2014
3. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control” Pearson Education,2015
4. Rik De Doncker, Duco W. J. Pulle, Andre Veltman, “Advanced Electrical Drives”, 1st Edition, Springer Science & Business Media2011
5. Bimal K. Bose, “Modern Power Electronics and AC Drives”, 1st Edition, Pearson Education2015
6. R. Krishnan, “Permanent Magnet Synchronous and Brushless DC motor Drives”, CRC Press,2009.
7. https://studentsfocus.com/ee8601-ssd-notes-solid-state-drives-notes-eee-6th-sem/

1702EE602	POWER SYSTEM ANALYSIS	L	T	P	C
		3	2	0	4

PREREQUISITE:

1. Transmission and Distribution
2. Electric circuit analysis

COURSE OBJECTIVES:

1. To model the power system under steady state operating condition. To apply efficient Numerical methods to solve the power flow problem.
2. To model and analyze the power systems under abnormal (or) fault conditions.
3. To model and analyze the transient behavior of power system when it is subjected to a fault.

COURSE OUTCOMES: After completion of the course, Student will be able to

CO1 – Explain the fundamentals of power system with the aid of single line diagram and per unit analysis(K2)

CO2 – Develop power flow models by addressing various power flow problems using iterative techniques(K3)

CO3 – Apply the symmetrical fault calculation methods for the unbalanced network using z bus matrix(K3)

CO4 – Apply the unsymmetrical fault calculation methods for the unbalanced network using sequence network analysis(K3)

CO5 – Make use of power system stability studies for planning and operation of network through various solution techniques(K3)

UNIT I POWER SYSTEM MODEL 12 Hours

Representation of power system components like synchronous machines, induction machines, transformers, transmission lines, loads etc., for steady state analysis - per unit quantities, impedance and reactance diagram - formulation of network matrices for the power systems - bus impedance and bus admittance matrices, reduction techniques on network matrices for network changes – case study.

UNIT II LOAD FLOW ANALYSIS 12 Hours

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 SYMMETRICAL COMPONENTS 12 Hours

Definition - introduction - review of symmetrical components - transformation matrices used in resolution of unbalanced voltages and currents - positive, negative and zero sequence networks of power system components - sequence networks of impedance loads, series impedance and rotating machines - representation of various types of faults in sequence networks – case study.

UNIT IV SHORT CIRCUIT ANALYSIS 12 Hours

Formulation of a mathematical model to analyses faults on power system – symmetrical faults – three phase short circuit – unloaded synchronous machine –problem of arcing faults – unsymmetrical faults – system representation – LG, LL and LLG fault – simple problems - effect of fault impedance - use of short circuit study data for relaying and breaking studies – case study of simultaneous faults on the system.

UNIT V STABILITY ANALYSIS 12 Hours

Definition and classification of power system stability – multi machine stability - single machine infinite bus (SMIB) system: development of swing equation - equal area criterion - determination of critical clearing angle and time by using modified Euler method and Runge-Kutta second order method; algorithm
And flow chart.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Load curves
2. Unit commitments

REFERENCES:

1. J. D. Glover, M. Sarma and T. Overbye, “Power System Analysis and Design”, Fourth Edition, CENGAGE – Engineering, 2007.
2. HadiSaadat, “Power System Analysis”, Second Edition, McGraw Hill Publishers, 2002.

3. Arthur R. Bergen and Vijay Vittal, “Power System Analysis”, Third Edition, Prentice Hall of India Private Limited, New Delhi, 2001.
4. John J. Grainger and Stevenson Jr W. D., “Power System Analysis”, McGraw Hill, 2003.
5. D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, Tata McGraw Hill Publishing Company, New Delhi, 2006.
6. T. K. Nagsarkar and M. S. Sukhija, “Power System Analysis” Oxford University Press, New Delhi, 2007.

7. PrabhaKundur, “Power System Stability and Control”, Second Reprint Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2006.
8. https://nptel.ac.in/courses/108/105/108105067/

1702EE603	MICROPROCESSOR, MICROCONTROLLER ANDITS APPLICATIONS	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Digital Electronics.
2. Linear Integrated Circuits.

COURSE OBJECTIVES:

1. To study the architecture of commonly used µp and µc.
2. To develop skill in assembly language program writing for 8085, 8086, and its applications.
3. To study the applications of µp and µc based systems.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Explain the architecture, memory organization, timing diagram and interrupt structure of microprocessor (K2)

CO2 Perform mathematical operation using 8085 & 8051instruction set (K3)

CO3 Explain the architecture, interrupt, memory organization and addressing modes of 8051(K2)

CO4 Practice interfacing of commonly used programmable peripheral devices using 8085 and 8051 (K3)

CO5Make use of 8051 controller for the control of simple electrical systems (K3)

UNITI **INTRODUCTION TO 8085 PROCESSOR** **9 Hours**

Hardware architecture of 8085, pin outs, functional building blocks of processor; interrupts, memory organization, I/O and memory interfacing.

UNITII **8085 INSTRUCTION SET** **9 Hours**

8085 instruction set-addressing modes, instruction format, assembly language programming using basic instructions- arithmetic operations, ascending and descending order, Fibonacci series etc..

UNITIII **8051 MICROCONTROLLER ARCHITECTURE** **9 Hours**

8051 microcontroller- architecture, instruction format, addressing modes; assembly language programming.

UNITIV **PERIPHERAL INTERFACING DEVICES** **9 Hours**

8255-Programmable peripheral interfacing, 8251-serial communication, 8279-programmable keyboard/display controller, 8257-DMA controller, 8253-programmable interval timer.

UNITV **APPLICATIONS OF MICROCONTROLLER** **9 Hours**

Washing machine controller; stepper motor control; D/A & A/D interfacing with 8051.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. A case study on applications of microcontrollers in automotive field.
2. Arduino/ARM processor based applications

REFERENCES:

1. R S. Gaonkar, “Microprocessor Architecture Programming and Application”, Prentice hall, New Delhi, fifth edition 2002.
2. Sunil Mathur, “Microprocessor 8085 and its Interfacing” Prentice hall India learning private limited, New Delhi, second edition, 2011.
3. Muhammad Ali Mazidi, Janice GilliMazidi and R.D. Kinely “The 8051 Micro Controller and Embedded Systems”, PHI Pearson Education, fifth Indian Reprint,2003.
4. Soumitra Kumar Mandal, Microprocessor & microcontroller Architecture, programming & interfacing using 8085, 8086, 8051, Tata McGraw Hill Education,2013
5. Krishna Kant, “Microprocessor and Microcontrollers”, Eastern Company Edition, Prentice-Hall of India, New Delhi, Second edition.
6. https://nptel.ac.in/courses/108/105/108105102/

1702EE651 LABORATORY	POWER ELECTRONICS AND DRIVES	L	T	P	C
		0	0	4	2

PREREQUISITE:

1. Power Electronics
2. Electrical Machinery – I &II

COURSE OBJECTIVES:

1. To determine the characteristics of power electronic devices.
2. To design a power converter for electrical drives.
3. To analyze the performance of power converter fed drives.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Construct experiments on power electronic component for obtaining characteristics curve (K3)
CO2 Make use of half-controlled converter for DC motor (K3).
CO3 Identify the characteristic plot of IGBT based PWM inverter (K3)
CO4 Infer the operation of AC voltage controller and Switched mode power converter (K3)
CO5 Make use of Simulation of PE circuits (K3)

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 fed DC Motor
5. AC to DC fully controlled Converter fed DC Motor
6. Step down and step up MOSFET based choppers
7. IGBT based single phase PWM inverter
8. IGBT based three phase PWM inverter fed three phase AC Motor
9. AC voltage controller
10. Switched mode power converter
11. Simulation of PE circuits (1Φ & 3Φ semiconverter,1Φ & 3Φ full converter, DC-DC converters)

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS:

1. Simulation of closed loop speed control of DC motor drive
2. Simulation of closed loop speed control of AC motor drive

REFERENCES:

1.K. Nandakumar,R. Anandaraj, “power electronics and drives laboratory Manual”, 2018
2.Krishnan.R, “Electric Motor and Drives Modeling, Analysis and Control”, Prentice Hall of India, 2001.
3. Lab manual prepared by course instructor.
4. Pillai, S.K., “A First Course on Electrical Drives”, Wiley Eastern Limited, 1993.

1702EE652	MICROPROCESSOR, MICROCONTROLLER ANDITS APPLICATIONS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Analog and Digital Integrated Circuits Laboratory
2. Microprocessor, Microcontroller And Its Applications

COURSE OBJECTIVES:

1. To provide training on programming of microprocessors and microcontrollers and understand the interface requirements.
2. To provide training on programming of microcontrollers.
3. To understand the requirements of interfacing.

COURSE OUTCOMES:

After completion of the course, Student will be able to

CO1 Perform mathematical operations and control instructions using 8085 processor (K3)
CO2 Practice interfacing of commonly used programmable peripheral interfaces using 8085(K3)
CO3 Perform arithmetical operations using 8051 microcontroller (K3)
CO4 Practice interfacing of commonly used programmable peripheral interfaces using 8051(K3)
CO5 Develop assembly language program to control simple electrical system using 8085, 8051(K3)

LIST OF EXPERIMENTS:

1. Simple arithmetic operations using 8085: addition / subtraction / multiplication/division.
2. Programming with control instructions: Ascending / descending order, maximum / minimum of numbers.
3. Programming with control instructions: Hex / ASCII / BCD code conversions.
4. Interface experiments with8085: A/D interfacing& D/A interfacing.
5. Interfacing of Serial communication using8085.
6. Interfacing of Keyboard and display interface using8085.
7. Simple arithmetic operations using 8051: addition / subtraction / multiplication/division.
8. Programming of I/O port with8051.
9. Study of stepper motor using 8085.
10. Study of dc motor using8085.

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS / INNOVATIVE EXPERIMENTS:

1. Programming of Traffic light controller using8085.
2. Programming of 8259 using8085.

REFERENCES:

1. S.Latha, “Microprocessor and microcontroller laboratory Manual”,2018.
2. Microprocessor 8085 lab manual by G.T .Swamy, Laxmi publication, first edition,2006.
3. Microprocessor Lab Manual, Rajesh Hegde, Kindleedition.

1704GE651 LIFE SKILLS: APTITUDE -II

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. To brush up problem solving skill and to improve intellectual skill of the students.
2. To be able to critically evaluate various real life situations by resorting to Analysis of key issues and factors.
3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students.
5. To augment logical and critical thinking of Students.

UNIT I PARTNERSHIP, MIXTURES AND ALLEGATIONS, PROBLEM ON AGES, SIMPLE INTEREST, COMPOUND INTEREST **6 Hours**

Introduction Partnership - Relation between capitals, Period of investments and Shares- Problems on mixtures - Allegation rule - Problems on Allegation – Problems on ages - Definitions Simple Interest - Problems on interest and amount - Problems when rate of interest and time period are numerically equal - Definition and formula for amount in compound interest - Difference between simple interest and compound interest for 2 years on the same principle and time period.

UNIT II BLOOD RELATIONS, , CLOCKS, CALENDARS **6 Hours**

Defining the various relations among the members of a family - Solving Blood Relation puzzles - Solving the problems on Blood Relations using symbols and notations - Finding the angle when the time is given - Finding the time when the angle is known - Relation between Angle, Minutes and Hours - Exceptional cases in clocks - Definition of a Leap Year - Finding the number of Odd days - Framing the year code for centuries - Finding the day of any random calendar date.

UNIT III TIME AND DISTANCE, TIME AND WORK **6 Hours**

Relation between speed, distance and time - Converting kmph into m/s and vice versa - Problems on average speed - Problems on relative speed - Problems on trains - Problems on boats and streams - Problems on circular tracks - Problems on races - Problems on Unitary method - Relation between Men, Days, Hours and Work - Problems on Man-Day-Hours method - Problems on alternate days - Problems on Pipes and Cisterns.

UNIT IV DATA INTERPRETATION AND DATA SUFFICIENCY **6 Hours**

Problems on tabular form - Problems on Line Graphs - Problems on Bar Graphs - Problems on Pie Charts - Different models in Data Sufficiency - Problems on data redundancy

UNIT V ANALYTICAL AND CRITICAL REASONING **6 Hours**

Problems on Linear arrangement - Problems on Circular arrangement - Problems on Double line-up - Problems on Selections - Problems on Comparisons - Finding the Implications for compound statements - Finding the Negations for compound statements- Problems on assumption - Problems on conclusions - Problems on inferences - Problems on strengthening and weakening of arguments.

TOTAL: 30 HOURS

REFERENCES:

1. Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT‟, 7thedition, McGraw Hills publication, 2016.
2.ArunSharma, „How to Prepare for Logical Reasoning for CAT‟, 4thedition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning‟, revised edition, S. Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations‟ revised edition, S. Chand Publication, 2017.
5. Rajesh Verma, “Fast Track Objective Arithmetic”, 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and Indu Sijwali, “A New Approach to REASONING Verbal & Non-Verbal”, 2nd edition, Arihnat publication, 2014.

1703EE006 DIGITAL SIGNAL PROCESSING

L	T	P	C
3	0	0	3

PREREQUISITE:

Electric circuit theory
Linear algebra

COURSE OBJECTIVES:

After completion of the course, Student will be able to

1. To classify signals and systems & their mathematical representation (K2)
2. To learn discrete Fourier transform properties and its computation (K2)
3. Make use of the characteristics of IIR filter to design of IIR filters for filtering Undesired signals (K3)
4. Make use of the characteristics of IIR filter to design of IIR filters for filtering Undesired signals (K3)
5. To study about a programmable Digital signal processor (K2)

UNIT I SIGNALS AND SYSTEMS **9 Hours**

Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem – Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution– Correlation.

UNIT II DISCRETE FOURIER TRANSFORM **9 Hours**

Introduction to DFT – Properties of DFT – Filtering methods based on DFT – FFT Algorithms – Decimation in time Algorithms,Decimation in frequency Algorithms – Use of FFT in Linear Filtering.

UNIT III IIR FILTER DESIGN **9 Hours**

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design byImpulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF)filter design using frequencytranslation.

UNIT IV FIR FILTER DESIGN **9 Hours**

Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques(Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques – Finiteword length effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum.

UNIT V DIGITAL SIGNAL PROCESSORS **9 Hours**

Introduction – TMS320c5X Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DSP Processors –TMS320C64XX, TMS320 C54X.

TOTAL: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

Finite word length effects, Multirate Signal Processing, Adaptive filtering

REFERENCES:

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.
4. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
5. R. Lakshmi Rekha, "Digital Signal Processing" – ALR Publications – 2016.
6. http://www.ti.com/processors/dsp/overview.html

1703EE009 POWER SYSTEM TRANSIENTS

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Transmission and Distribution.
2. Power Electronics.

COURSE OBJECTIVES:

1. To study the generation of switching transients and their control.
2. To study the mechanism of lighting strokes and travelling waves.
3. To compute the transients in travelling waves &integrated power system

COURSE OBJECTIVES:

After completion of the course, Student will be able to

CO1- Understand about the causes, types and effects of transients (K2)

CO2 –Investigate the phenomenon of switching transients and its effect (K3)

CO3 - Investigate the phenomenon of lightning transients and its effect (K3)

CO4 – Compute the transient response of travelling waves on transmission line (K3)

CO5 – Discuss the transients in integrated power system (K2)

UNIT I INTRODUCTION AND SURVEY OF TRANSIENTS 9 Hours

Review and importance of the study of transients , causes for transients; RL circuit transient with sine wave excitation ; double frequency 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 Hours

Over voltages due to switching transients - resistance switching, load switching, normal and abnormal switching transients; current suppression, current chopping; capacitance switching-capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients; ferro resonance.

UNIT III LIGHTNING TRANSIENTS 9 Hours

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 from lightning.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE 9 Hours

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 travellingwaves.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM 9 Hours

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: 60 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR:

1. Analysis Power System Transient Using Wavelet Transform.
2. Case Study about the Effect of transients developed in Home appliances.

REFERENCES:

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

4. Ramanujam.R, “Computational Electromagnetic Transients: Modeling, Solution Methods and Simulation”I K International Publishing House Pvt. Ltd, 2014.
5. Sakis Meliopoulis.A.P, “Power System Grounding and Transients: An Introduction “CRC Press; 1st Edition 2015
6. https://nptel.ac.in/courses/108105104/

ANNA UNIVERSITY
AFFILIATED INSTITUTIONS

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING
R – 2013

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 LT 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 Weihrich "Essentials of Management" Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

EE6711 **POWER SYSTEM SIMULATION LABORATORY** **L T P C**
0 0 3 2

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. Compliers: C, C++, VB, VC++ - 25 users

EE6712 **COMPREHENSION** **L T P C**
0 0 2 1

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

EE6801 ELECTRIC ENERGY GENERATION, UTILIZATION AND CONSERVATION **L T P C**
3 0 0 3

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** **LT 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 lighting strokes and the production of lighting 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.

EI6704	BIOMEDICAL INSTRUMENTATION	L T P C 3 0 0 3

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.

TOTAL : 45 PERIODS

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

I^2C 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

2-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"PearsonEducation,3rdEdition, 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. Trzynnadlowski, 'Introduction to Modern Power Electronics', Second edition, wiley India Pvt. Ltd, 2012.

GE6075 PROFESSIONAL ETHICS IN ENGINEERING **L T 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